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UNIVERSITY OF NAMIBIA

**Annual
Research
Conference
on Agriculture,
Engineering
and Natural
Sciences**

BOOK OF ABSTRACTS

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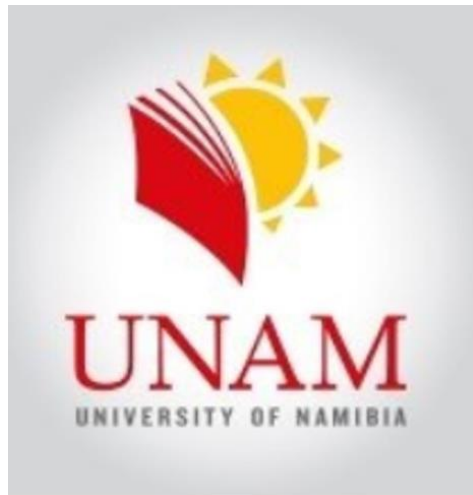
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IN-PERSON & VIRTUAL PRESENTATION VENUES

DAY 1: 23 NOVEMBER 2022

- **Morning sessions (08h00-13h05):**

Lecture Hall 1

Zoom link: <https://zoom.us/j/8091616845?pwd=cUZjVjhxOEFyZzRPdWlQbU9wU1lwUT09>

Meeting ID: 809 161 6845 Passcode: GT2871

- **Afternoon sessions (14h00-18h00):**

School of Military Science Lecture Rooms 1, 2, 3 & 4

Zoom link: <https://zoom.us/j/8091616845?pwd=cUZjVjhxOEFyZzRPdWlQbU9wU1lwUT09>

Meeting ID: 809 161 6845 Passcode: GT2871

DAY 2: 24 NOVEMBER 2022

- **Morning & afternoon sessions (08h00-15h00):**

Zoom link: <https://zoom.us/j/8091616845?pwd=cUZjVjhxOEFyZzRPdWlQbU9wU1lwUT09>

Meeting ID: 809 161 6845 Passcode: GT2871

- **Closing ceremony (15h30-16h00):**

Zoom link: <https://zoom.us/j/8091616845?pwd=cUZjVjhxOEFyZzRPdWlQbU9wU1lwUT09>

Meeting ID: 809 161 6845 Passcode: GT2871

PLENARY SPEAKERS



RESEARCH AND TESTING FOR ADVANCEMENT OF GREEN HYDROGEN TECHNOLOGIES IN NAMIBIA

Abstract

Enhanced by the worldwide political and economic situation in addition to required climate actions, Green Hydrogen Technologies (GH2T) experience currently a much more rapid push than any other industrial application. Along the horizontal value chain from hydrogen production via transport and storage towards usage, respective components and systems need to be brought into operation much faster than ever. For Namibia GH2T represent a major key technology for industrialization, securing independence in energy supply and income for further development of the country. For increasing wealth and the quality of life in Namibia, the vertical value chain of GH2T from materials via production towards sustainable service operation of systems will be even more important than the GH2T horizontal value chain. In addition to the extremely rapid development and application, trust in the extreme GH2T push needs to be created within societies, politics and industry. To provide rapidly technical safety, research and testing can directly be integrated into the value chains of GH2T, entailing capacity building and employment opportunities. The present contribution provides an overview about BAM under the mission Safety in Technology and Safety and its competence center H2Safety@BAM, where about 140 experts work in five application-oriented fields to build trust into the new GH2T. Exemplary deep-dives might elucidate how integrated research and suitable testing can be integrated to increase the safety and to speed-up market readiness of components for hydrogen transport and storage. Joint UNAM-BAM capacity-building via MSc and doctoral theses targeted at safe and prosperous development of GH2 technologies in Namibia will also be addressed.

Prof. Dr.-Ing. Thomas Böllinghaus holds a diploma in mechanical engineering, a doctoral degree in welding technology and simulation as well as a habilitation for materials science and welding technology from Helmut Schmidt University in Hamburg, Germany. His research especially focuses on metallic materials and their interactions with hydrogen in various aqueous and gaseous environments. Currently, he dedicates his research work to the development of smarter and easier to be applied test procedures for the new GH2 technologies aimed to increase the hydrogen cracking resistance of metallic materials. He is a Professor and a Faculty Member at OvGU Magdeburg and at Helmut-Schmidt-University in Hamburg. He published more than 150 contributions in welding, corrosion and hydrogen-metal interactions, is President-Elect of the IIW (International Institute of Welding) and EiC of the journal Materials Testing.

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AFROCENTRIC DRUG DISCOVERY AND DEVELOPMENT IN NAMIBIA

Abstract

In this plenary lecture, we illustrate the use of the Afrocentric approach in the discovery of novel plant active compounds that are being developed into wonder drugs for the treatment of HIV infection, malaria, cancer and gonorrhoea in Namibia.

Prof Kazhila C. Chinsemu is a Full Professor of molecular biology and drug discovery and development. He works at the crossroads of indigenous knowledge of medicinal plants and diseases. He is currently the editor-in-chief of the *International Science and Technology Journal of Namibia* and served as lead guest editor of prestigious journals including *Frontiers in Pharmacology*.

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INVITED GUEST SPEAKERS



UNDERSTANDING THE FATIGUE FAILURE MECHANISMS TOWARDS THE DEVELOPMENT OF EXTRA-LONG-LIFE GALVANIZED STEELS FOR SUSTAINABLE DEVELOPMENT OF OCEAN AND COASTAL AREAS

Abstract

In response to the global effort to reduce carbon emissions, the steel industry plans to be carbon neutral by the year 2050. Since it will be difficult to sell steel at the current prices, there will be a need to produce competitive steel products with extra-long life which can be achieved by effective corrosion resistance and mechanical durability. Hot-dip galvanizing is one of the cost-effective methods of corrosion protection of steel, and the effect of the galvanizing layer on the corrosion resistance of steel has been extensively studied. On the other hand, the effect of the galvanizing layer on fatigue properties has been scarcely studied, and although a reduction in the fatigue strength after hot-dip galvanizing has been pointed out, no mechanism has been proposed. To clarify the fatigue mechanisms, experimental fatigue testing was conducted on hot-dip galvanized AISI 1020 steel under different cyclic loading modes. Fractography analysis was conducted to investigate the relationship between the cracking mechanisms and the microstructure of the galvanizing layer. Mode I cracking was observed under tension-tension cyclic loading, while mixed-mode cracking was observed under tension-compression cyclic loading. Under tension-tension loading, the fatigue cracks had originated from the eta (η) phase of the galvanizing layer, while under tension-compression loading the fatigue cracks originated from the delta (δ) phase of the galvanizing layer. This is a novel research work that is a precursor to the development of a microstructure of the galvanizing layer for improved fatigue resistance of hot-dip galvanized steel.

Dr. Shatumbu Thomas Alweendo holds a Doctor of Engineering in Applied Marine Environmental Studies, Tokyo University of Marine Science and Technology, Japan. He specializes in Fracture Analysis, Testing, Characterization and Development of Engineering Materials for Sustainable Development of Coastal and Ocean Areas.

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CO₂-REDUCTION: HOW TO REDUCE CO₂ IN OUR ATMOSPHERE? HOW TO USE SEQUENCED CO₂ IN GREEN ECONOMY? -AN INSPIRATIONAL IMPULSE AND BLUEPRINT GENERATED FROM ORANGE ECONOMY

Abstract

In this century, we must meet the greatest challenge in modern history, decarbonizing all industries, including the blue economy, agriculture and food sectors, to mitigate global warming and biodiversity loss. By 2050, we need to feed another 1-2 billion people without having a second planet. Herein, I will present to you my research initiatives aim to feeding another 2 billion people, directly or indirectly. The first initiative is to grow marine kelp forests around the globe that restore the health of the oceans and lock away vast amounts of CO₂. Today, Kelp Blue Project initiative is in place aims to bring Kelp Blue Foundation, University of Cambridge and UNAM researchers and student together to jointly capitalize and pursue the hypothesis to determine whether there is a significant difference in the water geochemistry at the pilot, adjacent sites and control site? This will further give an answer the question: can the presence of the artificial kelp forest act as a carbon sequester? The second research initiative is the cultivation of spirulina as food for farm animals and humans. In recent years, we have learned a lot from an ancient inhabitant of the planet, the cyanobacterium *Arthrospira platensis* (Spirulina). Spirulina can not only fix large amounts of atmospheric carbon, but it is also composed mostly of nutritious protein and contains many healthy ingredients that we are studying in the lab. The third research initiative is the renewable energy research initiative. Under this initiative, I am presenting the ongoing research to improve the electrolyte's performance by using natural dye. The DSSC solar cell with surface area of 7.8 cm² was assembled and tested under direct sunlight illumination having a power input of 4.5 mW. The current and voltage values for the cell were 157.4 μA and 510 mV respectively. The resistance of the assembled DSSC was 0.931 Ω. Open circuit voltage 287.1 mV, short circuit current 170.8 μA, fill factor 33.5 %, with an efficiency of 0.37 % was obtained. Many postgraduate students show interest in this initiative and so far 8 students were graduated and 7 students are still pursuing research on this research topic. The third initiative is that of RS-DFID Africa Capacity Building Initiative whereby green hydrogen was produced from water using Zinc oxide powder. A PhD student is currently continuing with this research. Finally, the development of highly efficient and cheaper hydrogen storage materials is one of the main challenges that must be tackled in a widely expected green hydrogen economy in Namibia. In this presentation, the state-of-the-art of the prepared activated carbon (AC) powder using *Acacia erioloba* seedpods for hydrogen storage has been surveyed and analyzed. The prepared AC was also analyzed for its applicability in hydrogen storage and has shown great potentials to adsorb a large quantity of H₂ due to the high surface areas that can facilitate not only the molecular H₂ uptake via physisorption, but also the atomic hydrogen spillover via chemisorption whereby metal particles can be loaded by doping the AC with the transition metals.

Prof. Dr. Daniel Shipwiisho Likius holds a Ph.D. (Applied Chemistry and Chemical Engineering), Tokyo Kogakuin University, Japan. His research focuses on Nano-Micro Material Science for Renewable Energy, Photovoltaic and Photocatalysis Systems; Fuel Cells; Water splitting, carbon sequestrers. He has published over 28 peer-reviewed research articles and is currently an associate professor of material science and a coordinator of the Science and Technology Division for the Multidisciplinary Research Service of the University of Namibia

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MARKER-ASSISTED SELECTION (MAS) AND ITS APPLICATION IN LIVESTOCK BREEDING – A REVIEW

Abstract

Livestock farming plays a very important role within the Agricultural sector of the Namibian economy, accounting for about 57% of agricultural output. However, the the industry is faced with challenges which require innovative solutions. One of the constraints in livestock production in Namibia is the ability to predict the genetic performance of animals. Traditionally, selective breeding was used to select for breeding animals based on phenotype. The desired goal is the accumulation of "good" forms of genes in the population, over time. However, many important traits, such as fertility, longevity, adaptability, growth rate, milk quality, meat quality, wool quality, disease resistance are quantitative; controlled by many genes and the environment. It is therefore difficult to deduce genotype from phenotype and to relate genetic variation to differences in the phenotype. In addition, these traits are only fully expressed when an animal is mature, and therefore genetic progress is relatively slow. Marker assisted selection (MAS) facilitates the use of existing genetic diversity in breeding populations and can be used to accurately and efficiently improve desirable traits. The types of molecular markers commonly used to identify molecular markers include PCR-Restriction Fragment Length Polymorphisms (PCR-RFLPs), PCR-Single Strand Conformational Polymorphism (PCR-SSCP), Amplified Fragment Length Polymorphism (AFLP), Single Nucleotide Polymorphisms (SNPs), Microsatellites, DNA sequencing. These molecular markers have bot advantages and disadvantages. The use of high throughput DNA chip in animal breeding in the future is promising. MAS allows for more efficient and accurate improvement of desirable traits and better breeding decisions to match breeding goals.

Dr Theopoline Omagano Amushendje holds a Molecular Genetics and Wool Science, Lincoln University, New Zealand. Her research interest is geared towards developing genetic markers linked to traits of economic interest, characterization of livestock breeds and conservation of genetic diversity of indigenous livestock breeds. She has published over 10 peer-reviewed journal articles and is currently a Senior Lecturer and Head of the Department of Animal Production, Agribusiness & Economics, School of Agriculture & Fisheries Sciences of the University of Namibia.

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MILITARY ETHICS TRAINING AND DEVELOPMENT IN NDF

Abstract

Ethics education has been a more popular issue in various military services throughout the world over the years. In the past, senior-level academies of the armed forces offered ethical instruction with a concentration on officer and senior non-commissioned officers. However, the current ethics training's new strategy focuses on training military recruits to ensure moral leadership and decision-making at all levels. All levels of soldiers must weigh their options and act promptly. Armed forces must incorporate ethical education into the fundamental training of all officers and enlisted people if they want to boost military performance. Furthering their post-military professions and family lives, it will also enable leaders and their subordinates to deal with all counterparts more effectively. The foundation of critical thinking is education. A future leader will be given an additional lens to view reality after being carefully chosen and taught. In order to meet the demands of modern military operations, Professional Military Education must increase the effectiveness and quality of ethical education. However, despite popular desires to educate on this topic, many states have been unable to do so due to the changing moral climate of conflict and a lack of suitable resources. The paper answer one of the questions on; "Why ethics is important to the military and whether or not formal ethics training programs are effective or essential?" Hence the main goal of ethics education is to provide people the ability to morally differentiate between right and wrong. Knowing that a tough choice is morally correct, aids in coping and supports the prevention of psychological after effects. Future leaders will be able to use ethical behaviour and decision-making to their developing leadership skills. Most African military were built and structured primarily to deter foreign aggression, making it difficult for them to effectively combat other types of security challenges. This paper discuss all the above mentioned challenges.

Brigadier General Mumba Thaddeus Mahela holds a Masters of Public Administration, University of Namibia, Namibia and a Masters in Defence Strategic Studies, University of Botswana. He provides high-level academic, innovative, enterprising and research- driven leadership focusing on achieving outstanding academic standards in- line with the University of Namibia's mission, vision as well the mandate of the MODVA educating the members of Defence and is currently the Associate Dean of the School of Military Science and an active General officer of the Ministry of Defence and Veterans Affairs (MODVA).

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DAY 1 ABSTRACTS

GREEN SYNTHETIC FUELS/CHEMICALS

M. Amweelo

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Abstract

A massive reduction in CO₂ emissions from fossil fuel burning is required to limit the extent of global warming. Green synthetic fuels, including hydrogen and natural gas, are considered viable alternatives to fossil fuels. Indeed, they play a fundamental role in those sectors that are difficult to electrify (e.g., road mobility or high-heat industrial processes), are capable of mitigating problems related to flexibility and instantaneous balance of the electric grid, are suitable for large-size and long-term storage and can be transported through the gas network. Available fuel conversion technologies use renewable energy for the catalytic conversion of non-fossil feedstocks into hydrogen and syngas. The syngas quality can be improved by catalytic CO and CO₂ methanation reactions for the generation of synthetic natural gas. The produced gaseous fuels could follow several pathways for transport and lead to different final uses. Therefore, storage alternatives and gas interchangeability requirements for the safe injection of green fuels in the natural gas network and fuel cells are outlined. Indeed, the electric grid needs to be balanced instantaneously at all times. Still, energy generation is affected by intermittency and fluctuation of the energy sources that lead to both temporal and spatial discrepancy between the power supply and demand. Green synthetic fuels can support the transition to a decarbonized energy system. Hydrogen and synthetic natural gas are energy carriers that can be exploited as alternative fuels to reduce greenhouse gases (GHG) emissions and the depletion of fossil fuels. They enable cost-effective, long term and high energy density storage, distribution and transport. Moreover, synthetic fuels can be converted into heat or electric power (combustion, fuel cells) during peak loads, ensuring higher flexibility of the electric and gas grid. Nevertheless, hydrogen plays a primary role in the decarbonization of the road transport sector- the source of 24% of CO₂ emissions, which is annually increasing by 1.6% in the past decade.

Keywords: green synthetic fuels; power-to-gas; technology readiness level; supply chain; gas quality

CORROSION BEHAVIOR OF Cr₂O₃ COATING ON MILD STEEL IN SYNTHETIC MINE WATER

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Abstract

A Cr₂O₃ coating was sprayed on mild steel using the high velocity oxyfuel technique for protection against corrosion and wear. Microstructural, hardness and XRD analyses of the mild steel and the Cr₂O₃ coating were done, and their corrosion behavior was studied in synthetic mine water (pH values of 6, 3 and 1) using potentiodynamic polarization. Mild steel was less hard (160±50 HV₂) than Cr₂O₃ coating (1260±77 HV₂), thus a harder coating was needed to protect it. The XRD patterns of the mild steel substrate only had the α-ferrite phase and the coating had the Cr₂O₃ phase. The corrosion potentials for mild steel became more negative when the pH was decreased, and more positive for Cr₂O₃ coating under the same conditions. Ranking the corrosion rates of mild steel gave: pH 1 (0.72±0.02) > pH 6 (0.42±0.02) > pH 3 (0.37±0.04), and for Cr₂O₃ coating: pH 1 (0.110±0.004) > pH 6 (0.036±0.003) > pH 3 (0.024±0.001), making Cr₂O₃ a suitable coating due to its lower corrosion rates at all pH values and a higher hardness than the steel. Thus the coating would be protective in applications where hardness and corrosion give problems.

MODELLING TB HEALTH FACILITY READINESS - AN ASPECT OF HEALTH SYSTEM STRENGTHENING

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Abstract

The availability of Tuberculosis services in healthcare facilities is one of the significant aspects in ensuring quality TB health care. The readiness of the healthcare facility in treating and diagnosing TB is determined by the availability of Tuberculosis services at the facility. However, little is known about the relationship between TB health facility readiness and the availability of TB services. The main objective of this study was to investigate the best fitting count data model for TB readiness of health facilities while accounting for missing data and measurement error. This study analyzed data of 470 health facilities obtained from the 2017 health facilities census for the Service Availability and Readiness Assessment in Namibia. The predictor measure was a composite variable (with score of 0 to 11), the highest score indicates the high quality of TB services availability. Health facilities with > 50 in the TB service readiness index were considered to have high readiness to provide TB services. Poisson, Negative Binomial and Quasi-Poisson regression models were fitted to assess the association between TB service availability and facility readiness. The study found out that health facilities with high TB services available achieved high TB readiness scores in the adjusted models. Furthermore, TB readiness was found to be associated with the health facility managing authority and urban/rural. Different methods were used to generate TB health facility readiness index with minor variation when compared. All in all, TB health facility readiness in the adjusted models is significantly associated with service availability.

Keywords: Tuberculosis, service availability, health facility readiness, quality healthcare, Namibia

EXPLORING STUDENTS' MOTIVATION AND EXPECTATIONS ABOUT SCHOOL OF MILITARY SCIENCE PROGRAMMES

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Abstract

People enlist in the military for a variety of complex and varied motivations a number of psychological and economic considerations. These factors include learning a new skill or job, improving oneself, helping the country, and money for employment, time off, or lack of alternative opportunities, and they frequently involve a number of variables. Namibia's objective is to develop a small, highly trained, mobile, professional, and well-equipped force that is prepared to uphold regional integrity, protect Namibia's sovereignty, and actively contribute to global peace and stability despite the modest size of its defence force. Due to this, the nation needs highly skilled military officers who are skilled in both military and civilian professional fields in order to preserve peace and sovereignty. Although the demands for both under- and postgraduate military science studies programs keep on growing steadily, the reasons for such demand remain rather unclear. People pursue undergraduate degrees for a variety of reasons. The study explored to fill the gap, of candidates' motivation and expectations of them pursuing and who have graduated from the military science programmes before, during and after the course. Questions such as; what motivated the students joining the programmes offered by the School of Military Science and their expectations thereof were key to the study. A qualitative phenomenological research, was employed. This helped to understand the essence of participants' descriptions of a phenomenon as they relate to their own personal experiences. The study found that intrinsic motivation attracted just a few students to the programmes however extrinsic motivation was observed to a great extent. Learning motivation was seen worrisome, as a relative bigger number joined the programmes because there was sponsorship. The study suggests programmes awareness to potential candidates before joining the School. Students must choose the programmes for career development and not just a mere means of doing a programme due to the scholarship offered by the Ministry of Defence and Veterans Affairs.

THE CONTRIBUTIONS OF STAKEHOLDERS FOR THE SUSTAINABLE FUTURE OF THE NAMIBIAN AVIATION INDUSTRY

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Abstract

The speed of aviation sets it apart from other modes of transportation. The need for environmentally friendly aircraft will grow more pressing if flying becomes more affordable and accessible. Faster development of fuel storage facilities, additional aircraft operations vehicles, and expansive terminal designs may result from expedited changeover to sustainable aircraft. Airports will benefit from increased efficiency, less risk of negative climate change effects and increased adaptability to the changing operational conditions. To create a sustainable aviation sector, hydrogen aviation will require innovation from all stakeholders. Quantitative techniques are more focused on statistical analysis with large target groups. Due to the ability to concentrate on a small number of businesses, the qualitative method enabled in-depth analysis of aviation industry was sought best. Changes in behaviour are the primary means of reducing emissions; other methods, like as advancements in technology, are secondary. Operational modifications aim to make aircraft operations more efficient both on the ground and in the air. Similar results were reached by who suggested that technological advancements and behavioural modifications are the two strategies that can return aviation to a sustainable growth path. This study gives hope to managers and business professionals an in-depth understanding of passengers' thoughts, beliefs, and attitudes toward Corporate Social Responsibility in the aviation industry. It also aids in the development of a better awareness of the factors that should be given special consideration in order to increase interest in CSR.

Keywords: Sustainable, Consumer behaviour, Corporate Social Responsibility

AN ORDINAL REGRESSION ANALYSIS ON THE CHANGING OF EMPLOYMENT AMONG GRADUATES FROM UNIVERSITIES IN NAMIBIA

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Abstract

The study attempts to develop an Ordinal Logistic Regression (OLR) model to identify the determinants of graduates changing employers/employment using data from the 2021 National Graduate survey. This is because graduate unemployment is on the increase, there are job openings in the market but the graduates are not being absorbed since the jobs opening up are being grabbed by already employed graduates. During the survey, the graduates were asked how many times they have changed their employers. In response to that, some indicated 0 times, once, twice, three times, four times and five or more times. Since the response variable is the number of times changed employer with ordinal categories and the explanatory variables are more, an ordinal logistic regression model will be fit to the data to determine the relationship between changing employers/employment and the independent variables. Results of the analysis revealed that the duration of experience with the current employer and duration of experience with the previous employer was both significant determinants in graduate changing their employers. With years of experience being a requirement to gain employment, graduates with experience are at advantage than those without experience in the job market. The year of completion of study was a significant determinant as it determines how long graduate has been in the job market. The highest level of qualification and the economic sector of employment were also contributing factors of graduates changing their employment. Higher education institutions should incorporate internship programmes in all qualifications for graduates to gain experience.

Keywords: graduates, change of employment, employment, unemployment, ordinal regression, higher education institutions, Namibia,

SEISMIC STRATIGRAPHIC ANALYSIS FOR THE CHARACTERISATION OF PETROLEUM SYSTEM ELEMENTS, WALVIS BASIN, OFFSHORE NAMIBIA

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Abstract

Seismic stratigraphy emerged in the 1970s and has evolved to sequence stratigraphy with the incorporation of outcrop and well data. Recognition of seismic stratigraphic units and their seismic facies, such as reflection configuration, frequency, and amplitudes, allow for prediction of lithofacies intervals that may contain source, seal, and reservoir lithologies. Namibia has four offshore basins, namely, the Orange Basin, which is down South of Namibia, bordering with South Africa; the Lüderitz Basin, the Walvis Basin and Namibe Basin. These basins were formed during the Late Jurassic to Early Cretaceous breakup of Gondwana. The Walvis Basin is under-explored. There is limited information on the lithofacies in the northern part of Walvis Basin. Seismic stratigraphic analysis of the post-rift mega sequence of the Namibian passive continental margin has enabled depositional features to be interpreted in terms of the likely controls on their formation. Therefore, the question of mature source and reservoir lithofacies presence and their preservation in northern Walvis basin presents itself. The study aims to identify and delineate the key seismic sequences of the basin; establish the various seismic facies; and predict the major petroleum system elements within the basin (source, reservoir, traps etc). The advance understanding of the seismic stratigraphy and of source and reservoir lithologies in the northern Walvis basin will resuscitate interest in exploring the Basin further and may potentially encourage new dataset acquisition and further drilling campaigns in the Basin. Quantitative methods will be used in this study. A Schlumberger Petrel E&P modelling software will be used to for mapping seismic horizons, seismic lithofacies and seismic facies. Seismic sequence analysis; seismic facies analysis and prediction of the Major Petroleum System Elements will be carried out on the seismic data by picking major unconformities choosing significant boundaries from well data and to generate facies maps.

CHARACTERIZATION OF THE RESERVOIR AND DEPOSITIONAL ENVIRONMENT OF THE OWAMBO FORMATION, MULDEN GROUP, OWAMBO BASIN NAMIBIA

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Abstract

Reservoir characterization is the study of reservoir properties using geological, geophysical, petrophysical and engineering analysis, including uncertainty analysis of geologic and engineering data and spatial variations. Whereas, depositional environment is defined as an environment that has been preserved in the rock record at some time in its past, and it is vital in the reconstruction of earth history, understanding earth processes and identifying possible exploration targets. The study will be carried out in the Owambo basin located geographically between 14°-18°E and 19°S in Namibian territory and encompasses an approximate area of up to 350 000 square kilometers. Wireline logs will be utilized to characterize reservoirs and determine the depositional environment of the area as no values of permeability, volume of shale or water saturation has been recorded in any literature. Potential reservoir rocks have been identified as sandstones from the Nosib Group, carbonates from the Otavi Group and carbonates (limestones and dolomites) from the Owambo Formation within the Mulden Group. To date, five exploration wells (Strat Test-1, Etosha 1-1, Etosha 2-1, Etosha 5-1A and OPO-1) have been drilled, three 2D seismic acquisition campaigns and numerous aero gravimagnetic surveys have been conducted in the basin. Literature studied records the following results: 1) Soil gas survey showed the presence of anomalous levels of methane, ethane, propane and butane, 2) 2D Seismic Data identified the ramp anticlines, stratigraphic traps and antiformal traps, 3) Porosity in Otavi Carbonates ranges from 15% in logs and 21-37% in outcrops while in the Mulden upper Owambo Formation porosity of about 20% has been recorded in outcrops. The overall objective of the study is to determine characteristics of reservoirs and the depositional environment of the

Owambo Basin. This will be achieved by the delineation and lithology identification of potential reservoirs, analysis of petrophysical characteristics (porosity, permeability, volume of shale, water saturation) of the reservoir rock units and prediction of the Environment of Deposition (EOD). This study will utilize the quantitative and qualitative method to analyze respective data obtained from the National Petroleum Corporation of Namibia (NAMCOR). The Interactive Petrophysical Software (Petrel) will be applied to quantitatively determine petrophysical properties of reservoirs (porosity, permeability, water saturation), The qualitative method will be applied to wireline log data (gamma ray, resistivity, neutron, etc.) to delineate and examine different reservoir lithologies as well as determine their depositional environments.

DETERMINANTS OF WOMEN'S PARTICIPATION IN NAMIBIA'S LABOUR FORCE: A MULTINOMIAL ANALYSIS OF THE 2018 NAMIBIA LABOUR FORCE SURVEY

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Abstract

Women's participation in the labour force can be regarded as a sign of decreasing discrimination and an increase in women empowerment. Although various studies on identifying factors associated with women's participation in the labour force have been conducted worldwide, not much studies have been conducted on this topic in Namibia in recent years besides Mufune (2013) who used the 2009/10 NHIES and concluded that Namibian women still lagged behind men in many aspects of labour force participation despite increasingly entering the labour force due to post-independence policies that emphasize gender equality. This study aimed at identifying and examining determinants of women's participation in Namibia's labour force through a quantitative cross-sectional study using the 2018 NLFS and a multinomial logistic regression technique. Findings revealed that socio-demographic characteristics such as area-location, region, age-group, marital status, literacy status and education level (p-value<0.001) were significant determinants of employed women's participation in Namibia's labour force, while area-location, region, age-group, and literacy status (p-value<0.001) were significant determinants of unemployed women's participation. Compared to the odds of economical inactiveness, women from Hardap and Kavango-East regions; under 20 years old; married; had no education, had primary education, junior secondary education, senior secondary education and technical/vocational certificate/diploma (p-value<0.001); had low odds of employment. However, literate women (p-value<0.001) had high odds. Additionally, women from Erongo, Kunene, Omaheke, Oshana, Oshikoto and Otjozondjupa regions; aged 20-29, 30-39, 40-49 and 50-59 years old; and in consensual union (p-value<0.001) had high odds of unemployment, while those residing in urban areas (p-value<0.001) had low odds.

Keywords: Namibia, Women, Labour Force, Employment, Unemployment, Economical Inactiveness, Multinomial Logistic Regression

CHARACTERIZATION OF THE RESERVOIR POTENTIAL OF THE H-T FIELD, OFFSHORE WALVIS BASIN, NAMIBIA

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Abstract

Well log analysis and interpretation are useful in distinguishing the reservoir petrophysical parameters like porosity, water saturation and locating hydrocarbons zones. This approach has been successfully used in exploration and well development, to offer information and greater accuracy of reserve evaluation. In addition, it can be used to identify the depth and thickness of productive zones, to differentiate between oil, gas, and water in reservoir and to estimate hydrocarbon reserves. Chongwain et al, (2018) employed the well logs data to delineate reservoir depositional features and environment, and evaluate reservoir properties in four wells, M-Field, offshore Douala Sub-basin, Cameroon. The Walvis Basin is located in the West African sub-Sahara part of the Atlantic margin, and

in the eastern of the Walvis Ridge offshore Namibia. Good quality 2D and 3D seismic have been shot covering the entire offshore Namibian margin from shallow coastal waters to the abyssal plains. The Basin is underexplored with only eight exploration wells drilled in the basin to date. Drilling have successfully proven all elements of a working petroleum system but the right combination to produce a large discovery and unlock a new petroleum province remains elusive. In addition, light oil 38° to 42° API was discovered in several thin sandy lenses within the Aptial interval (Intawong et al., 2017), but no commercial discovery of hydrocarbons has been made to date. According to Domingos (2018) some of the reasons the wells failed discovering economic quantities of recoverable hydrocarbons include lack of one or two petroleum system elements and or process; with the absence of reservoir or charge being the common reasons of failure. Previous studies on the potential reservoir intervals in the Walvis Basin include the unpublished Master and PhD thesis (Domingos, 2018; Kukulus, 2004). Domingos (2018) focused on reservoir unit prognoses from seismic profile and comparing them to those of volcanics. Kukulus (2004) examined the potential reservoir intervals developed in the central and northern Walvis Basin and discussed a schematic play concept to aid further exploration activities. Although there is an in-house study by oil and gas company on the petrophysical evaluation of a block in the Walvis Basin, there is still a gap in the published literature on reservoir characterization of the Walvis Basin. The depositional environment of the Walvis Basin is not clearly understood, and the reservoir characteristics have not been clearly defined. This research aims to analyze the well log response such as gamma ray, resistivity, density, and neutron for potential reservoir identification and to determine the various petrophysical parameters from wells in the Walvis Basin.

AN ECONOMIC EVALUATION ON FRP FOR BRIDGE CONSTRUCTION IN SOUTH AFRICAN COASTAL AREAS

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Abstract

Fibre Reinforced Polymers (FRP) have been used for approximately 30 years as concrete strengthening materials and the polymers are also available in the form of reinforcing bars. This is primarily due to Steel Reinforced Concrete (SRC) being susceptible to the corrosion of reinforcing steel, especially in coastal environments. However, the FRP face the challenge of high material and initial construction costs then incorporated bridge construction. The research aimed to investigate the economic viability of using FRP as reinforcing elements in bridge construction in South Africa. This was done by conducting a life cycle cost analysis (LCCA) on two highway beam bridge superstructures: a SRC superstructure and a GFRP-RC (Glass FRP – Reinforced Concrete) superstructure. The initial construction costs were found to be the bulk of the life cycle costs (LCC) for both superstructures, with the initial costs of the SRC superstructure being significantly more than that of the GFRP-RC superstructure. This was primarily due to the cost of E-glass being approximately 2.1 to 2.9 times more expensive than steel. LCC savings were seen from the GFRP-RC superstructure over the SRC superstructure, in terms of maintenance costs. Furthermore, the GFRP-RC superstructure was found to be the least cost-effective investment over a 75-year LCCA period. It was concluded that it is not currently economical to incorporate FRP as reinforcing elements in bridge construction in South Africa. However, since the cost of FRP was observed to decrease over time, the incorporation of FRP rebars in bridge construction might be economically viable in the future.

Keywords: glass fibre reinforced polymers, steel reinforced concrete, life cycle cost analysis, bridge superstructure, construction.

INVESTIGATION OF THE DEPENDENCE OF SHEET RESISTANCE ON THE THICKNESS OF SPIN COATED POLY(3-HEXYLTHIOPHENE) THIN FILMS

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Abstract

Sheet resistance (R_{\square}) and thickness of as-cast and post-treated poly(3-hexylthiophene) (P3HT) thin films fabricated on non-conductive glass substrates by the spin coating method, were determined under dark, and illuminated conditions. R_{\square} of P3HT of thin films of different thicknesses were compared. R_{\square} of each P3HT thin film was measured in the dark and the light and compared to check the effect of illumination on the sheet resistance, and hence on the resistivity of the films. Commercially available P3HT was purchased and dissolved in chloroform (CHCl_3). Glass slides were cleaned using detergent, acetone, and alcohol, in the ultrasonic bath, followed by cleaning in distilled water. Dry, cleaned glass slides were used as substrates for the P3HT thin films. P3HT thin films were fabricated by spin coating CHCl_3 based solutions on clean glass substrates, in ambient air. The films were annealed at a controlled temperature, and then the R_{\square} of each thin film was measured, using the in-line four point probe method. The thicknesses of the thin films were varied by varying the spin speed (ω) of the spin coater. The results showed a correlation between the R_{\square} and the P3HT thin film thickness. The R_{\square} reduces as the thickness of the P3HT thin films increases in the light, and in the dark, for as-cast and annealed P3HT thin films. Annealing also reduced the R_{\square} of the P3HT thin films. R_{\square} showed some reductions when measured in the dark. The four point probe method can be used to characterise materials.

SPATIAL FRAILTY MODELLING FOR MULTIDRUG RESISTANT TUBERCULOSIS MORTALITY IN NAMIBIA

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Abstract

Multidrug-resistant Tuberculosis (MDR-TB) is fast becoming a major public health concern, with 80% of the reported global MDR-TB deaths occurring in high burden countries such as Congo, Kenya, Tanzania, South Africa, Ethiopia and Namibia where drug susceptibility testing is not routinely performed, making the reported prevalence of MDR-TB in the country an underestimate of the true burden. Thus, the main aim of this study was to examine the spatial variation of mortality among MDR-TB patients in Namibia by estimating the survival time of mortality among the patients under treatment for MDR-TB, in addition to identifying the risk factors of MDR-TB mortality and investigating the spatial pattern of these deaths. To accomplish this, this study adopted a retrospective cohort study design using the 2014-2017 MDR-TB records from the ministry of health and social services, with Kaplan Meier used to estimate the survival functions and 10 different Cox Proportional Hazard (PH) regression models fitted to determine the best fit model to use in modelling the MDR-TB mortality and identify its associated risk factors. Spatial mapping was used to map the spatial variation of the MDR-TB mortality for the associated risk factors. Results from the study showed that out of the 1432 MDR-TB patients in Namibia, 224 deaths were recorded. The Gompertz PH regression model (AIC=1469.197, BIC=1748.042) was identified as the best fit model to use, while the Gompertz PH regression model with Gamma (shared) frailty (AIC=1463.816, BIC=1642.698) was identified as the best fit model to use for the frailty modelling of the MDR-TB mortality. Patient's characteristics such as sex, age category, HIV status, region, district, number of previous TB treatments and patient type had a significant effect on their MDR-TB mortality. Furthermore, MDR-TB mortality was less likely to occur for patients who were males (HR=0.704, P-value=0.0016, 95% CI:0.529-0.936), from Onandjokwe (HR=0.265, P-value=0.048, 95% CI:0.071-0.986) and Oshikuku (HR=0.143, P-value=0.003, 95% CI:0.039-0.52) health districts. Moreover, MDR-TB mortality was more likely to occur for patients who were aged 55 years and above (HR=4.081, P-value<0.001, 95% CI:1.872-8.895), from Khomas (HR=3.012, P-value=0.008, 95% CI:1.328- 6.83), Omusati (HR= 9.238, P-value=0.001, 95% CI:2.476-34.46), and Oshikoto (HR=4.402, P-value=0.035, 95% CI:1.107-17.509) regions, and tested positive for HIV (HR=2.042, P-value<0.001, 95% CI:1.459-2.857). It is

therefore recommended that the Namibian government and policy makers consider conducting outreach sessions to increase awareness on MDR-TB, including early detection and screening programs, and patient's adherence, especially among female patients aged 55 years and above, with HIV and those living in Khomas, Omusati, and Oshikoto regions.

Keywords: MDR-TB, patients, mortality, risk factors, spatial variation, health districts

DESIGNING AND SYNTHESIZING OF A PORTABLE AIR CONDITIONER USING WATER AS WORKING FLUID

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Abstract

Hot weather is very long in Namibia, and the equipment to air-condition houses is costly in addition to high maintenance costs. Also, an effective air-conditioning system consumes lots of electricity which is increasingly expensive. There were efforts to improve air-conditioning by creating a portable steam fan, but it has some setbacks since it increases air humidity and makes breathing difficult. This study designed a portable air conditioner that uses water circulation as refrigerant, which absorbs the temperature as it passes through a copper coil. This study emphasizes optimizing and synthesizing a portable air conditioner to alleviate hot weather conditions in living rooms. A copper tube coil (12-mm diameter) was wrapped around a 50-W fan and was connected to a submersible 40-W pump. The heat exchanger process occurs as the coolant is pumped through the tube coil and the current of air from the fan blows around the coil. The ice cubes provided relatively good results for the first ten minutes of experiments, and the temperatures dropped by 5°C in a 4x10x2-m³ room size, but the ice cubes melted down quickly, and the temperatures went up again. The concentrated salty water did not provide excellent results because it is kept in plastic bottles to avoid any contact with the motor, and the energy is not adequately released. The results significantly improved when the water was mixed up with the antifreeze (coolant). The room temperatures dropped rapidly by 10 to 20°C in the first 15 minutes and kept the room cool for a long time.

Keywords: Refrigerant, Heat transfer, Cooling chamber, Heat source, Heat sink

PREVALENCE OF ANTIRETROVIRAL TREATMENT INTERRUPTION AND ITS ASSOCIATED FACTORS AMONG PEOPLE LIVING WITH HIV IN KEETMANSHOOP NAMIBIA: A RETROSPECTIVE STUDY FROM 2000 – 2021

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Abstract

Treatment interruptions are usual and may contribute to the worsening of patients' outcomes, therefore assessment of treatment outcomes' causes as well as routine monitoring should be considered by HIV/AIDS programmes to address the most occurring reasons for interruptions. This study explores the prevalence of ART interruption and its associated factors among ART patients in Keetmanshoop Health District in Namibia. A retrospective study of all PLHIV who have initiated ART treatment for more than six months as recorded in the Quantum ePMS of all 8 facilities in the district from 1 January 2000 to 31 December 2021 was used. Hence, a Generalized Linear Model was fitted to explore the factors associated with treatment interruption. Of 4143 clients analyzed in this study, 59.4% have been recorded as having interrupted treatment. 58.9% were female (33.1% had interrupted treatment), while 41.1% were male (26.3% had interrupted treatment). Those who had a significant effect on treatment interruption were male gender (p-value = 8.16e-07), 50+ (p-value = 0.0116), TB positive (p-value = 5.96e-06), TB Negative (p-value = < 2e-16), no TB screening documentation (p-value = 0.0231), patients on ART for 2 years and more (p-value = 7e-05), 40 – 999, 1000+, and none viral load, (p-value = <2e-16, <2e-16, <2e-16, respectively). The study recommends that intervention to reduce treatment interruption should target men, older age, patients whose viral load is 40 and above as well as patients on ART for more than 2 years.

Keywords: Treatment Interruption, HIV/AIDS, antiretroviral therapy, proportional multilevel regression, Quantum ePMS, generalized linear mixed effect model

IN SITU NEUTRAL DETERGENT FIBRE DIGESTIBILITY, IN VITRO ORGANIC MATTER DIGESTIBILITY AND METHANE PRODUCTION OF FOUR NAMIBIAN ENCROACHER BUSH SPECIES

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Abstract

Encroacher bush species have been undervalued due to insufficient information about their potential feeding value. This study evaluated the *in situ* neutral detergent fibre (NDF) digestibility, *in vitro* organic matter digestibility (OMD) and methane production of *Senegalia mellifera*, *Dichrostachys cinerea*, *Terminalia sericea* and *Rhigozum trichotomum*. Leaves and twigs (< 20mm) were harvested during late dry (LD) and early rainy (ER) seasons and shade-dried before being analyzed. The indigestible NDF (iNDF) was determined by *in sacco* nylon bag technique, while the two stage pepsin+cellulase solubility technique and Gas Endeavour Measuring System was used to determine *in vitro* OMD and methane, respectively. Increasing iNDF contents ($P < 0.001$) were observed from LD to ER season for all species, except for *S. mellifera* which decreased. The iNDF values ranged from 734 to 915 g/kg NDF with *D. cinerea* having the highest and *T. sericea* having the lowest content in both seasons. Except for *S. mellifera*, the *in vitro* OMD of other species decreased ($P < 0.001$) from LD to ER season, where *D. cinerea* recorded the lowest ($P < 0.001$) *in vitro* OMD in both seasons. *In vitro* methane production of all four species was higher ($P = 0.0004$) during the LD season compared to the ER season (147.6 versus 92.0 mL/g DM). Seasonal variability in fibre and phenolics may affect digestibility and methane production of the four species. In conclusion, based on the low OMD and high iNDF, the studied species may require further intervention to improve their digestibility and feeding value.

Keywords: Browse, Ruminants, Bush-feed, Digestibility

INTEGRATING A MACHINE LEARNING BASED INTRUSION DETECTION SYSTEM WITH A SITE TO SITE VIRTUAL PRIVATE NETWORK (VPN) IN AN ORGANIZATION

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Abstract

The devices that use the internet are becoming more vulnerable as it grows and the devices' vulnerabilities may be exploited by attackers. To transfer information safely through the internet, organisations utilize a site to site virtual private network (VPN) connecting two intranets of a single organisation. However, the information may not be secure as after it exits the site to site VPN tunnel, onto the internal network. The main goal of this study is to integrate a machine learning based intrusion detection system with a site to site VPN to predict potential attacks. Furthermore, other goals of this study are to acquire and utilise the CICID2017 dataset to test and train the model. This study will utilize the Machine Learning Development Life Cycle as the development methodology. An assessment of how accurate the model is in predicting the attacks contained in the aforementioned dataset as well as network features from a database, will be made. From which the results of the research will be taken. This paper may also be used as a baseline for further research as the model will only simulate its machine learning aspects when predicting attacks. Since this research's output is a Site to Site VPN IDS with machine learning integrated, it may anticipate any attempts to exploit the information upon its entry into the internal network from the site to site VPN tunnel. In return, knowing the type of attack that is about to occur.

Keywords: Machine Learning, Intrusion Detection System, Virtual Private Network

THE ANTIBACTERIAL ACTIVITY OF ENDOGENOUS METABOLITES EXTRACTED FROM GANODERMA LUCIDUM

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Abstract

Ganoderma lucidum, a medicinal mushroom, has several pharmacological activities such as anti-microbial, anti-oxidative, and anti-cancer effects. In this study, the antibacterial activity of cultivated versus wild *G. lucidum* was compared. The samples underwent phytochemical screening for alkaloids, steroids, phenols, flavonoids, saponins, and terpenoids, as well as quantification of the saponins and terpenoids content. Saponins content was highest in cultivated *Ganoderma* (57.3%) while terpenoids content was slightly higher in the wild *Ganoderma* (0.88%). Subsequently, the crude extracts were subjected to antibacterial testing against Gram negative (*Escherichia coli*, *Klebsiella pneumoniae*) and Gram positive (*Staphylococcus aureus*, *Streptococcus* group D) bacteria using disc diffusion and broth micro-dilution methods. The crude chloroform extract from wild *Ganoderma* showed excellent activity against all the test bacteria, with the highest activity recorded at 2.5 mg/mL against *E. coli* (13 mm), and the lowest against *S. aureus* (2 mm) at 5 mg/mL. Interestingly, all the wild *Ganoderma* extracts exhibited the lowest minimum inhibitory concentration (MIC) of 0.63 mg/mL recorded against *Streptococcus*, while the highest observed MIC was 10 mg/mL (cultivated petroleum ether against *K. pneumoniae*). Overall, the comparative results showed that the wild *Ganoderma* extracts exhibited better antibacterial activity.

Keywords: *Ganoderma lucidum*, cultivated, wild, antibacterial activity

ESIPT-INFLUENCED C₃-SYMMETRY, DISK-SHAPED FLUORESCENCE TURN-ON PROBE FOR Zn²⁺ BASED ON MELAMINE-NAPHTHYL MOIETY WITH HIGH AFFINITY TOWARDS Cu²⁺ IN CH₃CN

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Abstract

A C₃-symmetry turn-on probe for Zn²⁺ based on the melamine-naphthyl moiety (**H**) was synthesized via a simple one-step Schiff base reaction mechanism. The photophysical properties were investigated using spectroscopic methods of UV-Vis and fluorescence. The chemosensing properties of **H** were investigated via colorimetric methods, using heavy metal cations as well as biological anions, in aqueous soluble acetonitrile (CH₃CN). Subsequently, the probe demonstrated that it could discriminate few cations (Zn²⁺, Co²⁺, Ni²⁺ and Cu²⁺) and anions (CN⁻, F⁻, AcO⁻ and OH⁻) via colorimetric methods, observable by naked eye. The colorimetric method was further complemented by spectroscopic methods of UV-Vis, where spectral shifts were observed upon adding molar quantities of these cations and anions, evidencing that, chemical interactions has taken place, between the host and guest. Interestingly, fluorescence analysis carried out, demonstrated that the ESIPT-steered probe was highly selective to Zn²⁺ only, among the cations and anions used, turning the initially non-fluorescent **H** into a dual emissive **H-Zn** complex upon excited at 380 nm. The selectivity of **H** towards Zn²⁺ was based on the geometrical complementarity through coordination induced charge transfer, upon binding. The DFT predictions were carried out to complement the experimental data.

Keywords: Zn²⁺ fluorescent probe, Cu²⁺ and OH⁻ colorimetric sensor, Ditopic sensor, Dual emission probe

NAMIBIAN AIRPORTS DESIGNATED AS INTERNATIONAL AIRPORTS AND PORTS OF ENTRY/EXIT: SECURITY SCREENING PERSPECTIVE

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Abstract

The International Civil Aviation Organization is mandated to safeguard the civil aviation against unlawful interferences by ensuring that all passengers, baggage and cargo are thoroughly screened. This is done through the upgrade of airports safety and security measures to deter illicit activities at the airports. Lately, literature has indicated that criminals and terrorist syndicates have used airports as platforms to conduct unlawful activities given the ineffective security screening measures employed at airports. This study investigated screening measures at two international airports designated as ports of entry/exit in Namibia. Through a qualitative approach, data was collected from Hosea Kutako and Walvis Bay International airports designated as ports of entry/exit. The study reveals that airport screening system involves three types of screening measures, namely baggage screening, passengers/immigrants screening as well as cargo screening. However, security screening measures and procedures employed at these international airports do not meet the International Civil Aviation Organization and Airports Council International standards and need improvement. This is illustrated by the need for additional x-ray machines, additional security personnel and security awareness training programs. Moreover, the inadequacy of immigration officers at airports, the lack of computer operating systems used for screening and the need for fully integrated airports systems are some of the key findings. The study recommends a need for refresher courses for immigration officials at these airports and the need for cooperative agreement between Namibian police and Immigration to ensure accommodation for illegal migrants and to prevent illegal immigrants re-entering the country with unstamped passports.

Keywords: Aviation safety and security, screening measures, terrorism, designated ports of entry/exit

THE ROLE OF BIODEGRADABLE WASTE IN GROUNDWATER QUALITY- A CASE STUDY OF THE KUPFER BERG LANDFILL SITE IN WINDHOEK, NAMIBIA

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Abstract

Biodegradable waste (biowaste) is made up of a variety of biological byproducts of consumption or previously left over from production. Agriculture, forestry, food industry, and, of course, urbanized regions are the most common producers of biodegradable waste. Biodegradable waste is rarely retrieved and is instead transferred to landfills with other household waste. Without treatment, biowaste becomes the primary source of gas emissions, soil and groundwater pollution at the disposal site. Groundwater pollution by leachate from landfills that are not properly engineered or have leaky liners is a subject which has already been studied and known by most researchers. The goal of this study is to look into the quality of leachate derived from biowaste fractions and its possible impact on groundwater quality in the Kupferberg area, as well as to aid in the development of water pollution remediation strategies for the area and to contribute to the long-term management of the area's groundwater resources. In order to carry this study successfully, four different scenarios where biowaste was slowly added in percentages of 0 % biowaste, 25 % biowaste, 75 % biowaste and 100 % biowaste to the residual waste fractions (without biowaste) was modelled in the laboratory, using the Elusion method, which compares chemical and biological analyses in two different waste fractions (residual and bio-waste). A number of factors must be determined in order to characterize leachates (i.e. pH, electrical conductivity, TOC, DOC, COD, BOD, etc). When comparing the biodegradable waste fractions scenarios to the residual waste fractions, this study has shown that the analyzed components such as Cl, EC, SO₄²⁻, COD, NH₄⁺, TKN-N, and DOC were increasing with the increase in

the biodegradable waste fractions scenarios. As a result, several studies have also concluded that while pH, EC, TOC, DOC, COD, BOD, and other indicators can be useful, they do not give information on the presence of harmful pollutants and their potential environmental impacts. Organics assessed as BOD, COD, or TOC, on the other hand, can influence groundwater quality by causing taste, odour, and oxygen depletion.

THEORETICAL INVESTIGATION OF (TiO₂)_N CLUSTERS (N=2-3) DOPED WITH TUNGSTEN (W), CHROMIUM (CR), MOLYBDENUM (MO) AND RUTHENIUM (RU): Ti(TM)O₄ AND Ti₂(TM)O₆ CLUSTERS

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Abstract

The doping mechanisms of Ti₂O₄ and Ti₃O₆ cluster employed transitional metals: tungsten (W), chromium (Cr), molybdenum (Mo) and ruthenium (Ru) using the B3LYP variant of density functional theory, and additional calculations were computed using CCSD(T)//B3LYP theoretical level. The neutral and anionic ground state structures of Ti(TM)O₄ and Ti₂(TM)O₆ clusters were fully optimized without symmetry constraints and the stationary points characterized as minima via frequency calculations. There is an observed HOMO/LUMO orbitals localised TM states which results in a significant reduction of the HL gap narrowing which attained a visible light absorption, which is proved by the TD-DFT results of Uv-Vis absorption spectra. The molecular binding energy (E_b), chemical hardness (η) and chemical potential (μ) were calculated to evaluate the thermodynamic stability and chemical stability of the neutral (TiO₂)_N and Ti_{N-1}(TM)O_N clusters. The reorganisation energy was calculated as a function of the vertical electron affinity (VEA), vertical ionization potential (VIP), adiabatic ionisation potential (AIP), adiabatic electron detachment energy (AEDE) and vertical electron detachment energy (VEDE). At N=2, Ti₂O₄ and TiWO₄ to have higher hole mobility ($\lambda_h > \lambda_e$) while TiMoO₄, TiCrO₄ and TiRuO₄ clusters are ($\lambda_e > \lambda_h$), therefore clusters may be well suited for hole transport material and also an electron donor. At N=3, The Ti₃O₆ cluster and all Ti₂(TM)O₆ clusters, possess higher hole transfer than electron mobility ($\lambda_h > \lambda_e$), suggesting that this Ti₂(TM)O₆ cluster may be useful for electron transporting devices and may be categorised as an electron-transporting (n-type) and they are electron acceptor materials for solar cells application.

DAY 2 ABSTRACTS (UNDERGRADUATE STUDENTS)

SCHOOL OF AGRICULTURE & FISHERIES SCIENCES

DEPARTMENT OF ANIMAL PRODUCTION, AGRIBUSINESS & ECONOMICS

PERCEPTION AND ADAPTATION TO CLIMATE CHANGE: AN ASSESSMENT OF LIVESTOCK FARMERS IN OTJOMBINDE AND EPUKIRO CONSTITUENCY IN THE OMAHEKE REGION

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Abstract

The challenges of climate change are continuously increasing with rural communities being the most vulnerable, affecting their livelihoods. Unfortunately, this does not spare the Namibian communal farmers since agriculture is an essential component of their social well-being and main source of livelihood. Farmer's perception, impacts, adaptations, and mitigations strategies to climate change differs from individual's farmers point of view, therefore understanding their perception, impacts, adaptations and mitigations strategies align to climate change is thus highly vital for farmers involved in livestock production in particular communal farmers as it allows policy makers to formulate suitable strategies towards reducing climate change danger. Climate change constitutes a major threat to agricultural production, food security, and natural resource management. The objective of this study is to investigate farmers' perception and adaptation strategies to climate change in Omaheke Region. Data were gathered from (n=80) farmers from two constituencies in the Omaheke region using a random sample technique. Descriptive statistics and comparing of means are used to answer the research questions of this study. Preliminary result showed that more than 87.74% and 83.22% of the respondents perceived the existence of climate change with its attributes, temperature, rainfall and drought. Respondents from both constituencies conformed with Minwuye (2017) that education level, landownership, farm income, non-farm income, access to extension visit, farmer-to-farmer extension, access to climate information have significant influence on the choice of climate adaptation strategies. The improvement of adaptation techniques employing extension services, promotion of farmer-to-farmer extension, and utilization of various sources of climate knowledge, such as farmers associations and social organizations, should be the future policy priority.

Keywords: Adaptation, climate change, strategies, Agriculture

EFFECT OF DRYING METHODS ON CHEMICAL COMPOSITION AND *in vitro* DIGESTIBILITY OF ASPARAGUS OFFICINALIS PLANT RESIDUES AS A POTENTIAL LIVESTOCK FEED

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Abstract

Livestock production makes for at least 75% of all agricultural output in Namibia, making it an important economic and sociocultural activity. However, the biggest obstacle to achieving maximum output is a lack of feed, particularly during the dry season. Farmers lack understanding of local crops, making it difficult for them to identify viable sources of feed for their cattle. One of the primary preservation processing methods is drying. Nutrients degradation and nutrients retention can be impacted by drying techniques. This study's goal was to assess how different drying techniques

affected the chemical composition. The experiment's design was a completely randomized design (CRD), with two treatments sun and shade drying, each comprising eight replicates. Ground samples were analyzed for chemical composition and in vitro digestibility. For chemical composition, the results indicated that there is a significant difference ($p \leq 0.05$) between sun and shade drying in the %DM and %ash. Meanwhile, there is no significant difference ($p \geq 0.05$) in the %NDF, %ADF, %Hemicellulose, %EE, %CP, %Ca, %K and %P of *Asparagus officinalis* plant residues. Moreover for in vitro digestibility there is a significant difference ($p \leq 0.05$) in the %Organic Matter digestibility (%OM digestibility) while for %Dry Matter digestibility (%DM digestibility) there is no significant difference ($p \geq 0.05$). The study concluded that the use of shade drying technique results into a high nutrients retention than sun drying, thus there is a need for farmers to use shade drying as opposed sun drying.

Keywords: digestibility, drying, in vitro, nutrients degradation, nutrients retention, plant residues

CREDIT ACCESS EFFECTS ON SMALLHOLDER MAIZE FARMERS PRODUCTIVITY-EVIDENCE FROM MASHARE UHUNGU-VHUNGU IRRIGATION GREEN SCHEME AND COMMUNAL FARMERS IN KAVANGO EAST - NAMIBIA

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Abstract

Maize or corn (*Zea mays* L.) is a cereal crop that is an economically vital source of food and feed. Namibia is not producing enough maize hence it depends on imports to meet the local demand thus large quantities are being imported mainly from South Africa. Few studies have been done on limitations in financial markets which are a major constraint to financial access for SMEs' growth and productivity. Credit needs are characterized by; land preparation, planting, cultivation, and harvesting which are done over a period of time in which very little cash revenue is earned, while expenditure on materials, purchased inputs, and consumption needs are incurred. The main objective of the study was to analyse the impact of credit access on smallholder farmer's maize productivity. An exploratory research design was used in this study where data collection methods included of both qualitative and quantitative approaches with a random sampling technique. Data was collected from the smallholder farmers in Kavango east and analysed using SPSS (Statistical software application). Preliminary results show that there is a positive impact on credit access and productivity as most of the smallholder farmers with access to credit produce more tons of maize compared to those with no access or either sourcing from informal credit sources.

Key words: Maize, smallholder farmers, credit access, financial markets, impact and productivity

POLYMORPHISM OF THE PROLACTIN (PRL) AND KAPPA CASEIN (CSN3) GENES AND THEIR ASSOCIATION WITH MILK YIELD IN SAANEN DAIRY GOATS

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Abstract

The objectives of the study were to identify genetic variation in the Prolactin (PRL) and Kappa Casein (CSN) genes of Saanen dairy goats at Neudamm farm and Cheetah Conservation Fund (CCF) and to investigate the relationship between the genetic variation of PRL and CSN genes to milk yield in Saanen goats. A total of 39 does ($n = 9$ from Neudamm Farm and $n = 30$ from CCF) were used. The does were milked by hand twice a day in the mornings and afternoons. The milk yield was obtained from each doe daily for the period of seven months in 2022. Four ml of blood samples were withdrawn from each doe via the jugular vein puncture in K2E-EDTA anti-coagulant vacutainers tubes containing 0.5 EDTA. Genomic deoxyribonucleic acid was extracted from the blood using the Zymo DNA extraction kit, and the DNA quality was assessed using 3% agarose gels, electrophoresed at 100 volts for 30 minutes, and visualized on the UV trans-illuminator (Syngene bioimaging, Cambridge, United

Kingdom). PCR-RFLP was used to identify polymorphism in the two genes, using restriction enzymes HindIII and RsaI for CSN and PRL genes, respectively. The lactation milk production will be analyzed using the Chi-square test of the association at a 5% level of significance between the allele frequencies of CSN and PRL genes, and milk yield, to verify if the population is in Hardy-Weinberg equilibrium. Although a narrow study, it could provide useful information and understanding for improving milk production in dairy goats by marker-assisted selection.

Keywords: Caprine, Genetic Variation, Milk Yield, PCR-RFLP, Restriction Enzymes

COMPARISON OF SUMMER AND WINTER BREEDING SEASONS ON CALVING RATES AND GROWTH OF BONSMARA CATTLE IN CENTRAL NAMIBIA: A CASE STUDY

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Abstract

The reproduction rate and the age of marketing have a major influence on the number of cattle available for marketing every year. Producers profit depends on number of animals which is greatly influenced by conception rate, calving rate, low pre-weaning mortality and weaning rate. These parameters help evaluate reproductive performance in both summer and winter breeding seasons to establish a proper comparison. The real production potential of the beef industry in Namibia is still totally underutilized. A well-planned breeding season ensures optimum conception, calf survival and growth. The aim of this study was to determine the reproductive performance and growth of the Bonsmara cattle between summer and winter breeding seasons. The comparison of breeding seasons was aimed to direct the farmers on how to optimize reproductive and productive performance. Data will be captured in Microsoft Excel 2013 where editing and removal of outliers and errors will be done. Conception rates, birth and weaning weights will then be calculated in Excel and entered into SAS and the general lineal model (GLM) statistical analyses model will be implemented using the Proc GLM procedure of SAS to compare reproductive performs of summer and winter breeding season controlling for the confounding effects of farm management differences. The study is still in progress hence no result is available.

Keywords: breeding seasons, summer breeding, winter breeding, reproductive performance, Bonsmara

AN ANALYSIS OF THE MARKET VIABILITY OF VALUE ADDED INDIGENOUS PRODUCTS: A CASE STUDY ON STRYCHNOS COCCULOIDE (MAGUNI) IN NAMIBIA

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Abstract

The potential for market viability and commercialisation of indigenous product is relatively unknown. In Namibia favourable policy environment, reliable regulations and standards, as well as transparency in the commercialisation of indigenous products has proven to be particularly important over the years, to measure success toward achieving the Sustainable Development Goals. This paper analyses the market viability of value-added indigenous products (Maguni) to improve the livelihood of small-holder farmers in Namibia. To achieve the objectives' mixed approaches were used to determine the market viability using data from 70 participants. A standard probit model was used to analyse the attributes affecting the market viability. Preliminary results indicate that product price, age, income and product quality and safety increase the odds for consumers' willingness-to-pay for Maguni. Market viability will be influenced by market size and supply dynamics for Maguni. This study provides potential for alternative incomes for small-holder producers who have access, collect and process these products as well as contribute to the indigenous market's overall development.

EFFECT OF DRYING METHODS ON THE CHEMICAL COMPOSITION AND IN VITRO DIGESTIBILITY OF MARULA FRUIT PEELS

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Abstract

Marula fruit peels, obtained from marula juice making, are a potential source of animal feed, however, there is a high wastage of peels in Namibia as most farmers do not utilize the peels as a supplement for livestock particularly during the dry season to increase productivity. The potential of marula fruit peels and the impact of different preservation methods on chemical compositions and digestibility are not fully explored. This study investigated the effect of drying methods on the chemical composition and in vitro digestibility of marula fruit peels. Marula fruits were collected in Onayena constituency in Oshikoto region and transported to Neudamm campus for processing. Marula fruits were sorted, peeled and peels were randomly subjected to drying methods, namely: sun and shade. Dried marula fruit peels were ground to pass through a 1 mm sieve and analyzed for dry matter, ash, crude protein, ether extract, neutral detergent fiber, and acid detergent fiber. The in vitro digestibility will be determined using the Daisy II Incubator (ANKOM Technology Corp., USA). The Completely Randomized Design (CRD) was used for the experiment. Data will be analysed using the General linear model in SPSS version 27 at a 5% level of significance. The results are still pending; analyses are ongoing, and results are expected as soon as possible.

Keywords: chemical composition, in vitro digestibility, sun and shade drying methods, marula fruit peels

A COMPARATIVE STUDY ON THE FEED INTAKE, DIGESTIBILITY AND NITROGEN BALANCE OF KALAHARI RED GOATS FED WITH *Tylosema esculentum* VERSUS *Medicago sativa* AS A PROTEIN SUPPLEMENT

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Abstract

This study aimed to compare the intake, digestibility and nitrogen balance of Kalahari red goats fed different diets containing either *Tylosema esculentum* or *Medicago sativa* as a protein supplement. Eight (8) weaner goats with an average weight of 18 ± 5.6 kg were randomly assigned to two treatments namely, marama leaves/twigs and Lucerne (as a control). A randomized complete block design (RCBD) with four replicates was used, with gender being the blocking factor (4 males and 4 females). Experimental diets were formulated to meet the requirements of goats and consisted of crushed yellow maize, marula oil cake, molasses, premix and salt. The diets were offered at 3% the body weight of goats with water and basal diet (grass hay) being provided ad libitum. Goats were housed in individual metabolic cages for 21 days, with adaptation period of 14 days and a collection period of 7 days where faeces, urine, feed and refusal samples were collected. The interaction between gender and treatment did not have a significant effect on dry matter intake (DMI) ($p > 0.05$) and the dry matter intake did not differ significantly ($p > 0.05$) between treatments and gender ($p > 0.05$). Goats fed Lucerne diet had a much higher dry matter and organic matter digestibility (70.26% and 71.60%) compared to those fed marama diet (65.88% and 66.41%), however, marama had a higher crude protein digestibility compared to the lucerne diet ($p < 0.05$). Neutral detergent fibre digestibility and acid detergent fibre digestibility did not differ significantly ($p > 0.05$). There was no interaction between gender and treatment on the nitrogen balance (NB) ($p > 0.05$). However, goats fed marama diet had a significantly higher NB (69.35%) compared to the lucerne diet (47.18%) ($p < 0.05$). Nitrogen balance did not differ between gender ($p > 0.05$). Marama can effectively be used as a protein supplement to replace lucerne which would lead to increased productivity in ruminant livestock and utilization of under-utilized legumes.

Keywords: protein supplement, lucerne, marama, nutritional value, nitrogen balance

EVALUATION OF ORGANIC FEED ADDITIVES AND THEIR EFFECT ON GROWTH, CARCASS PARAMETERS, AND MEAT QUALITY OF ROSS BROILER CHICKEN

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Abstract

Consumer demand for food that is considered fresh, wholesome, free of hormones, antibiotics, and dangerous chemicals, and produced in an environmentally friendly manner has risen in recent years. As a result, a wide range of feed additives has been used as an alternative to improve the performance of birds due to the residual effects as a growth promoter. Feed additives have not been tested on Ross broiler chickens under Namibian conditions to establish their efficacy. The aim of the present study is therefore to investigate the effect of turmeric, garlic powder, and red-hot pepper as feed additives for Ross broiler chicks. An experimental design was employed focusing on eighty-day-old Ross broiler chicks (mixed sex). Data analysis was performed in SAS software (2018 version) using the general linear model with a statistical significance set at $P < 0.05$. (Data analysis in progress).

Keywords: Organic feed additives, growth, carcass parameters, meat quality, ross broiler chicken

THE SOCIO-ECONOMIC IMPACT OF COVID-19 ON POULTRY PRODUCTION AT GROOT AUB, KHOMAS REGION

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Abstract

When the Coronavirus pandemic began spreading across the world in 2020, this produced a variety of unanticipated shocks to farming and socio-economic systems around the world. This pandemic did not spare any community or society or any farming sectors including poultry sector. The current study was aimed at investigating the impact that Covid-19 had on poultry farmers at Groot AUB. The current study only targeted farmers that are involved in poultry activities. Structural questionnaires, field visit and interviews from 35 selected respondents were used. The data that was collected was analyzed using Microsoft Excel 2019. The study revealed that farmers at Groot Aub keep different species of poultry ; chickens, (local chickens 71.8, improved chickens 5.1% and exotic chickens 10.3%), ducks 5.1% and turkeys 7.7%. The result revealed that majority of the respondents keep poultry for income generation. The main constraints which were experienced during covid-19 among others was high cost of feed that was 17% before covid-19 and 24.6 % during covid-19 followed by poor nutrition of the birds which was 13.5% before covid-19 and 18.3% during covid-19. Results further indicate that the markets for the poultry products were farm gates (48.6%), local markets (34.3%), and middlemen (17.1%). The research findings revealed that the pandemic has a significant negative impact on the small-scale poultry farmers' access to feed availability, vaccines and day old chicks. Similarly, the pandemic had a significant impact on market availability, accessibility and the purchasing power of the consumers. Results further showed that farmers were forced to lower the price of eggs due to purchase power. Farmers found new ways of managing their poultry especially mixing feed with locally available material example kitchen left overs and egg shells during this time. Other constraints included limited market information and limited marketing places with 21.8% and 20.0% respectively. The study concluded that the outbreak of COVID-19 adversely affected poultry production in substantial ways based on the resources set aside for production and poultry management as well as information and communication. The study recommended that poultry farmers in Groot Aub should strengthen their supply chains at different stages, as well as to improve their preparedness and policy responses to COVID-19.

Keywords: COVID-19, impact, poultry production, Groot Aub

GROWTH CURVES OF DIFFERENT BEEF CATTLE GENOTYPES AT NEUDAMM CAMPUS FARM

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Abstract

Growth curves have been used to estimate mature body weight and increase in live weight in beef cattle. These curves can be used for pre-selection of beef animals as they can be used to predict future growth of an animal at any age. However little information is available regarding the growth curves of the beef cattle genotypes Nguni, Afrikaner and Afrikaner x Simmental cross at Neudamm farm respectively. Therefore this study aims at comparing the growth curves of free range beef cattle genotypes at Neudamm by determine the average daily gain (ADG), the age and weight at inflection point and the maximum growth rate & mature weight of this 3 cattle genotypes respectively. Measurements were taken in the mornings on monthly bases, and the growth parameters namely live weight (LW), heart girth (HG) and hip height (HH) were recorded using the electronic balance scale and the measuring tape. The measurements were recorded for a period of 5 months in 2022. Weight records available on the farm since 2010 will also be incorporated to increase precision of growth curve parameters. The data will be captured in Excel spread sheet, and outliers will be removed based on values deviating more than 2 standard deviation units from biological norms. The growth curve parameters will be analyzed using the non-linear growth modeling functions namely Gompertz, Richards and Brody.

Keywords: Growth curve, Live weight, Heart girth, Hip height, inflection point, mature weight

DETERMINATION OF HERBACEOUS BIOMASS YIELD AND CHEMICAL COMPOSITION OF DOMINANT GRASS SPECIES IN THE BUSH ENCHROACHED LIVESTOCK RANGELANDS AT NEUDAMM FARM

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Abstract

The objective of this study was to determine the herbaceous biomass yield and the chemical composition of dominant grasses species in the livestock bush encroached rangelands at Neudamm farm. Twelve camps in the livestock rangeland (in blocks D, E and J) were used in this study, were three belt transects were randomly laid in each of the bush encroached livestock camps. About four quadrats were randomly laid in each of the three belt transects per camp to determine the grass layer. Grasses were identified, recorded and harvested at a stumble height of 10 cm above the ground. Dominant grass species were harvested separately from each quadrat placed in khaki bags and milled using a milling machine that has a 1 mm sieve prior to the nutritional composition analyses and dry matter determination. The Shannon diversity index will be used as an information statistic. The assumption will be that all species will be present in a sample area and they will be randomly harvested. Hierarchical cluster analysis will be performed to classify the camps according to similarities in terms of biodiversity while the de-trended correspondence analysis (DCA) will be used to visualise differences in florist composition and rangeland conditions for the sampled camps. The means and standard errors of the means will be calculated for all chemical values determined. Tukey HSD test will be used to test for significant difference in chemical composition between camps.

Keywords: Belt transect, Bush encroachment, Density, Grass layer, nutritional composition.

FACTORS AFFECTING FERTILITY IN SIMBRA CATTLE IN NAMIBIA

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Abstract

The objectives of the study is to determine factors that influence the inter calving period (ICP), conception rate (CR) and age at first calving (AFC) in Simbra cattle in Namibia. Furthermore to

determine the ICP, CR, and AFC for cows mated in summer and winter seasons in Simbra cattle in Namibia. 60 596 Simbra cattle data records were used in the study from 1980 – 2022. Data editing was done on Microsoft excel and the data was analysed using the General Linear Models procedure of the Statistical Analysis System. The mean value of AFC and ICP were 34.13 and 422.1±10.7days respectfully. This study will help farmers identify factors affecting ICP, AFC and CR hence assisting them in making management decisions to increase cow efficiency and profitability for their farming enterprises.

EVALUATION OF GENETIC VARIATION IN MHC CLASS II DRB GENE ON TICK NUMBERS IN BOER GOATS

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Abstract

The objective of this study was to identify allelic variation in the MHC class II DRB gene and investigate the relationship of polymorphism of MHC class II DRB gene to external tick numbers of in Boer goats at Neudamm farm. Thirty Boer goats (n=15 female and n=15 male) were used in the study. The ticks were counted in two seasons, summer and winter. Blood samples were collected in four mL K2E-EDTA anti-coagulant vacutainer tubes via jugular vein puncture from the goats and immediately placed in a cooler box with ice packs and stored at 4°C until DNA extraction was performed. Genomic deoxyribonucleic acid (gDNA) was extracted from blood using Zymo DNA extraction kit, according to the manufacturer's protocol. The DNA quality was assessed using 3 % agarose gel, electrophoresed at 100 volts for 30 mins and visualized on the UV trans-illuminator (Syngene bio imaging, Cambridge, United Kingdom). Polymerase Chain Reaction- Restriction Fragment Length Polymorphism (PCR-RFLP) method was used to identify genetic variation in the MHC class II DRB gene using Pst1 and Taq1 restriction enzymes. Chi-square test will be used for association at 5% level of significance to test for allele frequency. The significance (P < 0.05) of mean variations of ticks between seasons will be determined using t-test. This study could pave the way for future genetic and conservation studies, leading to the identification of genetic markers associated with tick resistance in Boer goats.

Keywords: Boer Goats, PCR-RFLP, Polymorphism, Pst1, Restriction Enzymes, Taq1, Tick Count

FEED INTAKE, DIGESTIBILITY AND NITROGEN BALANCE OF BOER GOATS FED NATIVE FORAGE LEGUMES (VIGNA LOBATIFALIA, OTOPTERA BURCHELLII, LABLAB PURPUREUS AND MEDICAGO SATIVA)

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Abstract

Namibia is the driest country in Sub-Saharan Africa with harsh climatic conditions characterized by inadequate, late and erratic rainfall in several parts of the country and this affects livestock production. Native forage legumes have the potential to improve the nutrition of ruminants. The objective of this study was to evaluate the feed intake digestibility and nitrogen balance of native age legumes (Vigna lobatifalia, Otoptera burchellii, Lablab purpureus and Medicago sativa) fed to Boer goats. Four (4) male Boer goats, aged 4 months with an average initial body mass of ±13 kg were used in the feeding experiment. The goats were allocated to individual metabolic cages, measuring 10cm long 54 cm wide and 90cm above the ground allowing for the total collection of faeces and urine separately. The dietary treatments were (T1) – M. sativa, (T2) - V. lobatifalia, (T3) - O. burchellii, (T4) - L. purpureus) all at an inclusion of 25%. Grass hay and fresh water were available at all times. The goats were fed in a 4x4 cross over Latin square design with four periods of experimental feeding. Each period lasted for 21 days, resulting in 84 days of the experimental feeding. The goats were fed twice daily 09:00h and 16:00h. The level of feed offered was 3% of body weight. The study is still in the process and after completion the data will be analysed using one way analysis of variance (ANOVA) using SPSS (Statistical Packages of Social Sciences) software. The comparison of means will be tested using Duncan's new multiple range test. Statistical significance will be set at a P value of equal to 0.05.

Keywords: native forage, digestibility, feed intake, nitrogen

COMPARATIVE STUDY OF FARMER BASED ORGANIZATIONS INVOLVEMENT IN IMPROVING FARMERS' TECHNICAL SKILLS AND INCOME: A CASE OF THE OTJINENE AND EPUKIRO FARMERS' ASSOCIATION IN THE OMAHEKE REGION

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Abstract

Farmers' associations have made an important contribution to the improvement in skills of farmers'. With fewer developmental programs implemented in recent years, the role of farmers' association, there is considerable decline in activities designed to promote agricultural initiatives. Farmers' association exhibit an autonomous nature, held by members rather than the government or individual person. In the Omaheke region, the importance of farmers' association seems to create diversion discussions. Core to the discussion is the lack of participation. Participation in this study is defined as attending meetings, workshop, training, marketing of livestock under the auspice of the farmers' Participation is democratic, transparent, and accountability of each committed members. The main objective of the study was to compare how the Otjinene and Epukiro constituencies' farmers' associations contributes to the improvement of farmers' technical skill development and influence on revenue. Data were gathered from eighty farmers from two constituencies in the Omaheke district using a random sample technique. Descriptive statistics and comparing of means are used to answer the research questions of this study. Preliminary results indicate that both farmers associations have minimum involvement in their member's technical skills development with below average of 42% of the respondent's showing the lack of commitment of the farmers' association in providing non-marketing assistance. Respondents from both of the farmers' association conformed to Saad, El-Ansary, & Sherif (2021) that the organizational and administrative capabilities of farmer's organisations are the weakest. Keywords: farmers' association, participation, agriculture, marketing, development.

THE EFFECT OF UREA, CALCIUM HYDROXIDE AND UREA-CALCIUM HYDROXIDE TREATMENT DURATION ON THE CHEMICAL COMPOSITION AND IN VITRO DRY MATTER DIGESTIBILITY OF RICE STRAWS

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Abstract

This study was conducted to determine the effect of urea, calcium hydroxide and urea-calcium hydroxide treatment duration on the chemical composition and in vitro dry matter digestibility of rice straws. Rice straws were harvested from Ogongo campus, University of Namibia. It was chopped into 3-5cm and treated according to a 3×3 factorial arrangement with urea at 5%, calcium hydroxide at 5% and a combination of urea and calcium hydroxide at 2.5% each. The treatments were mixed with water thoroughly until all the granules have dissolved and the solution was sprinkled on the rice straws. Treated samples were transferred into fermentation plastics, pressed to remove air, sealed and incubated at room temperature for 7, 14 and 21 days. After incubation, the samples were milled with a miller that has a 1mm sieve for the determination of the chemical composition, which was done at the Ministry of Agriculture Water and Forestry, and in vitro dry matter digestibility in which the rumen fluid was collected from the dairy cows using a stomach tube. The research is in the process and after completion, the results will be analysed using IBM SPSS statistics; a two-way ANOVA will be used to compare different treatment duration of rice straws. A pair wise comparison using LSD at 5% level ($p < 0.05$) will be carried out to find the significant difference and to determine the right duration to incubate rice straw. Farmers will then be able to use treatments in order to enhance rice straw quality and the right incubation period in which the treatment will be effective.

Keywords: calcium hydroxide, chemical composition, in vitro, urea-calcium hydroxide, urea, rice straws

IN SITU NEUTRAL DETERGENT FIBRE DIGESTIBILITY, IN VITRO ORGANIC MATTER DIGESTIBILITY AND METHANE PRODUCTION OF FOUR NAMIBIAN ENCROACHER BUSH SPECIES

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Abstract

Encroacher bush species have been undervalued due to insufficient information about their potential feeding value. This study evaluated the in situ neutral detergent fibre (NDF) digestibility, in vitro organic matter digestibility (OMD) and methane production of *Senegalia mellifera*, *Dichrostachys cinerea*, *Terminalia sericea* and *Rhigozum trichotomum*. Leaves and twigs (< 20mm) were harvested during late dry (LD) and early rainy (ER) seasons and shade-dried before being analyzed. The indigestible NDF (iNDF) was determined by in sacco nylon bag technique, while the two stage pepsin+cellulase solubility technique and Gas Endeavour Measuring System was used to determine in vitro OMD and methane, respectively. Increasing iNDF contents ($P < 0.001$) were observed from LD to ER season for all species, except for *S. mellifera* which decreased. The iNDF values ranged from 734 to 915 g/kg NDF with *D. cinerea* having the highest and *T. sericea* having the lowest content in both seasons. Except for *S. mellifera*, the in vitro OMD of other species decreased ($P < 0.001$) from LD to ER season, where *D. cinerea* recorded the lowest ($P < 0.001$) in vitro OMD in both seasons. In vitro methane production of all four species was higher ($P = 0.0004$) during the LD season compared to the ER season (147.6 versus 92.0 mL/g DM). Seasonal variability in fibre and phenolics may affect digestibility and methane production of the four species. In conclusion, based on the low OMD and high iNDF, the studied species may require further intervention to improve their digestibility and feeding value.

Keywords: Browse, Ruminants, Bush-feed, Digestibility

DEPARTMENT OF CROP PRODUCTION AND AGRICULTURAL TECHNOLOGIES

EVALUATION OF GROWTH AND YIELD ATTRIBUTES OF THE DIFFERENT GENOTYPES OF IRISH POTATOES (*SOLANUM TUBEROSUM* L.) UNDER CONDITIONS IN NORTHERN NAMIBIA

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Abstract

Northern Namibia is potential for potato (*Solanum tuberosum* L.) production. The production is market-oriented, with considerable amounts imported from the neighboring countries; however, the tuber yield remains low on farmers' fields. As one option, the availability of high-yielding varieties has given attention to increasing the crop's productivity in the region. A field experiment was conducted at Ogongo Campus to evaluate the performance of potato genotypes for tuber yield and to identify a superior variety in tuber yield and yield components. The experiment was laid out in a randomized complete block design with three replications in the winter and summer during the 2022 primary cropping season. The results of the analysis of variance showed the presence of highly significant ($P < 0.05$) differences among varieties over some traits studied. The variety Mondial produced the maximum total tuber yield of 24.3 t ha⁻¹ and marketable tuber yield of 20.9 t ha⁻¹. Barcelona had the second highest tuber yield (20.7 t ha⁻¹) and while Rainbow (19.0 t ha⁻¹), Satis (14.7 t ha⁻¹) and Spunta (13.8 t ha⁻¹) had the 3rd, 4th, and 5th highest tuber yield in the trial. Conversely, local variety Tyson produced the minimum total tuber yield of 8.6 t ha⁻¹ and marketable tuber yield of 6.1 t ha⁻¹. Thus, it could be concluded that genotypic and environmental variations had considerable influence on tuber yield and the potato's attributes.

Keywords: Nicola, baby potato, agronomic traits; growth traits; and yield

GROWTH AND YIELD RESPONSE OF PEARL MILLET (*Pennisetum glaucum* (L)) ON DIFFERENT PLANTING PATTERNS AND FERTILIZER RATES UNDER SEMI-ARID NORTHERN NAMIBIA RAINFED CONDITIONS

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Abstract

Pearl millet (*Pennisetum glaucum* L.) is the staple crop for the majority of the population in North-central Namibia. Poor soil fertility and agronomic practices contribute to the poor growth and yield of the crop. A randomized complete block factorial experiment was carried out at the University of Namibia, Ogongo Campus, to determine the effects of planting patterns and fertilizer application on the growth and yield response of pearl millet. Treatments consisted of three planting patterns; P1 (Random traditional planting), P2 (Row spacing 75cm × 30cm Intra-row spacing), P3 (Row spacing 75 cm × 60cm Intra-row spacing), as the primary factors and two fertilizer treatments; F0 (No fertilizer) and F1 (NPK 30:45:30 kg.ha⁻¹ with six replications. Analysis of Variance revealed significant differences (P<0.05) between fertilizer treatments. Plant height, Number of tillers per plant, panicle weight and grain yield were increased by fertilizer application. The combination of Fertilizer application and planting pattern 2 produced the highest grain yield (521.9 kg.ha⁻¹), while the lowest yield (259.6kg.ha⁻¹) was observed in the pattern 75cm × 60cm spacing without fertilizer application. Planting patterns affect grain yield among all the measured variables, with the highest average grain yield (422.2 kg.ha⁻¹) observed in P2. The study reveals that closer planting intra-row spacing (30cm × 75cm) could have higher yield advantages over broader and traditional planting patterns.

Keywords: Pearl millet, planting pattern, plant density, fertilizer, NPK, Growth, North-central Namibia

DEPARTMENT OF FOOD SCIENCE AND SYSTEMS

EVALUATION OF THE MICROBIOLOGICAL QUALITY OF MEAT FROM NEUDAMM PROCESSING FACILITY

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Abstract

This study evaluated the microbiological quality of Beef and Game meat from the Neudamm Processing facility, to determine the overall safety and the hygienic status of the slaughtering method, so as to reveal the wholesomeness of the meat products sold at the shop and to instil consumer confidence that the meat is fit for human consumption. The study looked at the presence of indicator organisms as well as the shelf life and overall safety determinant organisms. Should the quality be found to be unacceptable the study may also help to design a quality management system at the slaughter facility. The indicators of safety assessed are Total Aerobic Counts (psychrotrophs and mesophilic microorganisms), Enterobacteriaceae and *Escherichia coli*. The pathogen assessed is *Salmonella*. Recommended examination procedures from International Commission on Microbiological Specifications for Foods was used in the examination for all the four test. Serial dilution was performed to obtain 6 dilutions. Total Aerobic Counts was done using the pour plate method on Plate Count Agar, incubated at 22°C (psychrotrophs) and 37°C (mesophilic) for 48 hours. Enterobacteriaceae and *Escherichia coli* was done using the pour plate method on Violet Red Bile Glucose Agar and incubated at 37°C for 24 hours and Chromogenic Colinstant Agar at 37°C for 24 hours respectively. *Salmonella* was done by pre-enrichment in buffered peptone water, selective enrichment in Rappaport Vassiliadis broth and selenite cystine followed by differential selective culture on Brilliant Green Agar and Xylose Lysine Deoxycholate Agar incubated at 37°C for 24 hours. Beef samples for *Escherichia coli* were within the acceptable limits, 3.4×10² 3×10² and 3.9×10² cfu/g. Unsatisfactory results were obtained from beef in Enterobacteriaceae and total aerobic count. For

game *Escherichia coli* sample 1 and 3; Enterobacteriaceae; SPC psychrotrophs sample 2 and Mesophiles were out of specification. There was no *Salmonella* detected from the meat.

Key words: Beef, Game meat, Total aerobic counts, Enterobacteriaceae, *Escherichia coli*, *Salmonella*, mesophiles, psychrophiles

DEVELOPMENT AND PROXIMATE ANALYSIS OF BAMBARA GROUNDNUTS (VIGNA SUBTERRANEA (L.) VERDC) MILK FROM FOUR VARIETIES

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Abstract

Bambara groundnuts are highly nutritious underutilized indigenous African crops that have been cultivated in Africa for centuries. This study evaluated four varieties of Bambara groundnuts milk (BGNM) on its proximate composition, microbiological analysis, sensory analysis and consumer acceptability, and antioxidant activity. BGNM was prepared by dissolving 50g of milled Bambara groundnuts flour into 500ml of water. Bambara groundnuts milk was sterilized at 72°C for 15 minutes. Microbiological analysis was done by performing 10^{-7} serial dilutions of which the count was NIL for the last two dilutions. There was no significant difference between the appearance, taste, aroma, and texture of the four varieties of milk at (P = 0.943), (P=0.936), (P=0.897), and (P=0.993) respectively. Panellists displayed acceptance of Bambara groundnuts milk. The sodium content for BGNM is not significantly different (P = 0.195). The ash, moisture, crude protein, iron, potassium, calcium, phosphorus and nitrogen contents differed significantly (P ≤ 0.05). The antioxidant activity was evaluated by DPPH free radical scavenging method and was significantly different (P ≤ 0.05) for each of the varieties.

Keywords: Varieties, Bambara groundnuts milk, DPPH, underutilized crop

OPTIMIZATION OF ENZYMIC PROCESS PARAMETERS FOR INCREASED JUICE YIELD AND QUALITY OF MONKEY ORANGE (STRYCHNOS SPINOSA) USING RESPONSE SURFACE METHODOLOGY

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Abstract

Monkey orange (*Strychnos* spp.) known as Maguni tree fruit is underutilised with many of the fruits and products wasted because of inadequate knowledge of processing methods and storage conditions. Few studies have been done on the clarification of indigenous fruit juices with enzymes, particularly for Monkey orange. Raw monkey orange pulp obtained after pressing is turbid, dark brown colour, very viscous and tends to settle during storage. Enzymatic treatment has been known to be effective in clarification and yield of several fruit pulps. Pectinase enzyme was used in this study. The effects of enzymatic process parameters on yield and quality of Maguni juice were investigated. Process parameters (enzyme concentration (50-650 µL), time (5-65 mins) and temperature (25-65°C)) were optimised for increased juice yield and quality of Maguni using Response Surface Methodology. Quality parameters analysed were viscosity, total soluble solids, clarity and as well as the yield of the juice. Preliminary results were obtained, yield range was 41-73%. In the results it showed that the addition of an enzyme clarified the juice and affected quality parameters positively. Optimisation would be conducted for further data analysis.

Keywords: Optimization, fruit, yield, quality, enzyme, process parameters

FORTIFICATION OF PEARL MILLET FLOUR WITH NAMIBIAN GROWN LEGUMES (SOYBEAN (GLYCINE MAX) AND COWPEA (VIGNA UNGUICULATA))

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Abstract

Pearl millet (*Pennisetum glaucum*) is a versatile cereal cultivated for food, feed, and forages particularly in African and Asian countries. This study was aimed at producing fortified pearl millet flour with its nutritional composition and properties attained. The fortified flours were made from cowpeas and soybeans at the ratios of 1:3 and 1:5. The proximate analysis of pearl millet flour, cowpea pearl millet flour (CM), and soybean pearl millet flour (SM) were investigated. The effects of cooking time and temperature on the fortified flours were determined. The porridge was made from fortified flours and cooked at different times (20 to 25 minutes) and temperatures respectively (65°C, 75°C, and 85°C). The flours and the cooked porridges were analyzed for: ash content, with a mean result between 0.3 to 5.0%, protein content, 8.5% to 30.2%, fat content 9.6 to 17.50%, moisture content 4.32 to 84.80%, crude fiber 0.66 to 3.22%. The results obtained from the fortified flours show that the chosen legumes and pearl millet are highly complementary, and when combined have high levels of protein. Although the cook time and temperature lowers the protein content significantly, the higher the temperature and the longer it is cooked, the lower the protein content.

Keywords: Pearl millet, Soybean, Cowpea, Fortified and composition

DEVELOPMENT OF A FISH PATTY INCORPORATED WITH FERMENTED BAMBARA GROUNDNUTS FLOUR

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Abstract

This research study focuses on developing a fish patty incorporated with fermented bambara groundnuts flour and determining the effect of the different levels of incorporation (0%, 2%, 6% and 8%) of the fermented bambara groundnuts flour on the fish patty in terms of its nutritional quality. The study also evaluated the microbiology quality of the fish patty developed to determine its safety for consumption and finally the acceptance of the horse mackerel fish patty through consumer and descriptive analysis. The nutritional properties of the fish patty determined were protein, ash, carbohydrates, fat and moisture content. Protein analyses were done using the Kjeldahl method at the Ministry of Agriculture, Water and Forestry laboratory, ash analyses were done using AOAC method 945, 46: 1999, fat analyses were done using AOAC (2000), moisture analyses were done using the conventional oven drying method and the carbohydrates analyses were done by calculated differences. The microbiology quality analysis were done by determining the total viable count using a method described by Fawole and Osco (2007). The protein content was found to range 21.0- 27.4% between the varieties and the fish patties incorporated with red variety had the highest protein content. Ash content value was found to range from 1.916 to 2.44% amongst the different levels of incorporation. The moisture content was found to be ranging from 56- 62%, increasing as the incorporation levels were increased.

Keywords: quality, fish patties, evaluation, bambara groundnuts flour

SHELFLIFE STUDY OF (HIBISCUS SABDARIFFA) AND (STRYCHNOS COCCULOIDES) DERIVED PRODUCTS USING ACCELERATED METHODS

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Abstract

Shelf-life prediction is increasingly becoming an important part of any new product development which will reduce food wastage and improve preservation. This study focuses on the shelf life study of Mutete (*Hibiscus Sabdariffa*) and Maguni (*Strychnos Coccoloides*) juice using accelerated methods. Shelf life analysis was done in terms of physico-chemical (Brix and pH), microbial (Total plate count,

Total coliforms, and Yeasts and Molds) and sensory analysis (consumer acceptance) of the juice. The juice samples were stored at 4°C (control) and 35°C, (accelerated) for a period of 30 days. Analysis was done every 5th day. The data was analysed using SPSS, General linear model.

Results for pH of Maguni and Mutete juice samples stored at accelerated storage changed significantly after 3 weeks of storage from 2.0 to 3.2 (for Mutete) and from 3.6 to 4.0 (for Maguni). There was no significant increase in the samples stored at the control. For Mutete and Maguni juice samples stored at accelerated temperatures, the brix content reduced from 37.8-36.2 for Mutete and 16.1-14.4 for Maguni. Results for microbiological tests for samples stored at refrigerated storage showed colony forming units within safe levels for consumption in the first two weeks having bacterial counts of 1×10^5 CFU/ml to 2×10^5 . While for samples at accelerated storage grew yeasts and moulds in the 2nd week of storage having ranging at $(1.2 \times 10^6 - 2.3 \times 10^6 \text{ cfu/ml})$. Acceptance tests with an overall score of 8.4 were done for samples in the first week where there was no growth to avoid health risks.

PHYSICO-CHEMICAL AND ORGANOLEPTIC PROPERTIES OF COOKIES INCORPORATED WITH GERMINATED AND COWPEA FLOUR

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Abstract

The objectives of the study were to determine the effects of the germinated and fermented cowpea flour incorporation levels on the proximate, phytochemical, microbiological quality and sensory properties of cookies. In agriculture, with the expanding development, the interest for prepared food and baked items especially cookies have been in demand, in both urban and local mass. An attempt was made to produce practical and healthy cookies and the impact of the small substitution of the wheat flour by vegetable protein on the quality attribute of cookies was separated. Vegetable protein is a good substitute because it is readily available and well-liked by consumers. It is known that plant proteins have useful properties. *Vigna unguiculata* (Cowpea) is the focus of this study due to its low price and high protein content. The properties of cowpea protein are investigated in relation to the effects of two pre-treatments, germination and fermentation. It has been noticed that there is need for full utilization of protein content found to be underutilized in the locally available legume crop. In this current study with two cultivars, Nakare and Bira which were both fermented and germinated, handled into flours and utilized for readiness of cookies. The cookies were formulated by incorporating different levels of germinated and fermented cowpea flour which were 15% and 35%. The physico-chemical, including proximate analysis and organoleptic factors remained assessed. Cookies were delivered from the mixes with 100% wheat flour as a control. The actual properties and organoleptic traits of the cookies were evaluated. With this development of cowpea flour, it has brought about an increment in the protein content.

THE EFFECTS OF RECLAIMED WATER IRRIGATION ON THE MICROBIOLOGICAL AND NUTRITIONAL QUALITY OF RAW SALAD VEGETABLES (RSV'S) (TOMATOES (*SOLANUM LYCOPERSICUM*), AND GREEN PEPPERS (*CAPSICUM ANNUUM*))

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Abstract

The Oswin Onesmus Namakalu Sanitation and Re-Use Treatment Plant and garden in Outapi in the Omusati region is a wastewater treatment facility engaged in the reclamation of wastewater for agricultural irrigation purposes. This research study was aimed at analysing the microbiological safety and nutritional composition of raw salad vegetables (RSV's) irrigated with reclaimed water. Tomatoes (*Solanum lycopersicum*) and Green peppers (*Capsicum annum*) were collected from Outapi and transported in a cool box. The vegetables were stored at room temperature throughout the analysis period. Water samples were collected of the wastewater before, during and after reclamation with UV and at the irrigation point. Water samples were collected in pre-sterilized bottles and analysed for

microbiological quality. The microbiological quality of the vegetables was analysed using pour plate methods for faecal coliforms, E. coli and total viable microorganisms, Salmonella and Staphylococcus aureus were determined using surface spread methods. Preliminary results of vegetables indicate an average %Nitrogen (N) content of 1.43 in Green Peppers and 2.16 in tomatoes. Preliminary microbiological results indicate no salmonella (0 cfu/25 g sample) in all vegetables, no faecal coliforms and no E. coli, this is an indication of efficient elimination of microorganisms from wastewater using UV. Faecal coliforms and E. coli were present in the water samples before and after reclamation, but not within the enumeration range (< 30 cfu/g), however, none were detected in the vegetables. This may be due to disinfection by external factors such as high temperatures, low humidity and the drip irrigation system. Drip irrigation system reduced the surface area for microbial contamination during irrigation. E. coli are neutrophilic organisms, growing best in neutral environments, hence the acidity of tomatoes may have inhibited the growth. A final round of analysis is still to be performed.

DEVELOPMENT AND PROXIMATE ANALYSIS OF AN INSTANT TOMATO POWDERED SOUP INCORPORATED WITH GAME MEAT

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Abstract

The importance of a healthy diet has driven the food industry into the development of instant, nutritious foods to satisfy the needs of consumers. This study aimed to develop an instant tomato powdered soup at three game meat incorporation levels, 0, 30, and 50%. The proximate composition of the soup was evaluated by determining its moisture, ash, fat, carbohydrate, and crude fiber, protein content, with the inclusion of minerals such as iron, magnesium, sodium, calcium and phosphorus. Microbiological analysis was done to ensure the safety of the soup by using the total plate count method at an incubation period of 24-48hrs, whereas a descriptive analysis test for sensory evaluation was done to determine the overall acceptability of the soup product. The results obtained indicated that on average, the soup incorporated with 50% game meat had the highest proximate composition values compared to that of 0 and 30% game incorporation levels, however, it was not the most liked according to the sensory evaluation results. This study can conclude that the soup is safe for consumption as they are all in the microbiological acceptance range, and consumers preferred the instant tomato soup with 30% game meat incorporation since it tastes better for them.

Keywords: Instant Tomato soup, Game meat, proximate analysis, sensory evaluation, microbiological analysis

THE EFFECT OF DIFFERENT PROCESSING METHODS ON THE NUTRITIONAL COMPOSITION, ANTI-NUTRITIONAL FACTORS AND EMULSIFYING PROPERTY OF INOCULATED AND NON-INOCULATED VIGNA SUBTERRANEA (BAMBARA GROUNDNUT)

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Abstract

Vigna subterranea (Bambara groundnut) is an underutilized legume termed as a "complete food". This study evaluated the effects of boiling and roasting on the nutritional composition, anti-nutritional factor (ANF) and emulsifying property of inoculated and non-inoculated cream, brown and red Bambara groundnut cultivars that were grown in Namibia. The cultivars were roasted for 15, 30 and 45 minutes at a temperature of 140°C respectively and boiled for 30 minutes in solution of 0.5g/100mL of NaHCO₃, NaCl, and MgSO₄ respectively. The results show that the mineral composition (P, K, Mg, Na, Mn, Zn) of non-inoculated beans increased after roasting and boiling, while there was a decrease in the mineral composition of inoculated beans. The results also indicate that a longer roasting time increases the fat, protein and fiber content. The overall nutrient composition increased in beans boiled in NaCl and MgSO₄. Findings also indicate that roasting reduces ANF and improves emulsifying

property of Bambara groundnut. In conclusion, roasting is a recommended processing method for small scale and large scale manufacturers as it destroys ANFs and increases macronutrients composition.

Keywords: Anti-Nutritional Factor, Legume, Functional Property, Inoculation, Bambara Groundnut

SCHOOL OF ENGINEERING, AND THE BUILT ENVIRONMENT

DEPARTMENT OF CIVIL AND MINING ENGINEERING

DEVELOPING A STATIC PEAK HOUR MICROSCOPIC TRAFFIC MODEL FOR THE DR SAM NUJOMA/ KAHUMBA KANDOLA STREET INTERSECTION, ONGWEDIVA

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Abstract

The increase in vehicle population in the town of Ongwediva has resulted in various operational and safety issues at multiple intersections in the town during peak traffic hours. The Dr. Sam Nuyoma/ Kahumba Kandola street stop-controlled intersection was identified as one of the key intersections on the Ongwediva urban road network with increasing operational issues (high congestion and hazardous traffic conflicts) over the past years. The main purpose of this study was to evaluate the performance of the intersection by developing a static peak-hour traffic simulation model for the base scenario using PTV VISSIM and to identify alternative traffic control methods to improve its operational and safety performance. The evaluation criteria considered in this research were queue length, stopped delay, stops, emissions and average vehicle delay. These criteria were used as a measure to assess the effectiveness of potential traffic management alternatives. Traffic data (traffic volume counts) was obtained from field surveys and used to generate the simulation model for the base conditions. For comparison, alternative traffic control methods (traffic circle- unsignalised intersection and traffic lights- signalised intersection) were simulated, analysed and compared to the base conditions of the intersection. The study observed 80 % operational improvements on all the measured criteria on the base conditions using the traffic circle for all peak hours. Therefore, the study results found that introducing a traffic circle as a traffic control method at the Dr. Sam Nuyoma/ Kahumba Kandola street intersection would significantly improve the traffic operations and safety of the intersection.

EXPERIMENTAL EVALUATION OF THE PERFORMANCE BENEFITS OF FLOATING SOLAR PANELS

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Abstract

This study was conducted to examine a key aspect on the benefits of cooling effects on floating solar panels over water bodies. An experimental study was carried out by floating a solar panel on water and quantify its performance benefits. The experiment was setup in a such a way that one solar panel was placed on top of water in a basin, which resembles a reservoir, and another was placed on the support structure on the ground representing a conventional set up for a period of three days. The highest ambient temperature recorded during the experiment was 38 °C, which means the ambient temperature can get very hot and may lead to a decrease in performance and power output of solar panels. The power output for each panel was measured in the intervals of 15 minutes between 10 am and 2 pm, and compared the results. Based on the experimental results, the floating solar panel showed better performance due to the cooling effect compared to the ground mounted panel. The cooling effect lowers the temperature of the solar cells, thereby improving the power generated by the module and the module's performance. The results show that the solar PV modules with cooling effect have an efficiency increase of 6.07% compared to the ground-mounted panels.

A FEASIBILITY STUDY ON PRODUCING HYDROGEN USING WIND POWER: A CASE FOR LÜDERITZ, NAMIBIA

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Abstract

Namibia is experiencing an energy crisis because the electricity supply is low compared to the demand and thus, importing over 60% of the energy required from the Southern Africa Power Pool (SAPP). However, Namibia is well vested with renewable energy resources such as wind, solar and biomass. Lüderitz, a coastal town, is one of the areas with good wind energy potential. Namibia has shown interest in using desalinated sea water and wind power for electrolysis to produce green hydrogen. Green hydrogen will play a major role in future energy systems, to reduce carbon emissions and store excess energy coming from renewable and intermittent power sources such as wind and solar PV. Technical evaluation and systems integration are of major importance for integrating hydrogen into energy systems. Hence, this study presents a technical and economic feasibility evaluation of producing green hydrogen in Lüderitz using wind power. Wind speed for the month of January 2018, based on a 10-min averaging time series collected in Lüderitz was analysed to predict the electrical energy generated at hub heights of 45 m and 80 m. The average wind speed for the month of January was 8.16 m/s at 45 m measuring height. Weibull distribution method was used to predict the shape and scale parameters and predict the wind power output. The wind energy production and hydrogen production by electrolysis were carried out and the levelised costs of energy (LCOE) for both were determined.

Keywords: Wind speed, Wind energy, Electrolysis, Green hydrogen

DEPARTMENT OF MECHANICAL AND METALLURGICAL ENGINEERING

THE EFFECT OF HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF 304 STAINLESS STEEL

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Abstract

Austenitic Stainless steels are sensitized when exposed to elevated temperature range of 470-750°C causing carbide precipitations at grain boundaries. Carbide precipitation can have negative effects on the resistance to intergranular corrosion and reduces the tensile properties of stainless steels, specifically strength and toughness. This paper evaluates an optimum heat treatment strategy for solution annealing of AISI 304 stainless steel after sensitization. Standard shear, impact and hardness test specimens were fabricated by cutting a 1m long rod into 5 x 80 mm and 5 x 30 mm using a handsaw. A 1m stainless steel rod was procured which had an elemental composition of 0.08% carbon, 18.21% Chromium, 0.67% Silicon, 8.17% Nickel and 1.47% Manganese. A total of 8 samples were sensitized in a high temperature furnace at a temperature of 660 degrees Celsius for a period of 1 hour. These samples were then normalized. These samples were further solution annealed at different temperatures: 700°C, 800°C and 900°C followed by water quenching. Heat treated samples were then mechanically tested for hardness, impact strength and shear stress. It was found that the highest hardness value of the sensitized sample was that at 660 degrees Celsius while for the solution annealed sample it was at 900 degrees Celsius. This was the temperature they found to be the best to avoid the growth of grains in the solution annealed stainless steel sample.

Keywords: Solution-Annealing, Sensitization, Mechanical Properties, Chromium carbides and Heat Treatment

GRAVIMETRIC CHARACTERIZATION OF PYRITE CARBOTHERMIC REDUCTION IN THE PRESENCE OF LIME

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Abstract

Carbothermic reduction of a pyrite concentrate (40.75 % Fe, 48.04 % S, 0.11 % Cu) was conducted in this study with the aim to assess the iron metallization degree from a high sulphur content phase with negligible amount of nonferrous, the assessment was done through mass percent reduction. Pyrite metallisation is a step toward value addition to pyritic deposits such as the Ojihase Mine's resource in Namibia considered in this research. The research methods were considered in three steps: the thermal decomposition, the ion exchange as well as the carbo-thermic reduction at 1273K, 1373K and 1473K. The mass percentage reduction against time was determined based on experimental results and the overall chemical reactions at each stage and ANOVA was used for data analysis. At thermal decomposition stage, the percentage mass reduction increased with treatment time, it was flatter at higher temperature but remains consistently higher than percent reduction at lower temperatures. At ion exchange stage, the percent mass reduction was random, but yet showing much less values than the percentage reduction obtained at the thermal decomposition stage. At carbo-thermic reduction stage, the percent mass reduction decreased with increased treatment time at 1273K and 1473K for different C/CaO ratio, however the opposite phenomenon was observed at 1373K. In general, Higher C/CaO ratio triggered more mass percent reduction.

Keywords: Thermal decomposition, ion exchange, Carbothermic reduction, Mass percent reduction, Ojihase Mine

SIMULATION OF HEAT TRANSFER THROUGH METAL BARS

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Abstract

Heat transfer is the study of thermal energy transport within a medium or among neighboring media by different heat transfer modes, and this made possible by spatial variation in temperature. This variation in temperature is governed by the principle of energy conservation, which when applied to control volume or a control mass states that the sum of the flow energy and heat across the system, the work done on the system and energy stored and converted within the system is zero. Heat is transferred through three different modes, conduction, convection, and radiation. However, this study focused on how heat is transferred linearly through conduction along different uniform dimensions metal bars, which are aluminum, brass, copper, and stainless steel. The metal bars were exposed to water at different temperatures on both ends. The hot water was treated as heat source, while the cold water was a heat sink. The heat transfer through the metal bars were simulated and analyzed using Solid works' flow simulation add-in. The inlet and outlet temperatures for both hot and cold water, as well as the temperature across the bars were assessed.

CHARACTERIZATION OF GRASS BRIQUETTES AS A SOURCE OF ENERGY

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Abstract

Electricity and gas are becoming increasingly expensive; hence low- income earners cannot easily afford them. Ordinary people use firewood which results in devastating deforestation in semi-arid soil, where it takes several years to replace cut trees. This study investigates biomass materials such as grass,

tree leaves, and farm wastes as an alternative energy source. The study produced biomass briquette samples based on compaction pressure, such as low-pressure compaction (5 MPa), medium-pressure compaction (100 MPa), and high-pressure compaction (above 100 MPa). We have combined different grass species as their energies are almost the same. Twenty (20) samples of pure biomass and 20 samples blended with coal (5%, 10%, 25%, and 50%) were prepared and mixed with 1% to 5% of the organic binder. The survey conducted a series of experiments and tests. The results showed that grass briquettes generate sufficient energy and can be used as an alternative to firewood and charcoal to reduce deforestation, as trees have a longer life cycle than grasses. Furthermore, it also showed that grass briquettes could be used for industrial and domestic applications, especially when blended with a small portion of coal; this was validated by comparing the energy extracted from biomass briquettes with the energy extracted from firewood and coal.

Keywords: Biomass briquettes, Specific fuel consumption, Ignition time, Water boiling time.

THE EFFECT OF BIOACTIVE GLASS CHARACTERISTICS AND PROPERTIES ON THE CONTROLLED DRUG DELIVERY PERFORMANCE OF BIOGLASS SCAFFOLDS

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Abstract

There is an ongoing effort to innovate engineering materials that are used in medical applications to support, enhance, or replace damaged tissue or perform a biological function. For example, bioceramics and bioactive glasses are a subclass of biomaterials that are being used as implants in clinical settings due to their similar chemical and structural properties to the body's own bone minerals. Originally intended for clinical use as grafts in musculoskeletal defects, glass ceramics have evolved into very appealing biomaterials for regeneration in tissue engineering. Naturally, they are finding widespread orthopaedic application as scaffolds for soft/hard connective tissue regeneration and repair, as well as effective carriers of growth factors and localized drug delivery. Controlled drug release is gaining traction as a method of developing targeted, long-term drug delivery systems capable of delivering effective drug concentrations into infected or injured sites while minimizing potential side effects and limitations associated with traditional drug administration. In fact, immunization therapies, for example, for protection against many infectious diseases, such as AIDS and cancers are linked to protein vaccine delivery. This article reviews reported properties and characteristics of bioactive glass scaffolds applied as protein vaccine and drug delivery systems. The mechanical and bio-reactive properties of porous scaffolds are discussed in terms of biomaterial composition, microstructure, and the fabrication technique used to synthesize the glass-ceramic and process it into an implantable scaffold.

Keywords: Glass ceramic, Bioactive glass scaffold, Controlled drug delivery, Tissue regeneration

MODELLING AND INVESTIGATING THE NATURE OF PAVEMENT INDUCED DYNAMIC FORCES DUE TO HEAVY VEHICLES GENERAL ASYMMETRIES

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Abstract

Heavy vehicles dynamic loadings deteriorates pavements; hence in critical conditions, dynamic impact wheel forces exceed pavement design static axle loads. In this study, validated virtual three-dimensional (18 DOF) models capable of predicting reasonable pavement imposed dynamic wheel

forces due to general asymmetric loading, system translations and asymmetric kinematic excitation were developed and validated to investigate pavement induced dynamic forces due to heavy vehicles' general asymmetries by graphically overlaying the models' sprung mass' Center of Mass vertical dynamic responses and their wheel-pavements' FEA results. Effects of changes in pothole depths and heavy vehicles speed were also investigated per model. Despite the center of mass shifting due to sprung mass load configurations, an increase in heavy vehicles speed indicates less amplification on the system chassis vertical dynamic response as well as on induced pavement dynamic loading as compared to the increase in the pothole depth, for the same cases of general eccentricities. Eccentrically loaded asymmetrically and kinematically heavy vehicles excited seem to have statistically significant influence on pavement dynamic loading.

Keywords: eccentricities, pavement loading, vertical dynamic response, heavy vehicles

IMPACT OF TURBOCHARGERS ON HAUL-TRUCK ENGINE PERFORMANCE AT OPERATING ALTITUDE, SPEED AND LOAD IN THE MINING INDUSTRY

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Abstract

This paper investigates the effect of Turbochargers on the performance of Diesel Engines within Haul Trucks in the mining Industry, in terms of Output-Power, Torque, NOx emissions, and Specific fuel consumption. For this aim, an 8 Cylinder, 4 stroke, Caterpillar engine with a 17:1 compression ratio was simulated with and without a turbocharger. The turbocharger under study has a 2.7:1 compression ratio and the simulation was carried out using the Diesel RK engine simulation software. The simulations were conducted at the QKR Navachab Gold Mine geographic conditions and Haul truck performance requirements with most effect on engine performance. These are Altitude, Load and Speed. Simulation data analysis showed that at all Altitudes, the turbocharged engine produces more than twice as much torque and power as the naturally aspirated engine. Torque and power produced decreases with increasing altitude and increases with decreasing altitude at a much higher rate in a turbocharged engine. Furthermore, Specific fuel consumption and NOx emissions in both engines remain roughly constant throughout the pit depth, with NOx decreasing rapidly at Altitudes above 1600m. This research might be useful to pinpoint turbocharger strengths and weaknesses in real world mining operations, as well as identify ideal Ambient and Engine-Turbo operating conditions that maximise effect of turbochargers on Haul Truck engines performance, hence improving mining production capabilities through greater engine power as well as reducing fuel costs and emissions.

MATHEMATICAL MODELLING OF A BOILER ECONOMIZER FOR A DIRECT AIR-COOLED GENERATION UNIT

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Abstract

The boiler is a core component of the steam power plant. It is where the conversion of water to steam takes place and the steam is used to drive the turbine to generate electricity. The main components of the boiler are the water wall tubes, superheaters, and economizers. The economizer is the heat recovery system in which heat gained from the exhaust flue gas is used to preheat the feedwater before it is fed to the boiler. Therefore, it is important to conduct performance analysis of the boiler economizer in order to optimize the overall performance of the boiler. In this study, a one-dimensional mathematical model of a boiler economizer for a direct air-cooled generation unit was developed by applying mass and energy principles. The developed mathematical model was solved by using Effectiveness-NTU and Gauss-Seidel iteration methods coded in MATLAB, and was validated using the literatures. The model results agreed with that of the literatures, with discrepancies that are accounted for by the overall heat transfer coefficients and the economizer's surface area. The outlet temperatures of the flue gas and feedwater, as well as the tube walls temperatures were determined

by the model, are essential in performance analysis, and detection of unusual operation of the economizer, such as overheating. In addition to that, the influence of the ash fouling on the economizer performance was also analyzed.

Keywords: Boiler economizer, Flue gas, Feedwater, Model, Fouling

ASSESSMENT OF SILICA REVERSE FLOTATION FROM TANTALUM SEMI-FINISHED CONCENTRATE

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Abstract

African Tantalum owns the tantalite valley mine and processing plant which is located in Southern Namibia. The plant produces the tantalite concentrate by gravity concentration using shaking table. The processing performance results showed that the semi-finished concentrate from this plant contains silica (SiO₂) as the main impurity from the ore (~ 73%). In this study, the reverse flotation of silica from tantalum (Ta₂O₅) semi-finished concentrate was assessed with the aim to determine the flotation performance in two size fractions considering the collector and frother dosage as variables. The sample was split into two size fractions, namely -75 µm and -150+75 µm, which were used as flotation feeds. Flotation experiments were carried out in a 1.7 L Denver laboratory flotation cell. The X-ray fluorescence (XRF) machine was used to determine the chemical composition of the flotation feed and products. The findings demonstrated that the combined effect of the frother and collector gives the maximum recovery at 120 g/t of frother and 1200 g/t of collector in all two size classes studied. The tantalum recoveries of 86% and 77% were achieved for the -150+75 µm and -75 µm size fractions respectively

DEPRESSION OF PYRITE IN THE ZINC CONCENTRATE OF ROSH PINAH ZINC CORPORATION

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Abstract

Rosh Pinah Zinc Corporation produces a zinc concentrate from a complex ore consisting mainly of sulphides such as chalcopyrite (CuFeS₂), galena (PbS), pyrite (FeS₂) and sphalerite (ZnS). The sulphides are hosted in the silicate gangue. High pyrite content in the zinc concentrate is a concern as it increases the energy cost of the electrolytic refining stage of the zinc production. The batch flotation tests were conducted to explore the means of depressing pyrite in the zinc concentrate while maximizing sphalerite recovery. Various operating parameters investigated using the 2.5 L cell on the laboratory Denver flotation machine include NaCN (100 and 50 g/t), a combination of sodium cyanide with ferrous sulphate (FeSO₄/NaCN at 100/120 and 150/240 g/t). The pulp pH was maintained at 8.5 through the addition of lime (CaO). The other operating parameters (collector type and dosage, frother type and dosage, dextrin/silicate depressant concentration) were fixed during the test campaign. The mass and metal recoveries for various experimental conditions were calculated to assess the selectivity of the depressants and establish the optimum operating parameters yielding maximum depression of Fe-containing mineral(s).

THEORETICAL MODELLING OF ANNULAR FILM CONDENSATION AND HEAT IN RECTANGULAR MICROCHANNELS

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Abstract

This study developed a theoretical model of steam annular film condensation heat transfer in rectangular microchannel of an air-cooled condenser tube bundle. A theoretical control-volume-based model was developed based on the assumptions of smooth interface between the annular liquid film and vapor core, and uniform film thickness around the channel's circumference. The conservation principles of mass, momentum and energy were applied to control volumes encompassing the liquid film and vapor core separately. The model was validated using literatures. The condensation is achieved by rejecting heat to air. The data span of steam with qualities in the range of 0.64 - 0.9, and mass flow rate in the range of 7.83 kg/s – 16.27 kg/s. The model results were compared to predictions of some correlations in literatures in which steam condensation flow heat transfer were evaluated. The effects of the hydraulic diameter and the condensate film thickness on the heat transfer coefficient and friction factor were investigated. The influence of the microchannel shape on the condensation heat transfer was highlighted too.

Keywords: Annular film, Condensation, Heat transfer, Rectangular, Microchannel

MATHEMATICAL MODELLING OF STEAM BOILER PERFORMANCE FOR A DIRECT-AIR COOLED GENERATION UNIT

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Abstract

A power generating unit's performance mainly depends on the boiler performance. In this paper, a mathematical model describing the thermal performance of the boiler, which is the measure of how much heat from the flue gas is transferred through the walls of the tube to the feedwater inside the tubes, is presented. The model was referred to as a closed thermodynamic system, where no heat, mass and energy were lost from the boiler's tubes surrounding. For a control volume, the mass and energy conservation principles were applied, and the governing equations were derived. The governing equations were solved using the Log Mean Temperature Difference (LMTD) method in conjunction with iterative method coded in MATLAB software. The design data from the generation unit considered was used to validate the mathematical model. The effects of the flue gas temperature as well as the inlet feedwater temperature on the exit steam conditions were investigated.

AN INVESTIGATION ON THE EFFECTS OF GENERAL ASYMMETRIES ON THE VERTICAL VIBRATION OF HEAVY VEHICLES WITH AGING SUSPENSIONS

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Abstract

Improper heavy vehicle suspension maintenance has bad influence on the heavy vehicle ride comfortability; it is influenced by general asymmetries. Combined effects of heavy vehicle asymmetric

loading, eccentric kinematic excitations, and elastic and dissipative properties distribution on the vertical vibration was investigated in this study at varying heavy vehicle speed and pavement distress factor (pothole depths). The approach utilized validated virtual 3D (18 DOF) models' vertical dynamic responses with eccentric loading configurations and kinematic excitations at defined vehicle speed, pothole depth and diminished leaf spring and tire suspension properties, thereafter comparatively analyzed their responses against models having symmetrical elastic and dissipative suspension properties distribution. The displacements and orientations of sprung mass' center of mass notably shifts due to asymmetric loading and usage of aging suspensions on the vehicles, both in static and dynamic responses conditions. This tends to illustrate the influential effect of elastic and dissipative properties distribution on the heavy vehicle suspension on heavy vehicle motion responses in the presence of asymmetrical kinematic excitations and loading configurations on the heavy vehicles.
Keywords: general asymmetries, vertical dynamic response, heavy vehicles, aging suspension

LEACHING COPPER FROM A LOW-GRADE SULPHIDE ORE OF THE OTJIHASE DEPOSIT: A COMPARATIVE EVALUATION OF COLUMN AND AGITATION LEACHING TECHNIQUES

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Abstract

This investigation evaluated the extraction of copper from a low-grade sulphide ore (containing mostly chalcopyrite associated with chalcocite) using agitation leaching and column leaching (simulating the heap leaching). Comparative studies showing the leaching efficiencies of the two methods, as well as the market price for copper, can help to make the decision about the appropriate method for copper extraction while being cognisant of the fact that agitation leaching is relatively expensive in terms of capital investment and operating costs than the heap leaching. The test work was conducted at a laboratory scale whereby sulphuric acid was used as a leaching agent. For agitation leaching, the factors investigated include the leaching agent concentration (1 and 1.5 M), operating temperatures (25, 50 and 80°C) and dissolution time (0.5, 1, 1.5, 2 and 2.5 hours). The other factors such as particle size (80% passing 75 µm) and agitation speed were fixed during the test campaign. For column leaching, only the leaching agent concentration was varied at 1 and 1.5 M while collecting the kinetic samples over a period of 24 hours. The feed size for column leaching was 80% passing 2 mm. The chemical composition of the feed and the leach residues were analysed using the X-ray fluorescence (XRF) while the inductively coupled plasma-optical emission spectrometry (ICP-OES) was used to determine the elemental composition of the generated pregnant leach solutions (PLS). The leaching efficiencies for the set of experimental conditions were calculated. The results for agitation leaching tests showed that the temperature and leaching agent concentration positively affect the dissolution of copper minerals in the ore. The similar effect of leaching agent concentration on dissolution rate was also observed for column leaching. Keywords: column leaching, agitation leaching, copper sulphide, acid leaching.

ENHANCEMENT OF SILICA DEPRESSION FOR OPTIMAL FLOTATION OF SPHALERITE AT ROSH PINAH ZINC CORPORATION

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Abstract

The froth flotation process is widely used to beneficiate sulphide ores such as the complex Cu-Pb-Zn ore at Rosh Pinah Zinc Corporation (RPZC). The performance of froth flotation is function of design parameters (e.g., cell design) and process variables (e.g., airflow rate, impeller speed, reagent suite).

The reagent suite can include collectors, depressants, activator, pH modifier and frother. Optimization of the process variables is critical for the good metallurgical performance, in terms of recovery and grade. RPZC is currently experiencing process challenges with the ZnS concentrate containing high silica content (above cut-off of 3% Si). In this study, a single-factor factorial design approach was used in the quest to enhance the silica depression through the optimization of the dextrin (C18H32O16) concentration. The dextrin concentration was varied at 20, 50, and 100 g/t while the concentrations of other reagents were fixed at plant dosages; i.e., collector SNPX at 40 g/t, Betafroth 608 (frother) at 10 g/t, pH modifier (CaO) at pH 10.5, sphalerite depressant at NaCN at 90 g/t and sphalerite activator (CuSO₄) at 250 g/t. The data is represented through multiple regression analysis. The results show that 60 minutes of grinding is necessary to achieve the optimum grinding liberation degree of -150mm for flotation. Then, the flotation kinetic tests showed that the optimal flotation time is at 5 minutes of 100 g/t of dextrin. The feed entails assays; 56% of SiO₂, 4.508% of Zn and 0.831% of Pb. Under optimum flotation conditions the recovery of lead is at 8% of 2.022 % assay and zinc is at 22% of 20.231 % assay where silica is at 42% of 40% assay. The recoveries are low due to low mass pull. Finally, the optimal dosage of the depressant and process variables will be recommended to the Rosh Pinah Zinc Corporation.

ASSESSMENT OF THE DRY SECTION SCREENS PERFORMANCE AT NAMDEB SENDELINGSDRIFT TREATMENT PLANT

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Abstract

The study was undertaken to assess the performance of the horizontal vibrating screens in the dry section of Namdeb Sendelingsdrift Treatment Plant. A suitable sampling protocol was developed, with a sampling frequency of once per day for a period of 6 weeks. The first sampling point was the feed to the triple-deck vibratory screen, which is fitted with 3, 16 and 40 mm screens. The other sampling points were the products of the triple-deck vibratory screen (-3 mm, a combined stream of -40 and +16 mm, as well as the -16 and +3 mm stream). The +40 mm and -3 mm size fractions are the waste streams in the plant. The belt cut samples were then collected considering a minimum length of 1 m. The samples were further processed at the lab to determine the moisture content and particle size distributions (using 3, 4 and 6.7 mm screens). Mass balances around the dry screening section were performed, before screen efficiencies were calculated to assess the performance of the screens. Actual plant data during the sampling campaign was also acquired to validate the study's results. The regression analysis showed that the screening efficiency is an exponential function of the screen aperture size, and decreases with the moisture content in the feed. The study also established that the fines in the feed negatively affect the screen performance as they agglomerate, cake and clog the screen apertures, which is aggravated by high moisture and gypsum contents in the feed.

Keywords: dry screening efficiency; recovery of diamonds; sampling protocols; moisture in feed; agglomeration of fines; regression analysis.

AN ASSESSMENT OF FACTORS DRIVING THE CONSUMPTION OF AMMONIA (NH₃) AT SWAKOP URANIUM PROCESSING PLANT

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Abstract

There is a current need at Swakop Uranium (SU) processing plant, to reduce the rate of ammonia (NH₃) consumption, which is a major driver that influences the production cost. It is required for

stripping of UO_2SO_4 uranium (VI) sulphate from loaded organic phase into aqueous phase and for precipitation of Ammonium di-uranate (ADU) from ammonium uranyl sulphate solution (Ok liquor). This high rate of ammonia consumption escalates the budget and reduces profit. Therefore, this study aimed at assessing factors that drive the consumption of NH_3 and suggest ways of reducing the consumption. Four experiments were conducted: U_3O_8 content loaded on the organic phase (Alamine 336) versus NH_3 consumption rate during stripping, effect of ammonium sulphate strength of the stripping liquor on ammonia consumption rate during stripping, final product calcining off gas scrubber effluent's effect on ammonia consumption during ADU precipitation and the correlation between varying the Organic to Aqueous (O/A) ratio and NH_3 consumption rate. The focus is on the volume of ammonium hydroxide used in each occasion. Ammonia consumption rate was observed to decrease with increasing U_3O_8 content on the organic phase. It was noted that NH_3 consumption rate decreased by 62% as U_3O_8 content doubled from 2.10g/l to 4.20g/l. The ammonia consumption rate trend shows that per grams of uranium to be treated the consumption can be lowered by increasing the concentration of the strip liquor (Ammonium sulfate). Ammonia consumption increases with increasing acid content in the off-gas scrubber effluent. It was evident from the obtained results that reducing scrubbing O/A ratio by increasing scrub water, will reduce acid carry over to the strip circuit, thus, reducing ammonia consumption rate. Keywords: Swakop Uranium (SU), ADU Precipitation, Solvent extraction, Production cost.

EFFECT OF COMPACTION PRESSURE ON THE XRF READINGS OF TANTALUM ORE CHEMICAL COMPOSITION

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Abstract

Tantalite Mine, is a tantalum mine owned by African Tantalum (Aftan). The mine, situated in the Tantalite Valley of the Karas region, and also features a tantalum ore processing plant. There are different streams from the plant including the tantalum ore (Ta_2O_5), concentrate and tailings. All streams are analyzed using XRF machine to determine the Ta grade in each stream. Before XRF analysis, the ore is ground into powder. However, the mine reports significant fluctuations in Ta grade (chemical composition) readings, compromising repeatability of the results and the estimation of revenue from the ore. The Aftan technicians attribute the variation to the presence of voids in the tested powder samples, and therefore suggest compaction of the ore. This work aims to examine how the tantalum ore compaction pressure affects the level of variation in the Ta grade read-out of samples on the XRF machine. 5 groups of ore samples were prepared, each with a different moisture content. Each group was subjected to different compaction pressure values using hydraulic press. The Ta grade in the compacted samples was analyzed with an XRF machine. From the XRF analysis, it was concluded that the Ta grade read-out increases with an increase in compaction pressure.

CHARACTERIZATION OF RAW NAMIBIAN CLAY AND DETERMINATION OF MECHANICAL PROPERTIES OF CLAY FIRED BLOCKS

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Abstract

Clay is an important raw material in the fabrication of ceramics. Communities in Northern Namibia have, for centuries, used clay from water pans to make pottery. Despite widespread use, there is a lack of engineering data on Namibian clay, and recommended areas of application. This work investigates the characteristics of two clay samples, one sourced from Uis in Erongo region, and another from liheke, Oshana region, Namibia. The chemical element composition of the clay was determined first through XRF analysis. The whitish Uis clay was characterized as Kaolin, possessing 55% SiO_2 and 19% Al_2O_3 as significant elements. The dark grey liheke clay possessed 68% SiO_2 and 13% Al_2O_3 as significant elements, and was characterized as Illite. The Uis clay was dried and pulverized, while liheke clay was ball milled to reduce particle size to less than 2 mm. The samples were sieved to

obtain particle sizes in the range of 150 μm to 75 μm . Blocks of 40 mm x 40 mm x 160 mm made from 100% clay mortar were made and fired at temperatures between 500°C and 900°C. The firing duration was between 1 and 3 hours. The mechanical properties of the blocks were obtained through a 3-point flexure and compressive strength tests. The results are compared to those of 100% cement blocks of the same dimensions.

SCHOOL OF MILITARY SCIENCES

DEPARTMENT OF MILITARY STUDIES

THE NEED TO COMPUTERISE THE PERSONNEL MANAGEMENT SYSTEM OF THE NAMIBIAN DEFENCE FORCE

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Abstract

Many organisations particularly government agencies are still using conventional methods which are merely paper-based to record the data of their employees, which often results in downright waste of time in generating reports or searching for members' records and loss or damage of files as opposed to computer database methods. These growing administrative inadequacies in the Namibian Defense Force are of great concern; hence, the study has been conducted to assess the need to computerise the Personnel Management System (PMS) of the Namibian Defence Force (NDF). The study employed a mixed method approach and was conducted in Windhoek, Ministry of Defence and Veterans Affairs (MODVA), particularly Human Resources Directorate as well as 21 Infantry Brigade, whereby eighteen (18) participants were purposefully selected. Moreover, observation, structured interview guides, open-ended and close-ended questionnaires were used to collect data pertaining to security, practice and operation of the current paper-based Personnel Management System. The data collected was then analysed using SPSS tool and thematically analysed to draw conclusions. The study revealed that the NDF records are stored in cabinets and retrieved manually and there is no computer database to store them or help in retrieving the records. The results from the study show that the current paper-based Personnel Management System is time-consuming and unsecured. The conceptual framework for a computerised PMS was proposed based on the literature review as well as the field study. This paper recommends that the NDF should prioritise the development of a computerised PMS, for efficient decision-making.

Keywords: Computerisation, Database, MODVA, NDF, Personnel Management System

DEPARTMENT OF AERONAUTICS AND ASTRONAUTICS

NAMIBIAN AIRPORTS DESIGNATED AS INTERNATIONAL AIRPORTS AND PORTS OF ENTRY/EXIT: SECURITY SCREENING PERSPECTIVE

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Abstract

The International Civil Aviation Organization is mandated to safeguard the civil aviation against unlawful interferences by ensuring that all passengers, baggage and cargo are thoroughly screened. This is done through the upgrade of airports safety and security measures to deter illicit activities at the airports. Lately, literature has indicated that criminals and terrorist syndicates have used airports as platforms to conduct unlawful activities given the ineffective security screening measures employed at airports. This study investigated screening measures at two international airports designated as ports of entry/exit in Namibia. Through a qualitative approach, data was collected from Hosea Kutako and Walvis Bay International airports designated as ports of entry/exit. The study reveals that airport screening system involves three types of screening measures, namely baggage screening, passengers/immigrants screening as well as cargo screening. However, security screening measures and procedures employed at these international airports do not meet the International Civil Aviation Organization and Airports Council International standards and need improvement. This is illustrated by the need for additional x-ray machines, additional security personnel and security awareness training programs. Moreover, the inadequacy of immigration officers at

airports, the lack of computer operating systems used for screening and the need for the fully integrated airports systems are some of the key findings. The study recommends a need for refresher courses for immigration officials at these airports and the need for cooperative agreement between Namibian police and Immigration to ensure accommodation for illegal migrants and to prevent illegal immigrants re-entering the country with unstamped passports.

Keywords: Aviation safety and security, screening measures, terrorism, designated ports of entry/exit

AN EXPLORATORY STUDY OF AVIATION SAFETY ON AIRPORT GROUND HANDLERS IN NAMIBIA: A CASE OF HOSEA KUTAKO INTERNATIONAL AIRPORT AND EROS AIRPORT

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Abstract

This research project has a concern on the general safety of airline and airport employees doing what is called ground handling in aviation. As part of the Aviation industry endeavor to making itself the safest means of transport, everyone working on the industry needs to be well informed, trained and abiding to policies and safety procedures as guidance provided by the International Civil Aviation Organization and local civil aviation authorities. The leading aviation authority in Namibia is the Namibia Civil Aviation Authority (NCAA). Questionnaires and observations were used to collect data. The study has employed a qualitative design for the collection of data used in exploring and understanding the nature of ground handlers' safety at Hosea Kutako International Airport and Eros Airport. The study found out that ground handlers are working on a safer environment with a good training routine on safety of 3 to 4 times training workshops per year despite the observation that saw a lack of safety awareness in some areas of operation. In addition the has study found out that some aviation operators have failed to classify their employees as ground handlers which shows a lack of effort into ensuring and giving the necessary safety trainings to these ground handlers. The study recommended for NCAA to be doing monitoring of any recommended training for aviation operators and contractors. The study is also recommending aviation operators to properly classify their operations and make their training manual accessible on their websites for those that wants to look at their manuals.

Keywords: Ground Handler, Safety, Training, Aviation

AN EXPLORATORY STUDY ON THE ISSUES AND CHALLENGES FACED BY FEMALE PILOTS IN THE MILITARY: A CASE STUDY OF NAMIBIAN AIR FORCE

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Abstract

This research aimed to identify issues and challenges faced by female pilots employed by the Namibian Air Force (NAF). Therefore, by identifying issues and challenges faced by female pilots in the Namibian Air Force, and recommending effective measures. The research is a qualitative research and different methods of data collection were used as primary data were collected through questionnaires and interview. The newspapers, internet and journal formed part of the secondary data collection. The researcher interviewed six female pilots using purposive sampling and thematic analysis was used to analyze the data. University of Namibia and Ministry of Defense and Veteran Affairs ethical guidelines were adhered to throughout the study. Using the above mentioned methods of data collection, it was established that gender discrimination occurs in the Namibian Air Force with 83% of respondents agreeing that there has been discrimination based on their gender. Similarly, 66.7% of respondents said that they find it hard to balance work and life, especially during pregnancy. The study also found that 33% of female pilots included in the study have been sexually harassed. In the final analysis, the study recommends that the Namibian Air Force to have a designated office, preferably a civilian female officer, who is outside of female pilot's chain of command to receive such complaints. Lastly the Ministry of Defense ,in particular Namibian Air Force should empower female

pilots in an organization to make military decisions as it was revealed by the participants that the highest rank of a female pilot is a Wing Commander, a rank below management cadre.

Keywords: Air Force, Pilots, Military, Qualitative

DEPARTMENT OF NAUTICAL SCIENCE

EVALUATION OF OFFICERS' NAVIGATION TRAINING AND EDUCATION: A CASE STUDY OF THE NAMIBIAN NAVY

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Abstract

Navigation of a ship demands navigation personnel to have a great deal of practical and theoretical knowledge of navigation, which requires one to meet specific maritime navigational standards set out by the International Maritime organizations (IMO) for the safety of persons at sea. Established in 1994, the Namibian Navy have been training officers in maritime navigation at foreign military institutions, notably in South Africa and Brazil. While the Admiralty Manuals on Navigation serve as the basis for navigation training for naval officers, the IMO oversees navigation training in the maritime industry. The research involved the naval navigational branch with the aim to critically assess the navigation education and training in the Namibian Navy. Both qualitative & quantitative approaches were used to obtain primary data from the Namibian Navy navigation officers using closed-ended questionnaires. The former facilitated the analysis of the Namibian Navy's training doctrine as being on par with International Maritime Organization standards, while the latter determined various training standards received in comparison with the general and naval international standards. Empirical findings highlighted that the: Namibian Navy has adopted a South African officers navigation training model, officers' training differed with indifferent scope of duty, 26% of the officers acknowledged that the overall navigation standard of competence is below 50% and South African and Brazilian training models are philosophically complementary to the Namibian Navy training philosophy. Therefore, the study recommends streamlining of navigation training, creation of an independent accreditation board, and establishment of a navigation training facility for the Namibian Navy.

Keywords: Maritime, Maritime Training & Education, Navigation, Navy

SCHOOL OF SCIENCE

DEPARTMENT OF BIOCHEMISTRY, MICROBIOLOGY & BIOTECHNOLOGY

THE CULTIVATION OF TWO EDIBLE EXOTIC PLEUROTUS MUSHROOMS SPECIES ON THE INVASIVE ALIEN PROSOPIS PLANT IN NAMIBIA

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Abstract

Cultivation of mushrooms in Namibia has been a slow undertaking, which a few farmers have embarked on. Namibia is home to a number of invasive plant species, including Prosopis genus known as mesquite tree. The utilization of alien invasive species as substrate source to cultivate mushrooms has not been investigated. This research explored the use of Prosopis as a potential substrate for cultivating exotic mushroom strains Pleurotus djamor and Pleurotus citrinopileatus, whilst quantifying the biological efficiency to determine the percentage yield of mushrooms produced. Three different substrate treatments were used to circumvent possible contamination, namely steam sterilization, pasteurization and immersion in alkalinized water. Results gave a percentage yield of 3.18 for P. citrinopileatus, however, consecutive yields have not been calculated as successive flushes were not attained to compute final percentage yield, this is attributed to variable flush interval ranging from 4-10 days. Reliable biological efficiency calculations are yet to be established with the use of Prosopis sawdust substrate. Therefore, continued efforts with substrate treatment methods would best identify the technique with a positive effect in mushroom percentage yield, which could validate the use of Prosopis substrate for mushroom cultivation for Pleurotus species.

Keywords: Prosopis, substrate, invasive species, Pleurotus djamor, Pleurotus citrinopileatus, biological efficiency

ASSESSMENT OF VITAMIN A LEVEL IN ADDIBLE COMMERCIAL OILS IN WINDHOEK

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Abstract

Despite the idea and the work done in using edible oil as a delivering vehicle of vitamin A into the human body, as a fight against Vitamin A deficiency in different countries. There is too low effort put in monitoring and controlling the vitamin A in edible oil that enter the market around Windhoek in Namibia. The objectives of the study were to quantify and assess variation in concentration of vitamin A, between two popularly consumed branded oils (sunflower and canola) and the less consumed DePalma oil, another objective was to get information whether the assessed oil samples contain vitamin A concentration that is over or under the fortification standard (at least 60.00 IU/g). 500 µl of 16 duplicate samples of each oil brand was injected into a reaction vial, inverted twice for the reaction to take place and placed immediately in the measuring chamber of the I Check Chroma 3 device that determine and display the vitamin A concentration. Vitamin A was detected in 100% of the DePalma oil, with level ranging from 87.93 IU/g to 89.39 IU/g and a very low concentration of vitamin A was detected in samples of sunflower oil and canola oil, with concentration level of 3.0mgRE/kg (10.00 IU/g) and bellow. The assessment results show a higher level of vitamin A, higher than the fortification standard, present in a less consumed (DePalma) oil from the open markets which

upon consumption, may result in vitamin A toxicity. A very low vitamin A level, lower than the fortification standard, detected in the popularly consumed branded oils (sunflower and canola), available at Windhoek closed markets, implies a lower contribution toward anti-vitamin A deficiency idea. The results of the assessment supported that there is a low control and monitoring of vitamin A in edible commercial oils at Windhoek closed markets. This study fills in a gap in Namibia's knowledge and it is part of growing body of researches in controlling and regulating vitamin A fortification, in relation to fights against vitamin A deficiency.

POSSIBILITY ON DOMESTICATING KAKALAHAMBO MUSHROOMS

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Abstract

Kakalahambo is a natural scarce basidiomycetes fungus that is edible and one of the delicacies in Ohangwena region in Namibia. It has a variety of uses such as providing nutrition as it serves as a source of food in the local community. It is characterised by a smooth stem which is radially veined, and it has a tapering slightly upwards or equal, slender body. The gills are fairly crowded and adenate and it has a black spore print. These mushrooms only thrive in soils rich with manure, accompanied by heavy rain, making it scarce thus a need to find ways on how it can be domesticated to be available throughout the year. Two methods were used in this study. The first method used a piece of a dry mushroom that was grown on potato dextrose agar for culture preparation. After the culture was obtained, the spawn was developed and later inoculated on wheat straw substrate supplemented with manure rich soil. Another method used was serial dilution from the given soil sample using 8 test tubes. The soil used was collected from omahangu field in Ohangwena region where these mushrooms were found growing in abundance. The results for this research are yet to be available.

Keywords: domesticating, serial dilution, Kakalahambo, culture preparation

CONFIRMATION OF 5 DEVIL'S CLAW GENES IN AFFYMETRIX USING POLYMERASE CHAIN REACTION

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Abstract

The plant known as Devil's Claw (*Harpagophytum procumbens*) is indigenous to Southern Africa's Kalahari Desert. The Khoisan people of the Kalahari Desert have been using it as a treatment and painkiller for a variety of ailments for thousands of years, including pregnancy difficulties and skin conditions. Devil's Claw and *Arabidopsis thaliana*'s preliminary DNA-DNA hybridization (ATH1 gene chip) produced a gene pool that has to be verified and further researched. Using PCR analysis and bioinformatics methods, this study attempts to confirm the presence of 5 of those genes in this pool. DNA extraction from the tissue plant, quantification using the nano-drop as well as gel electrophoresis, and a subsequent PCR analysis using certain primers are all steps in the confirmation process. Finally, bioinformatics is used to analyse the PCR-positive genes (BLAST). This helps understand their homologous and respective functions.

Keywords: Affymetrix, Blast, DNA-DNA hybridization, *Harpagophytum Procumbens*, Polymerase Chain Reaction

ANTIOXIDANT ASSAY OF HERBAL/PLANT CRUDE EXTRACTS AND SYNTHETIC SHAMPOOS

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Abstract

Oxidative stress such as dust and pollution can contribute to an increased overgrowth of microorganisms that cause a disproportion of microbiota on the skin of the scalp. This allows dandruff causing fungi such as, *Malassezia furfur*, to thrive and secrete an irritant that damages the skin cells on the scalp and cause conditions like dandruff. Antioxidants bind to free radicals and neutralize them which can prevent and delay skin cell damage, thereby reducing the occurrence of dandruff and other scalp conditions. In this study, the antioxidant of methanol Citrus limon and Aloe barbadensis miller plant extracts were evaluated and compared to synthetic commercial shampoos to assess the potential future use of these plant extracts as substitutes for anti-dandruff treatments. The synthetic shampoos were used as is. The antioxidant activity was evaluated using DPPH free radical assay (2,2-diphenyl-1-picrylhydrazyl) and reducing power assay. We expect to see increased antioxidant activity in the lemon and aloe vera extracts compared to the commercial shampoos since they may contain little to no natural antioxidant substances. In conclusion, the use of natural antioxidants such as aloe and lemon as anti-dandruff treatments could be used as an affordable alternative to shampoos without the side effects from synthetic antioxidants.

Keywords: Antioxidant assays, Aloe vera, dandruff, Lemon, shampoo

BIOCHEMICAL AND MORPHOLOGICAL IDENTIFICATION OF PSYCHROTROPHIC BACTERIA AND FUNGI IN SPOILT FOOD STORED IN REFRIGERATORS

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Abstract

It is generally known that psychrotrophic organisms are commonly found in cold environments. These environments usually have varying temperature fluctuations which allow these organisms to thrive and grow. As a result, the purpose of storing food at refrigeration temperature as a common measure for controlling the growth of psychrotrophic microorganisms including some pathogens, as well as prolonging product quality, is usually defeated. The primary purpose of this research was therefore, to biochemically and morphologically identify the psychrotrophic bacteria and fungi respectively, causing spoilage in properly cooked food stored in containers inside refrigerators. Four types of food were sampled for the purpose of this study, and these were: cooked beans, cooked spaghetti, cooked mince and a boiled potato. In addition to gram staining for the identification of bacteria, three biochemical tests were carried out, namely, urease, casein hydrolysis, and xylose lysine deoxycholate tests. Only the beans' sample showed the growth of bacteria, which showed both positive and negative results for the urease test. For the casein hydrolysis test on the other hand, all the bacteria that grew in the beans' sample tested both negative and positive for this specific test, while the xylose lysine deoxycholate test showed no growth from the beans' sample which thus indicates the absence of *Salmonella* or *Shigella* species. Morphological analysis using naked eyes was used in the identification of fungi after culturing each food sample in Sabouraud Dextrose Agar (SDA). The resulting fungal species were then confirmed by comparing their morphology to those documented in literature. According to literature, identified fungal species were mostly from the genus *Cladosporium*, and a few different species such as *Penicillium chrysogenum*, *Aspergillus fumigatus* and *Rhizopus stolonifer*. As it is important to know which organisms are responsible for contaminating refrigerated food, studies of this kind are therefore encouraged for future research. This will allow better and appropriate solutions to be employed in the control against these microorganisms, thus ensuring the prolonged shelf life of perishable, refrigerated foods.

Keywords: psychotropic, bacteria, fungi.

PHYTOCHEMICAL PROFILING OF THE KIAAT TREE (PTEROCARPUS ANGOLENSIS) WOOD SHAVINGS AND ITS EFFECT ON THE GANODERMA MUSHROOM GROWN ON IT

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Abstract

The Ganoderma mushroom (*Ganoderma lucidum*) have been used as traditional medicines for many centuries. It has effect in promoting health ranges from boosting the immune system, optimising efficiency and anti-cancer properties. Phytochemicals include compounds that are beneficial to human health. The Kiaat tree (*Pterocarpus angolensis*) has been used in traditional medicines for problem such as stabbing pains, eye problems, malaria, blackwater fever, stomach problems, and increasing the supply of breast milk for lactating women. Phytochemicals are generally regarded as the source of above benefits. Saponins, terpenoids, anthraquinones, coumarins, flavonoids, and alkaloids are some of the phytochemicals utilized in pharmaceuticals for their health benefits. This study focused on determining the phytochemicals in the Kiaat woodchips and the Ganoderma grown on it. Sequential extraction was performed using hexane, dichloromethane, ethyl acetate, and methanol. The extracts were screened for phytochemicals using TLC plates to compared between the two samples. Results showed that saponins and terpenoids are present in both samples with anthraquinones, alkaloids and coumarins only present in the wood, while flavonoids only present in the mushroom. This can be concluded that, mushrooms might be unable to absorb all phytochemicals found in the Kiaat.

Keywords: Kiaat, *Pterocarpus angolensis*, Ganoderma, mushroom phytochemicals

PROXIMATE, FATTY ACID AND AMINO ACID ANALYSIS OF RAW AND COOKED HEPSETUS CUVIERI (AFRICAN PIKE)

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Abstract

Malnutrition is a global problem, with Sub-Sahara being mostly affected. Fish are nutritionally valuable in the diet as it contains macronutrients and micronutrients. This study aimed at evaluating the nutritional value of African pike found in the Zambezi River and determining if there is difference in the nutrient values between cooked and raw samples. The dried fish were split into two parts, both were ground but one part was boiled before analysing. Proximate nutrient analysis was done using the AOAC method, while amino acids and fatty acids composition was evaluated using TLC analysis and appropriate spray reagents. Protein content was found to be 0.18% and 1.70%, ash content; 6.73% and 7.96%, fat content; 6.79% and 4.73%, carbohydrate content; 86.3% and 85.6%, and the total calorie content in the samples were 9.62 and 8.03 Kcal/100g for cooked and uncooked, respectively. The fatty acids identified were linoleic-, palmitic-, stearic-, and oleic acid. Five essential amino acids were detected; methionine, lysine, isoleucine, valine and leucine. In conclusion the cooked sample had less nutritional value compared to the uncooked sample with respect to protein and ash content, but had higher fat and carbohydrate content than the uncooked sample.

ANTIBIOFILM ACTIVITY OF LIQUID HAND SOAP INFUSED WITH MYROTHAMNUS FLABELLIFOLIUS

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Abstract

In the present study, homemade liquid hand soap infused with *Myrothamnus flabellifolius* extracts at different concentrations, was evaluated for its antibiofilm activity against *Staphylococcus aureus* a high biofilm producer and skin bacteria. *Myrothamnus flabellifolius* is a well-known indigenous plant with known antioxidant activities. The soap was prepared on a stove using virgin coconut oil infused with DCM: Methanol (1:1) extract at 1, 5, 10 mg/mL concentrations. The antibiofilm inhibition and reduction was evaluated using the crystal violet staining assay. Overall, the biofilm inhibition ranged from 56% to 63%, while biofilm reduction ranged from 31% to 35%. The non-infused soap had higher inhibition and reduction activities compared to the infused soap. However, both infused and non-infused soaps had lower inhibition and reduction activities compared to ampicillin that was used as control. In conclusion, homemade process can be utilised to manufacture affordable soap with antibiofilm activity. There is a need for using other solvent extracts to evaluate their potential.

IDENTIFICATION OF PLANT GROWTH PROMOTING BACTERIA IN RHIZOSPHERE OF INDIGENOUS LEGUMES

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Abstract

Plant growth promoting bacteria are bacteria that aid in the growth of plants and protect plants from various types of diseases. These bacteria have characteristics such as biological nitrogen fixation, phosphate solubilization, ACC deaminase activity and production of siderophores and phytohormones. The plants soil sample was used to carry out the bacteria isolation and identification instead of the root nodules. This study aims at isolating plant growth promoting bacteria from the rhizosphere and identification of the isolated plant growth promoting bacteria. The plants under study chosen were *Senegalia erioloba* and *Senegalia mellifera*. A total of 10 bacterial isolates were obtained of which 7 were found to be gram positive and 3 were found to be gram negative. The bacterial colonies were run through a PCR to amplify DNA. The result of PCR was run through a gel electrophoresis in which bands were observed. Bacterial DNA sequencing is yet pending. The results from Sequencing will then be used to identify the bacteria which was isolated.

Keywords: Plant growth promoting bacteria, Rhizosphere, *Senegalia erioloba*, *Senegalia mellifera*

EVALUATION OF IN-VITRO ANTIBACTERIAL ACTIVITY & PHYTOCHEMICAL ANALYSIS SCREENING OF THE MICHAEL KNOTT (MK) AQUEOUS CREAM COMPOSED WITH ESSENTIAL NAMIBIAN OILS COMMIPHORA WILDI OR THE COLOPHOSPERUM MPOANE

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Abstract

Worldwide there is an increase in the mortality from skin diseases and they have presented devastating therapeutic challenges due to resistant bacterial strains. This has brought a rise of medical systems, in which numerous skin products have been sprouting. This study aims to investigate the antibacterial activity of the MK cream. The MK cream is not only a moisturizer used to relieve dry skin conditions but an emollient with the potential to prevent bacterial growth. It comprises of essential Namibian oils *Commiphora wildi* or the *Colophospermum mpoane*, derived from traditional medicinal plants that are rich in a wide variety of bioactive compounds and are used in traditional settings to treat skin

conditions such as diaper rash and acne. An evaluation for antibacterial activity of the MK cream against gram positive bacteria *Staphylococcus aureus*, *Candida albicans* and gram-negative bacteria *Escherichia coli* and *Neisseria gonorrhoeae* was carried out by means of the disc diffusion antibacterial assay. Four samples of the MK creams were used, namely the aqueous cream, the aqueous cream with urea, the aqueous cream with urea and *Commiphora wildi* and the aqueous cream with urea and *Colophosphorum mpoane*. All the samples exhibited good antibacterial activity and showed good inhibition zones. The creams with the essential oils both showed a high antibacterial activity against both gram positive and gram-negative bacteria, with the best activity, albeit moderate, being recorded for the sample comprising of *Colophosphorum mpoane* with zones of inhibition of 14 and 12 mm against *Escherichia coli* and *Candida albicans*, respectively while the positive control ampicillin inhibited 17 mm. The sample of the aqueous cream and the aqueous cream with urea displayed equipotent activity against *Escherichia coli* with zones of inhibition of 10 mm. The findings of this study will not only add value to the traditional uses of medicinal plants but can also be used to provide protection against bacterial pathogens.

Keywords: *Commiphora wildi*, *Colophosphorum mpoane*, antibiotic resistance, MK cream, Antibacterial activity, *Escherichia coli*, Phytochemical screening

GENOTYPING OF SARS-COV-2 USING REAL-TIME PCR TO IDENTIFY CIRCULATING SARS-COV-2 VARIANTS IN CASES FROM KHOMAS AND OTJOZONDJUPA REGIONS.

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Abstract

SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) is a coronavirus strain that is responsible for the current COVID-19 pandemic. On January 30, 2020, the World Health Organization declared the viral epidemic a Public Health Emergency of International Concern, and on March 11, 2020, it declared it a pandemic. This virus is prone to mutation and when changes to the genetic code occur during genome replication (due to genetic mutations or viral recombination), different SARS-CoV-2 variants arise. Variants that emerged during this pandemic were Alpha variant (B.1.1.7), discovered in the United Kingdom, Beta (B.1.351) in South Africa, Gamma (P.1 & P.2) in Brazil, Delta (B.1.617.2) in India and more recent Omicron variant (B.1.1.529). Namibia was affected by these variants and thus the objective of this study was aimed at identifying the circulating Variants of Concern in two Namibian regions namely Khomas and Otjozondjupa. Consequently, a retrospective quantitative approach was undertaken for this study where viral Ribonucleic acid (RNA) was extracted from 134 positive COVID-19 samples using the PureLink™ Viral RNA/DNA Kit protocol. The genotyping of the extracted nucleic acid from the samples was done using a Bio-Rad Real-Time Thermocycler, after which the data were analysed using Bio-Rad Maestro software. Our findings show that a large set of the chosen sample population variants were able to be determined using Real-time PCR. Of the 134 positive COVID-19 samples, only 100 were genotyped successfully with the results of the remaining 34 samples still pending. To conclude, the fourth COVID-19 wave in these two regions shows that there was a surge in the Omicron variant (B.1.1.529) and it is worth noting that genotyping nucleic acid amplification assays can facilitate high-throughput SARS-CoV-2 variant surveillance by genotyping utilizing PCR rather than population-level sequencing.

Keywords: SARS-CoV-2, Variants, RT PCR

COMPARITIVE ANALYSIS OF THE NUTRITIONAL CONTENT OF BAMBARA GROUNDNUT LANDRACES

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Abstract

Bambara groundnut (*Vigna subterranea* (L) Verdc.) is a leguminous orphan, underutilised and less exploited crop in Africa. In Namibia the crop is mainly grown in the northern and north eastern parts of the country and today Bambara groundnut seeds are found harvested, consumed and sold by street vendors locally. The objective of this study was to compare the nutritional macro nutrients (fat, starch, protein, and carbohydrate content) in four different Bambara landraces that are locally grown by farmers in Namibia and ascertain if there is a nutritional difference among them. Four different Bambara landrace seeds, sorted according to colour (Cream, brown, reddish maroon, and dark brown) were analysed for their nutritional content. Moisture content determination, crude ash determination, protein determination and fat determination along with phytochemical screenings was done. For crude ash all four seed types were found to have less than 3% ash content. All the four seed types had moisture content that was less than 7% and protein content close to 21%. Fat determination is also expected to be relatively the same with no significant difference observed. The cream coloured seeds showed slight presence of flavonoids particularly flavanones. However, all the seed types did not show the presence of terpenes and saponins. In conclusion, with each determination carried out in duplicate and averages along with standard deviation calculated, it was found that there was no major or significant nutritional difference observed among the four landrace seed types.

Keywords: leguminous, orphan crop, *Vigna subterranean*

ISOLATION, CHARACTERISATION AND MOLECULAR IDENTIFICATION OF ENDOPHYTIC BACTERIA IN *SENEGALIA MELLIFERA* AND *SENEGALIA ERIOLOBA*

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Abstract

Legumes form a large group of plants which are members of the Fabaceae family that represent about 10% of the estimated 4300 native plant species found in Namibia vegetation types. Plant associated bacteria are known as endophytic bacteria that are found within the plant which have a symbiotic relationship with the plant host and do not cause any harm to the plant. Endophytic bacteria have plant growth promoting attributes. The aim of this study was to isolate, characterize and identify isolates from *Senegalia mellifera* and *Senegalia erioloba* using bacterial culture and identify the isolated endophytic bacterial species with molecular tools such as DNA isolation, colony polymerase chain reaction (PCR) amplification, gel electrophoresis, sequencing and sequencing analysis. Various bacterial endophytes were isolated from the leaf tissues of the two species using bacterial culture tryptic soya agar. All the eight isolates were screened for the gram reaction. Preliminary characterization of the eight endophytes at different dilutions showed that there were gram positive bacteria and gram-negative bacteria present. It is expected to find the DNA size of endophytes that will show a convergence or divergence of the isolates and where the endophytes belong by conducting further sequencing of the PCR products. Molecular characterisation of the selected eight isolates was carried out by colony PCR amplification of endophytic colonies and then gel electrophoresis was performed.

Keywords: Molecular identification, endophytic bacteria, *Senegalia mellifera*, *Senegalia erioloba*, indigenous legumes

GROWING OF CORDYCEPS MUSHROOMS ON EGG-BASED SUBSTRATE

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Abstract

This paper presents the growing of Cordyceps in an egg-based recipe. Cordyceps is a type of edible mushroom belonging to phylum Ascomycota that has been used as one of the most valued Chinese medicines. Cordyceps are used mainly for food and medicine purposes. In medicine Cordyceps are commonly used in the treatment of kidney and lung problems. The aim of this study was to determine if Cordyceps mushrooms can be successfully cultivated in the egg-based recipe and to find out how long it will take to grow and to determine the mushroom percentage yield. The method included preparing the Cordyceps sub culture under sterile environments, making the recipe by blending eggs, yeast, potato dextrose agar and water, sub packaging the prepared fluid blended medium into bottles containing 35 grams of brown rice, slightly closing the bottles, and sterilizing the bottles in the autoclave 121°C for 15 minutes, cooling the bottles before inoculating with 3-4 cubes of the sub culture under aseptic condition, as well as storing them in a box at room temperature for incubation. The process of growing Cordyceps using the egg recipe was proven possible, however the time taken was longer. In all the inoculated bottles, only one container had Cordyceps growing.

Keywords: Cordyceps, Cultivation, egg-based recipe, sub culture

COMPARATIVE ANALYSIS OF GASTRO-INTESTINAL FUNGAL AND BACTERIAL COMMUNITIES OF TWO NGUNI HERDS FROM DIFFERENT GEOGRAPHICAL LOCATIONS IN NAMIBIA

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Abstract

Nguni cattle are well adapted for the Namibian climate; they have a tolerance to drought and are a very fertile cattle breed (Maciel et al., 2016). Existing literature covers breeding, meat production and genetic makeup of the Nguni cattle (Mapholi et al., 2016; Nesengani et al., 2018; Madilindi et al., 2020; Mkize and Zishiri, 2020). This study is aimed to investigate the differences in bacterial and fungal diversities from two herds of Nguni cattle's dung that are in two different geographic locations. DNA was extracted directly from the fecal samples using a Zymo quick-DNA midiprep plus kit, as per the manufacturer's instructions. The extracted DNA was then subjected to PCR amplification using the 16S rRNA universal primers (27F and 1492R) and fungal primers (ITS1 and ITS2). The sequencing results are still pending.

USE OF VACHELLIA ERIOLOBA TO REDUCE BACTERIAL CONTAMINATION OF WATER IN WINDHOEK, NAMIBIA

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Abstract

Vachellia erioloba, formerly known as Acacia erioloba, is used by Namibian traditional healers to treat various bacterial infections. However, its antibacterial application in the treatment of contaminated water is not well understood. Therefore, the aim of this experiment was to evaluate the antibacterial effects of V. erioloba leaf, stem and seed extracts against bacteria isolated from contaminated water obtained from the University of Namibia (UNAM) Fountain. Vachellia erioloba was collected at the UNAM Main Campus. A completely randomized design with three replicates was used in this study. Leaf, stem and seed extracts were prepared using absolute ethanol. The contaminated water was serially diluted, plated on nutrient agar and bacterial colonies were then sub-cultured onto new nutrient agar plates. Antibacterial testing of the extracts was done using the agar well diffusion. Ciprofloxacin served as a positive control. The zones of inhibition were recorded in millimeters (mm).

The Shapiro-Wilk test revealed that all the data were not normally distributed ($p < 0.05$). Kruskal Wallis test showed a significantly higher difference in the zone of inhibition for the stem extract compared to the two extracts for leaves and seeds ($p < 0.001$; stem: $5.69 \pm 0.16a$; leaf: $3.95 \pm 0.05b$; seed: $3.88 \pm 0.06b$). Our results suggest that *V. erioloba* stem extracts may be used to reduce bacterial contamination of water. Use of *V. erioloba* stem extracts may be important for water treatment in rural areas.

Keywords: *Vachellia erioloba*, antibacterial, agar well diffusion, zone of inhibition

MOLECULAR IDENTIFICATION OF SOME NAMIBIAN INDIGENOUS MUSHROOMS

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Abstract

Mushrooms have currently attracted the world's attention as a source of food and income, and they are being used as medicine and food supplements. The identification of mushroom species based on morphological characteristics can be misleading and prone to errors, thus cannot be fully relied upon. The objective of this study was to identify some indigenous Namibian mushrooms using molecular tools. Mushroom genomic DNA for 3 species was isolated using Quick-DNA™ Fungal/Bacterial Microprep kit. Species with DNA that was successfully isolated were amplified using Internal Transcribed Spacers (ITS1 and ITS4) primers. Polymerase Chain Reaction (PCR) amplicons obtained were sequenced. The data collected was analyzed using Bio Edit. Basic Local Alignment Search Tool (BLAST). The search was carried out using the National Centre for Biotechnology Information (NCBI) database to perform sequence similarity. The nucleotide sequences results were obtained and samples; S5 showed 100.00% similarity to *Glomus* species, S12 showed 83.59% similarity to *Chlorophyllum globosum*, and S13 showed 100.00% similarity to *Lentinula edodes*. Phylogenetic tree showed close relationship between *Chlorophyllum globosum*, and *Glomus* species. Molecular identification of these indigenous mushrooms using ITS was successful. This is the first report on the identification of these Namibian mushrooms using the ITS sequences.

Keywords: Indigenous mushrooms, Molecular identification, Internal Transcribed Spacer, National Center for Biotechnology Information

ANTIMICROBIAL ACTIVITIES AND PRELIMINARY PHYTOCHEMICAL ANALYSIS OF NAMIBIAN MISTLETOE

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Abstract

The application of medicinal plants in the treatment of various human ailments have been practiced since ancient times. Currently, most people still use plants as a major source of primary health care. With the emergence of drug resistant pathogenic microbes, medicinal plants provide an alternative solution, through the discoveries of new bioactive substances. Plants have been shown to produce biologically active compounds that can be used in drug development and other industries. One such group of plants are mistletoes, which are parasitic plants that are found grown on a variety of plants. These plants are used in many parts of the world including Namibia, for the treatment and management of illnesses such as diarrhea, fever, gonorrhoea and other venereal diseases, hemorrhoids, menopausal problems, lumbago, burns and cuts, and expulsion of afterbirth in cattle. The aim of the present study is to investigate the antibacterial properties and the phytochemicals constituents of the leaves and flowers extracts of a Namibian mistletoe qualitatively. Three types of extracts were prepared: ethanol, dichloromethane, and water solution. Crude extracts of a mistletoe leaves and flowers were screened for their antibacterial and phytochemicals properties on *Staphylococcus aureus* and *Escherichia coli*. Preliminary phytochemical screening was done through Thin Layer Chromatography (TLC) for crude extracts of ethanol, dichloromethane and water for the

presence of alkaloids, saponins, tannins, and flavonoids. Antibacterial activities of both three extracts were determined by disk diffusion method at four different concentrations (50, 25, 12.5 and 6.25 mg/ml). The extracts of both three solvents did not demonstrated any antimicrobial activity against *Staphylococcus aureus* and *Escherichia coli*. The lack of antibacterial activities observed is believed to be due to the absence of the phytochemical constituents in the mistletoe plant.

Keywords: Mistletoe, Antibacterial activity, Phytochemical, Medicinal plants

TESTING FOR THE PRESENCE OF BIOSURFACTANTS – A KEY COMPONENT OF OIL-DEGRADING BACTERIA.

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Abstract

In the informal parts of Windhoek, many people make a living by fixing cars in informal workshops. These workshops do not adhere to health or environmental regulations, resulting in oil spillage (small scale). One way in which oil spillages can be cleaned up is by using bacteria – a process called bioremediation. The bacteria break down the oil into simpler compounds rendering the oil harmless and providing nutrients to other organisms. Biosurfactants are molecules produced by oil-degrading bacteria to reduce the surface and interfacial tension of oil. This study aimed at determining the bacteria's ability to produce biosurfactants. Soil samples were obtained from four different informal workshops in Windhoek. After culturing the bacteria, the drop-collapse method and methylene blue method were used to test for the presence of biosurfactants. All the soil samples showed to contain biosurfactant-producing bacteria. This indicates that soil naturally contains oil-degrading bacteria. My research reflects on the principles behind these two testing methods and how biosurfactants can be produced to aid these informal workshops to remediate the soil to rehabilitate the soil and prevent oil from entering the water systems. Future research can look at ways to produce cost-effective biosurfactants and compare the degradation speed of different oil-degrading bacteria. Keywords: Biosurfactant, biosurfactant-producing bacteria, engine oil, oil-degrading bacteria,

GEOMETRIC MORPHOMETRIC VARIATION IN GENUS PAROTOMYS THAT OCCUR IN NAMIBIA

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Abstract

Genera *Parotomys* is currently recognized in Namibia, consisting of two species: *Parotomys brantsii* and *Parotomys littedalei*. These member species are also found in other African countries such as Botswana and South Africa. Small mammals play important roles in ecosystems, but are often overlooked due to their small size and plentiful abundance. Morphometrics, the study of the variation and change in form amongst organisms, serves as a basic methodological tool in various fields of biological research, including systematics. Skull shapes are commonly used in taxonomic analysis and are particularly suitable for landmark based geometric morphometrics. This study aimed to determine geometric morphometric variation in adult individuals of genus *Parotomys* from different locations; Keetmanshoop district, Luderitz district and Skeleton Coast National Park. For this purpose, 50 skulls obtained from the National Museum of Namibia were examined and separated into age groups (adults and juveniles). Out of the 50 skulls, I digitized 20 adult specimens, 13 cranial landmarks in adults of genus *Parotomys* (n=20) were analyzed by geometric morphometrics in tpsRew software. The measurement error testing was done to ensure that there was consistency in digitizing the landmarks on skull images and no digitization errors. The findings of this study reveal that there is no significant variation in the skull shapes of adults that occur in different locations. Results of this study could help future studies identify how different variables affect small mammal morphology, answer general ecological and evolutionary questions about shape. I recommend future studies to consider using outline based geometric morphometrics.

Keywords: geometric morphometrics, landmarks, *Parotomys*, cranial, skull, tpsRew, geographic

VALUE ADDITION USING INDIGENOUS MUSHROOMS TERMITOMYCES, TRUFFLE AND OYSTERS TO PRODUCE MUSHROOM FLAVORED BOEREWORS

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Abstract

This study focused on product development and value addition using indigenous Namibia mushrooms. Mushrooms are macro fungi with characteristic fruiting bodies which are large enough to be seen with the naked eye and picked by hand. Mushrooms are a good source of proteins which contains all essential amino acids, they are high in fiber, rich in vitamins and low in cholesterol. Mushrooms are commonly used for variety of dishes in different shapes and forms. The objective for this study was to determine whether value can be added to the meat using indigenous mushrooms to produce mushroom flavored boerewors. The mushroom species used were the oysters, truffles and Termitomyces species which were collected by the staff from the Zero Emissions Research Initiative Division. The mushrooms were dried and ground using a milling machine. The mushroom powder was weighed into 50g each and sealed into plastic bags. The samples were taken to MEATCO processing unit and mixed with the minced meat and other ingredients to develop the mushroom flavored boerewors. The Sensory evaluation test is yet to be carried out to determine the best flavor.

Keywords: Value addition, product development, indigenous mushrooms, boerewors.

EFFECT OF VACHELLIA ERIOLOBA ON THE GERMINATION OF SORGHUM AND MILLET SEEDS AND GROWTH OF MAIZE PLANTS IN NAMIBIA

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Abstract

Acacia has been used as a bio-fertilizer in southern Ethiopia to enhance the growth and yield of maize. Unfortunately, its effects on sorghum and millet seed germination and maize growth have not yet been documented in Namibia. This study aimed to determine the percentage germination of sorghum and millet seeds under Acacia treatment and non-Acacia treatment conditions and the effect of Acacia on the growth of maize plants in Namibia. A completely randomized design was used in this study. The laboratory experiment had three replicates and the treatment was Acacia leaf extracts. The greenhouse experiment had four replicates and the treatment was pounded fresh Acacia leaves. Data collected included percentage germination (laboratory experiment), stem length, length of leaves, and number of leaves (greenhouse experiment). Data were tested for normality using Shapiro-Wilk test. Normally distributed data were analyzed using independent samples t-test. Data that failed the normality test were analyzed using the Mann-Whitney U test. Results showed that there was a significant difference in the number of leaves between treatment and control (Mann-Whitney U test, $p < 0.030$), stem length ($t = 5.025$, $p < 0.01$), and length of leaves ($t = 4.331$, $p < 0.01$). However, there was no significant difference in percentage germination of millet and sorghum seeds under Acacia treatment and control conditions (millet: $t = 4.660$, $p > 0.10$; sorghum: $t = 2.092$, $p > 0.105$). Our study shows that *Vachellia erioloba* leaf bio-fertilizer may promote the growth of maize but *V. erioloba* leaf extracts may not enhance millet and sorghum seed germination. Keywords: Acacia, leaves, bio-fertilizer, maize, sorghum, millet, growth, germination.

ANTI-BIOFILM ACTIVITY OF MANGIFERA INDICA AND MORINGA OLEIFERA METHANOLIC PLANT LEAVES EXTRACTS ON A RANGE OF CLINICAL VETERINARY BACTERIA

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Abstract

Medicinal plants have been used traditionally due to their ease of use, access and great effectivity over biofilm forming bacteria in the veterinary sector, these plants have proven to be great

alternatives for costly medications. This study aims to determine the following: the presence of phytochemicals in methanolic leaves extracts of *Mangifera indica* and *Moringa oleifera*, the biochemical confirmation of bacteria isolated from clinical veterinary samples such as, *Klebsiella pneumonia*, *Escherichia coli*, *Staphylococcus aureus* field strain and *Staphylococcus aureus* ATCC:25923, their biofilm formation capabilities and whether the plant extracts can inhibit or eradicate biofilms. Minimum inhibitory concentrations (MIC) were determined by serial dilution to obtain the lowest inhibitory concentration of the plant extracts against the test organisms. A thin layer chromatography was used to screen the plant extracts for the presence of coumarins, saponins, antraquinones and alkaloids. Bacteria were grown on MacConkey agar and Mannitol salt agar (MSA) to determine if they are lactose positive or negative. They were also grown on Sulfur, Indole, Motility (SIM) media for conformation of the test bacteria. Then, the biofilm formation was determined by growing the test organisms in flat bottom 96-wells microtiter plates that were incubated for 24 hours, stained with crystal violet and optical densities were measured at 595nm. Biofilm inhibition and eradication followed the same procedure but in the presence of plant extracts. The final MIC of 2ml plant extract was used to make 1,0.5, 0.25, 0.125ml dilutions for both plants over 9ml bacterial stock in broth. *M. oleifera* showed a greater growth inhibition over *E. coli* and *K. pneumonia* at an MIC of 1ml but showed no growth inhibitory for both *S. aureus* bacterial strains. *M. indica* showed a moderate growth inhibition for *E. coli* and a greater one for *K. pneumonia* at an MIC of 1ml but no growth inhibition was observed for both *S. aureus* bacterial strains. A high presence of saponins were observed for *M. oleifera* with a moderate presence of antraquinones and coumarins but no presence of alkaloids. *M. indica* had a high presence of saponins with no presence of antraquinones, coumarins, and alkaloids. Biochemical tests confirmed all test bacteria to be the right strains. *K. pneumonia* and *S. aureus* field strains showed a strong biofilm formation ability, whereas *S. aureus* ATCC 25923 showed a moderate biofilm formation and *E. coli* formed the weakest biofilm. *M. indica* showed the highest inhibition against *E. coli* with an inhibition percentage of 92.8, whereas *M. oleifera* showed the highest eradication percentage of 92.9 %. Preliminary results of this study validate the use of selected plants as alternative treatments for treating bacterial diseases in the veterinary sector, however, in-vitro and in-vivo toxicology effects of the extracts have to be studied.

Keywords: Anti-biofilm, Clinical veterinary bacteria. *M. indica*, *M. oleifera*, Biofilm formation, inhibition, eradication.

EFFECT OF VACHELLIA ERIOLOBA ON THE GROWTH OF BEANS IN NAMIBIA

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Abstract

Lack of experimental data as to whether *Vachellia erioloba* supports the growth of beans, has constrained the development of *Vachellia*-based bio-fertilizers for use in beans. In this milieu, efforts are being made to test whether *Vachellia* leaves have the biochemical values needed to support the growth of beans in Namibia. The aim of this study was to compare the growth of beans under *Vachellia* leaf treatment and control conditions. *Vachellia* leaves were crushed using a mortar and 15 g of crushed leaves were applied to Solwezi beans planted in pots in the University of Namibia greenhouse. Beans were grown in a completely randomised design in four replicates. Independent variables were the *Vachellia* treatment and controls. Measurements of the number of leaves, length of leaves, height of plants, and number of dying plants (after four weeks of growth) formed the dependent variables. Data were tested for normality using the Shapiro-Wilk test. All the data were not normally distributed ($p < 0.05$). Mann-Whitney U test revealed that there was no significant difference in the number of leaves between control and treatment ($p > 0.791$). Mann-Whitney U test showed that there was no significant difference in length of leaves under control and *Vachellia* treatments ($p > 0.462$). The height of beans was the same under control and *Vachellia* treatments (Mann-Whitney U test, $p > 0.250$). Mortality of bean plants under control and *Vachellia* treatments was not significantly different (Mann-Whitney U test, $p > 0.54$). Our results suggest that the application of *V. erioloba* leaves

does not significantly improve the growth of beans. Key words: Vachellia erioloba, leaves, beans, growth, bio-fertilizer.

DETERMINATION OF MICROBIAL CONTENT AND THE EFFICACY OF ASH TREATMENT OF WATER COLLECTED FROM NATURAL WATERBODIES IN OMUSATI REGION, NAMIBIA.

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Abstract

Despite the availability of pipeline water, natural waterbodies in Namibia's Omusati region are still regarded the primary source of water for humans and animals. These bodies of water may be heavily contaminated with bacteria as a result of activities such as washing, swimming, and animal fecal contamination. The current study assessed the quality of the water by identifying bacteria present and analyzing the efficacy of traditional ash water treatment. This study examined the types and quantity of microbes present in top surface and below surface water collected from different natural waterbodies such as an earth dam (etale) and a well (eendungu). Bacteria were isolated using standard cultivation methods, and their Colony Forming Units (CFUs) were calculated. A flowchart of nine biochemical tests, including motility, indole, catalase, citrate, and urease, as well as microscopy, was utilized to identify isolates in both untreated and ash-treated water samples. The current study identified Serratia, Shigella, E. coli, and Enterobacter species. The study also identified harmful and uncountable CFUs levels in untreated drinking water samples from etale and eendungu, which are dangerous to both humans and animals. Overall, it is vital to educate the Omusati region community about the microbiological health of waterbodies and to implement appropriate legislation guiding the proper treatment of untreated water for better humans and animal's health. Keywords; water quality, waterborne microbes, and natural water bodies

ASSESSMENT OF AFLATOXIN M1 LEVELS IN COMMERCIALY MARKETED DRINKING YOGURT IN WINDHOEK

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Abstract

Aflatoxins are carcinogenic compounds that arise from foods contaminated with Aspergillus fungi, either Aspergillus flavus, Aspergillus parasiticus or Aspergillus nomius, with Aflatoxin B1 (AFB1) being the most harmful. AFB1 is converted to Aflatoxin M1 (AFM1) by hydroxylation and is then secreted in the milk of dairy cows, following consumption of AFB1 contaminated feed. Milk provides nutrients required for human health, thus the presence of Aflatoxins is concerning as they have been found culprit to ailments such as aflatoxicosis and cancer. The objective of this study was to determine AFM1 levels in commercially produced and marketed drinking yoghurt. Whether Namibian manufactured milk products meet regulatory standards for safe consumption and consumers are aware of the effects of aflatoxins to health, pose great concern to Namibia's food production health standards. This study will provide information that can bridge the gap of these concerns. The Aflatoxin M1 ULTRA ELISA quantitative kit from Helica BioSystems was used to detect AFM1, via immunoassay method, in 42 purchased samples. AFM1 was detected in all samples, with levels observed in the 0.4 -0.5µg/L range. This value is of concern as it is higher than the EU limit of 0.05µg/L and infers potential toxicity to consumers. These levels of AFM1 may be due to cows fed with contaminated feed or contamination during milk processing. This infers a shortage of regulation in Namibia compared to other regulatory governments, thus further investigation is required to determine the main sources of AFM1 and develop AFM1 regulations.

ANTIOXIDANT POTENTIAL OF LIQUID HAND SOAP INFUSED WITH MYROTHAMNUS FLABELLIFOLIUS

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Abstract

Soaps are detergents made from oils and fats through the saponification process and are used to remove dirt and impurity. Industry manufactured soaps contain additives, such as synthetic antioxidants that can be harmful to skin health. The current study was to formulate liquid hand soap infused with *Myrothamnus flabellifolius*, a well-known indigenous medicinal plant found in Southern Africa, has good antioxidant activity and evaluate the soap's activity with extracts at different concentrations. The soap was prepared on a stove using virgin coconut oil and infused with DCM: Methanol (1:1) extract at 1, 5, 10 mg/mL concentrations. The antioxidant activity was evaluated using DPPH scavenging and reducing power assays. The reducing power assay showed a dose dependent pattern with the soap having high reducing power than vitamin C a known antioxidant control. DPPH radical inhibition ranged from 45% to 92% and was comparable to the control at high extract concentration infusion. In conclusion, homemade process can be utilised to manufacture affordable soap and the use of natural antioxidant component may increase the efficacy of the soap without the side effects of synthetic antioxidant. Future studies should include more antioxidant assays, solid soap, addition of essential oils and purification of the extract. Key words: Antioxidant, *Myrothamnus flabellifolius*, Soap

NUTRITIONAL ASSESSMENT OF RAW AND COOKED COPTODON RENDALLI (REDBREAST TILAPIA)

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Abstract

Food insecurity and hunger are two major problems facing the world, especially the developing world. This study aimed at evaluating the nutritional value of the redbreast tilapia found in the Zambezi river and determining if there is difference in the nutrient values between cooked and raw samples. The fish sample were air dried as traditionally done by the community around the river and dried samples were analysed. The sample were divided into two, one was ground and analysed, while the second one was boiled before analysing. Proximate nutrient analysis was done using the AOAC method, while amino acids and fatty acids composition was evaluated using TLC analysis and appropriate spray reagent. Protein content was 0.37% and 2.39% for cooked and uncooked samples. Ash content in the fish was found to be 3.93% and 3.74% for cooked and uncooked respectively. Fat content was found to be 7.83% and 6.45% for cooked and uncooked respectively. Carbohydrate content in the fish was found to be 87.87% and 87.43% for cooked and uncooked Total calorie content in the fish samples were calculated to 11.96 and 11.11 Kcal/100g for the cooked and uncooked fish. A number of fatty acids were identified namely, linoleic acid, palmitic acid and oleic acid. Four essential amino acids were detected, namely valine, lysine, isoleucine and leucine. In conclusion the cooked fish samples were found to have a higher nutritional content, compared to the raw fish samples. However, a protein loss was occurred during the preparation process and as a result, less protein was retained in the cooked fish samples, compared to the uncooked. It is also observed that the crude carbohydrate and mineral content in both the cooked and uncooked samples were significantly similar and thus one may conclude that little to change occurs to the carbohydrate and mineral content when cooking the fish.

NUTRITIONAL ANALYSIS OF OREOCHROMIS ANDERSONII (TREE-SPOT TILAPIA)

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Abstract

Fish are important sources of animal protein and micronutrients that can assist in combating malnutrition, a problem that affects the entire globe with Sub-Sahara being mostly affected, and assist in income generation. This study aimed at evaluating the nutritional value of Three-spotted Tilapia found in the Zambezi river and determining if there is difference in the nutrient values between cooked and raw samples. The fish sample were air dried as traditionally done by the community around the river and dried samples were analysed. The sample were divided into two, one was ground and analysed, while the second one was boiled before analysing. Proximate nutrient analysis was done using the AOAC method, while amino acids and fatty acids composition was evaluated using TLC analysis and appropriate spray reagent. Protein content was 0.06% and 3.43% for cooked and uncooked samples. Ash content in the fish was found to be 4.27% and 6.99% for cooked and uncooked respectively. Fat content was found to be 8.69% and 4.94% for cooked and uncooked respectively. Carbohydrate content in the fish was found to be 86.98% and 84.64% for cooked and uncooked. Total calorie content in the fish samples were calculated to 7.37 cooked and 6.08 uncooked Kcal/100g. A number of fatty acids were identified namely, linoleic acid, palmitic acid, stearic acid, and oleic acid. Four essential amino acids were detected, namely methionine, lysine, isoleucine and leucine. In conclusion when comparing the approximate analysis results obtained it is evident that the cooked samples has more fat and carbohydrate content whereas the uncooked samples has more protein and ash content. There were a few discrepancies that occurred during the experiments that could also lead to the low percentages and thus more studies and experiments could be done in order to obtain the best results.

PHYTOCHEMICAL AND ANTIOXIDANT ANALYSIS OF A NAMIBIAN MEDICINAL PLANT: DICEROCARYUM ERIOCARPU (OMUTI UO VAKURUHA)

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Abstract

Dicerocaryum eriocarpu is a perennial herb with pale purple flowers, that grows along the ground in the Kalahari. The herb has been used traditionally to treat malaria, diabetes, blood pressure, and was recently used to treat Covid-19 symptoms. The plant has also been used as a spa natural body cleanser and detoxifier, as well as to treat period pains, prevention of miscarriages and to improve fertility in women. Despite the prolong use of Dicerocaryum eriocarpu by the local people in Namibia, research on the chemical and biological activity of the plant is lacking to the best of our knowledge. Hence, the purpose of this study was to screen and quantify major groups of phytochemicals, evaluate antioxidant potential activities from Dicerocaryum eriocarpu root and shoot tissues. Plant extracts were prepared by different organic solvents. Qualitative phytochemical screening showed positive results for flavonoids, steroids, terpenoids and cardiac glycosides. Quantitative phytochemical analysis was performed to test for Total Tannins Content, Total Flavonoids Content and Total Phenolic Content. Preliminary results show that the total flavonoid content was 44.495 mg quercetin/g in methanol root extract and 37.029 mg quercetin/g in the mixture of ethanol: methanol shoot extract. DPPH and reducing power were used to test for antioxidant activities, but results are still pending. It is expected that the high levels of flavonoid content especially in the roots and presence of steroids in the plant may also show antioxidant activity in D.eriocarpu.

ANTIBACTERIAL ACTIVITY OF METHANOLIC EXTRACTS OF THE LEAVES OF ZIZIPHUS MUCRONATA AND DIOSPYROS LYCIOIDES AS IT PERTAINS TO FOOD HYGIENE ("ZIZIPHUS MUCRONATA AND DIOSPYROS LYCIOIDES")

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Abstract

A study was conducted to prepare *Ziziphus mucronata* and *Diospyros lycioides* plant leaves for extraction with methanol and to prepare crude phytochemical extracts from the leaves of *Z. mucronata* and *D. lycioides*. In addition, the antibacterial activity of the extracts was ascertained to observe if the growth of the selected bacteria, namely *Salmonella typhimurium*, *Klebsiella pneumoniae* and *Escherichia coli* could be inhibited and whether the bacterial colonies that have already grown could be eliminated by plant extracts. This was all in correlation to food hygiene and how the selected plant extracts could potentially eradicate or unravel a way to minimize the growth or contamination of the bacterial strains mentioned, in the food industry. With a few adjustments, the methanol extract preparations were carried out in accordance with the Du Preez (2012) procedure. Plant extracts' and antimicrobial properties might be explained by the presence of secondary metabolites such as anthraquinones, flavonoids, and saponins and based on the qualitative chemical tests provided by Farnsworth (1966) and Nyambe, these substances were tested for (2014, p. 39 - 40). The bacterial swabs of *Salmonella typhimurium* and *Klebsiella pneumoniae* were provided by co-supervisor Mr. Henrico Mariano Bock from the veterinary laboratory in Windhoek. The *Escherichia coli* was provided by supervisor Dr. Ronnie Bock from the University of Namibia, School of Medicine in Windhoek. A biochemical test was done on the bacterial strains provided, to ensure pure cultures were dealt with. The bacterial strains were inoculated, grown and disc diffusions were performed on Mueller-Hinton Agar to view the inhibition zones that were induced by the plant extracts. The bacterial strains were standardized before this. Thin Layer Chromatography (TLC) was also carried out to determine the phytochemical constituents, thin layer chromatographic profile and UV analysis of *Z. mucronata* and *D. lycioides* leaf extracts. The leaves of *Z. mucronata* and *D. lycioides* were collected, dried, pulverized and extracted. The results proved to be conclusive with the objectives with certain samples but not with others, this could have been due to arbitrary limitations of the study. Some plates formed gratifying inhibition zones after performing the disc diffusions and others not so much. The plant extracts tested positive for all of the phytochemicals that were tested for. Phytochemically, the plant extracts seem to have an overall effect on the growth of the bacterial strains.

DETERMINATION OF CULTURABLE AIRBORNE BACTERIA AND FUNGI DIVERSITY IN OFFICES LOCATED IN DIFFERENT BUILDINGS OF THE UNIVERSITY OF NAMIBIA: A PUBLIC HEALTH PERSPECTIVE

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Abstract

Enclosed areas are full of airborne bacteria and fungi, although indoor microbes are generally not harmful to humans, exposure to certain airborne bacteria and fungi can lead to some adverse health reactions. Bioaerosols in built environments, more specifically airborne indoor bacteria, and fungi, have been the object of numerous studies over the years. However, no studies of this nature have been done to characterize these microorganisms in the offices at the University of Namibia (UNAM), and thus the purpose of this study is aimed at discovering which airborne bacteria and fungi are present in UNAM offices as well as determining their diversity.

Bacterial and fungal samples are collected from selected UNAM offices using the open plate technique using nutrient agar to cultivate bacteria and Potato Dextrose Agar for fungi. Pure cultures are obtained from the isolates and DNA is then extracted from the pure cultures. DNA extraction is carried out using the Quick-DNA Fungal/Bacterial Miniprep Kit by Zymo-Research. Further procedures include amplifying the DNA obtained via polymerase chain reaction which is then visualized using gel

electrophoresis. The PCR products are then sent for sequencing analysis to Inqaba Biotech Industries in Pretoria, South Africa. The sequences will be analyzed for identification using the Molecular Evolutionary Genetics Analysis (MEGA) Program and the identities of the bacterial and fungal isolates will be obtained by blast-searching them against known sequences on the National Center for Biotechnology Information (NCBI) database and positively identified sequence are used to construct phylogenetic trees using the MEGA v9 software. The results for this study have not yet been observed and a conclusion will be drawn according to the results.

ANALYSIS OF MK CREAM FOR ANTIOXIDANT ACTIVITY

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Abstract

Aqueous creams are used worldwide to relief dry skin conditions and even at times as a substitute for soap during bathing. These creams are made from a mixture of emulsifying ointments, water and phenoxyphenols. Phenoxyphenols can be used as a 2.2% solution or a 2% cream for the treatment of superficial wounds, burns, or abscesses infected by *Pseudomonas aeruginosa*. In skin infection, derivatives of phenoxyethanol are used in combination with either cyclic acid or zinc undecenoate. Essential oils are incorporated into aqueous creams to enhance moisture, add fragrance or add therapeutic qualities including antiseptic, antimicrobial or antioxidant properties to the cream. The objective of this study was to test the MK Cream for antioxidants activity and to also analyse the different antioxidants found in the MK cream. four samples namely aqueous cream only, aqueous cream with urea, aqueous cream with urea and *Commiphora wildii* essential oil and aqueous cream with urea and *Colosporpermum mopane* essential oil were investigated. Antioxidant activity of the samples at different concentrations were evaluated using the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging and the ferric reducing antioxidant power. The study revealed that the samples with aqueous cream with urea, aqueous cream with urea and *Commiphora wildii* essential oil and aqueous cream with urea and *Colosporpermum mopane* had antioxidant activity. It is also showed the presence of phenoxyphenols. In conclusion, the MK Cream has potential to be used as an aqueous cream that could be used as antiseptics.

Keywords: Antioxidants, essential oils, DPPH, IC50, free radical scavenging, MK Cream

TARGETED NEXT-GENERATION SEQUENCING OF MYCOBACTERIA TUBERCULOSIS

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Abstract

The World Health Organization (WHO) has declared tuberculosis (TB) as the second infectious killer with COVID-19 first, in the year 2020 it was stated that about 9.9 million people were diagnosed with TB in the world. TB is caused by a bacterium, *Mycobacterium tuberculosis* (MTB). MTB is diagnosed for by a variety of methods such as by GeneXpert, Line Probe Assay (LPA). The need for a time efficient diagnosis that produces the drug susceptibility/resistance profile for the first- and second line drugs was called for, this brought about next generation sequencing, the focus of this study. This study aims to evaluate the use of targeted Next-Generation Sequencing from cultured samples. This study is a qualitative study. MTB DNA isolation was done 34 cultured samples using the Genolyse kit. Polymerase chain reaction (PCR) was then performed on the isolated DNA using the DeepLex-Myc TB kit. Baym Library preparation was then performed on the DNA amplicons and then sequencing was done with the Illumina HiSeq 2500 high throughput sequencer. Nucleotide sequences of the samples were analysed by GenoScreen against first (Rifampicin, Isoniazid, Pyrazinamide, Ethambutol and

Streptomycin) and second (Fluoroquinolones, Kanamycin, Amikacin, Capreomycin, Ethionamide, Linezolid, Bedaquiline and Clofazimine) line drugs. From 34 samples, 53% showed resistance to first line drugs with 94% showing resistance to Rifampicin, and 8.75 showed resistance to the second line drugs. Treatment of TB patients remains a challenge due to generalized medicine, the use of NGS would be of benefit.

Keywords: Mycobacterium tuberculosis, next-generation sequencing, drug susceptibility profile, drug resistance

DEPARTMENT OF COMPUTING, MATHEMATICAL & STATISTICAL SCIENCES

IMPACT OF COVID-19 ON SME: AN EVIDENCE FROM NAMIBIA

A. Kadhila

Abstract

In contrast to larger organisations, SMEs have received the short end of the stick when facing the wrath of COVID-19 economic decimation. Bounding the study to Namibia, where there hasn't been any study done on how exactly the pandemic has worsened an already declining economy, The purpose of the search is to elucidate the impact of COVID-19- related cases and lockdown measures on issues related to SMEs. A questionnaire distribution will be made to Namibian SME owners using surveys as a research approach to obtain quantitative data. The data will be analysed with the appropriate stochastic models.

DEVELOPMENT OF WEB-BASED MANAGEMENT SYSTEM FOR ELCIN CHURCHES IN KHOMAS REGION (NAMIBIA)

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Abstract

The transformation of nature in the modern world with a huge amount of quality information that gives meaning and inform people's critical attitude and approach to life has motivated the need for even faith-based organizations (churches) to show accountability in the management of data and resources committed to their care by members. This research study was conducted to assess the efficiency of the current manual church management system (which includes, manual book data entry, financial book records and verbal information sharing among ELCIN churches in Khomas region). and present the possible changes that needs to be done. The methodology used is both qualitative research method and quantitative research method. A simple purposive sampling was used to pick the closest churches to the researcher as samples. Online surveys and face to face interviews were used to gather data. Both primary and secondary data were collected. The findings indicated that ELCIN churches in Khomas region use register books to record events such as Baptisms, Confirmations, Marriages, and Financial records and use verbal communication to share information. A web-based church management system was developed to succeed the manual data entry into registry books and help share information more efficiently. Future work will be done to decentralize churches Management System across all ELCIN churches in Namibia.

Keywords: ELCIN, Management system, Baptism, Confirmation, Marriage

HEDGING GEOPOLITICAL RISK WITH GOLD

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Abstract

This work serves to investigate the relationship between geopolitical risk and gold prices as well as demonstrate how the relationship differs from current measurements of economic, financial, and political risk as well as how gold reacts to geopolitical risk in a very unique manner from other assets.

For a time frame ranging from February 1985 to September 2022, we empirically investigate the effect of geopolitical risk (GPR) on gold returns. We demonstrate that GPRs and geopolitical threats (GPTs) have a negative impact on the returns to gold by modeling volatility using an exponential generalized autoregressive conditional heteroskedasticity (EGARCH). Our result provides additional validation of gold's exceptional reputation as a global safe haven asset.

Keywords: Gold, Geopolitical Risk, Safe Haven

AN AUTOMATION OF THE PAPER-BASED SYSTEM TO A WEB-BASED DISTRIBUTED SYSTEM FOR THE LAW ENFORCEMENT AGENCY.

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Abstract

Many developed countries have developed and implemented several information management systems, since the advancement of technology and those systems have rapidly improved the day-to-day operations of law enforcement. These systems keep records, manage and retrieve information about potential suspects, convicts and offenders. However, law enforcement agencies in developing countries such as Namibia still use manual paper-based system to keep record of policing operational data. These batch of papers are piled away in storage facilities which is highly inefficient, bulky and time consuming. Therefore, challenges like this will be eradicated as this system will upgrade to modern technologies such as Distributed database systems to store and retrieve information. Probability sampling method was used to pick random participants from a non-biased point of view within the policing department. This sampling method is chosen to investigate how stakeholders are affected by the manual system. Online surveys were drafted using survey monkey. Findings show that, highest population find the current system time consuming as well as lack of storage issue. However, they gave convincing response showing interest in the automated system, there is a need for automated systems to improve the day-to-day operations of law enforcement. Furthermore, a web-based database system implemented for the law enforcement agency within the Khomas region will be accessible anywhere and anytime provided there is stable internet connection. Information would be recorded upon case registration, any other data entry activities relating will be stored directly to the database.

Keywords: Management systems, Convicts, Suspects, Policing, Automated systems

FROM ELLIPTIC INTEGRALS TO ELLIPTIC CURVES AND CRYPTOGRAPHY

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Abstract

Elliptic curves have been object of study since the beginning of 19th century, and still today they form an active area of research because of the applications to number theory and cryptography. In this talk, we will introduce elliptic curves following a historical approach; that is, starting from elliptic integrals, elliptic curves will be presented as certain Riemann surfaces appearing in the proof of the addition formula for elliptic functions. Elliptic curves carry a structure of abelian group, which the feature essential for applications to cryptography.

Keywords: Elliptic Integral, Elliptic Function, Projective Space, Riemann Surface, Holomorphic Map, Meromorphic Map, Holomorphic Differential, Meromorphic Differential, Elliptic Curve And Cryptography

A STUDY OF METHODS FOR SOLVING HYPERCHAOTIC FINANCE SYSTEMS

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Abstract

This paper is concerned with the methods for solving the HCFS problem. Throughout this paper three methods are observed namely the finite difference methods, finite element methods, and spectral methods with the goal of determining which is most effective in identifying and solving HCFS. It turns out that the spectral methods are more efficient compared to other methods in accurately locating, and solving chaos.

Keywords: Hyperchaotic Finance System, Hyperchaotic System, Chaotic Finance System, Chaotic System, Hyperchaos, Chaos, Lyapunov Exponent, Dynamical Behavior, Spectral Methods, Chebyshev Polynomial, Nonlinear System

DEVELOPMENT OF A CENTRAL METADATA REPOSITORY FROM SELECTED INSTITUTIONS OF HIGH LEARNING IN NAMIBIA

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Abstract

This research study aims at designing and developing a central metadata harvesting repository from the selected available Institutional Digital Repositories which are the University of Namibia, and Namibia University of Science and Technology repositories. The Dublin Core Metadata standard is used for metadata. The Open Archives Initiative Protocol for Metadata Harvesting standard version 2.0 was used to gather metadata from the selected Digital repositories. The study's primary goal is to create a central metadata repository with search indexing capabilities. The repository is configured with the most recent space version, and harvesting is done through its user interface and a customer harvester that has been created to enhance the harvesting capabilities to match the metadata being gathered from the selected Institutions' digital repositories. Users expect appropriate scholarly information based on their queries in the shortest possible time. At present, they are enforced to explore separate repositories for their desired scholarly material. This research attempts to address the previously described problem of "searching individual digital repositories" by constructing a central metadata repository providing single search dialogue box. This provides users with capabilities to search efficiently contents from the selected institutional digital repositories. The developed central metadata repository provides a central point to advance and include other institutions' digital repositories metadata if they come up in the future with minor configurations.

Keywords: Metadata repository, digital repositories, metadata management

A MOBILE PHONE APPLICATION TO IDENTIFY AND CLASSIFY LITHOPS IN NAMIBIA USING MACHINE LEARNING

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Abstract

Lithops also known as flowering stones are indigenous plants, mostly found in the Southern parts of Namibia. Lithops blend in with surrounding rocks making it difficult to positively distinguish them as either lithops or as normal stones. In addition, the identification of lithops is particularly complex and time-consuming due to similarities in the plant species and intra-species heterogeneity. This study aims to develop a mobile phone application to assist users in identifying different kinds of lithops. The application will make use of the leaves of the plant as an identification method. Leave samples were collected and fed to the database using the TensorFlow framework. The TensorFlow framework assists in implementing best practices for data automation, model tracking, and model training through

machine learning. Different unique features that lithops poses were used to train the system, enabling the system to be able to differentiate amongst the lithops. The identification still proved to be a challenge due to similarities so additional features such as the drawings on the Apex of the leaves helped with further classification. For future work, the identification could be enhanced using machine learning in order to correctly identify and classify lithops.

Keywords: Identification, lithops

CREDIT RISK MANAGEMENT AND ISSUES OF BAD DEBTS IN NAMIBIAN COMMERCIAL BANKS.

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Abstract

The objective of this work is to investigate the impact of Non-performing loans on the performance of commercial banks in Namibia. The analysis employed auxiliary information gathered from annual financial reports of four commercial banks in Namibia as well as the Namibia financial stability reports from the Bank of Namibia, over a period of 2017-2021. The study utilized NPL as a subordinate variable, and macro-economic factors, namely; Unemployment rate, GDP growth and Bank's lending rate as determinants of bank profitability. By employing a vector auto-regressive (VAR) model and impulse response analysis, we investigate the effects of macroeconomic factors on Non-performing loans. We further conducted a stress test on NPL ratio to determine the resilience of the four Commercial Banks to shocks in order to validate the financial stability of the banks. The empirical findings show that gross domestic product and unemployment rate have a negative impact on Non-performing loans. The study also outlines the different methods of reducing NPLs (Credit risk management) in Namibian Commercial Banks.

Keywords: Non-performing Loans (NPLs), Vector Auto-regressive (VAR) model, Credit Risk Management, Macroeconomic factors.

CREDIT RISK MODELING TECHNIQUES FOR INSURANCE

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Abstract

Insurance sector contributes significantly to any economy, it also carries inherent dangers. The proper management of credit risks is critical to the success of each insurance institution and other financial companies; consequently, if credit risks are not well managed, most organizations, particularly those whose main activities deal with day-to-day risk management, may fail. Kokobe (2016) stated that anticipating and evaluating credit risk and the chance of default of a firm entail identifying and analyzing risks, designing and executing risk-handling techniques, methodologies, and models in order to mitigate the impact of risk on the firm's financial performance. The goal of this research is to learn about the best strategies for estimating credit risk in insurance. To investigate the link between risk management approaches and insurance company financial performance. To investigate the impact of credit risks on insurers and their benefits. As a result, this study will investigate the factors that influence credit risk application as well as the limits of current modeling procedures among insurers.

Keywords: credit risk, model, insurance

OVERVIEW OF CREDIT RISK AND CREDIT RISK MANAGEMENT: CASE STUDY OF BUILDING SCORING MODEL AND PROBABILITY OF DEFAULT MODEL

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Abstract

The Basel II Accord of 2004 was introduced following substantial losses in the financial markets. The major losses incurred, and the overall impact has shown how much of an influence credit risk and the management thereof can have on the sustainability and profitability of institutions. The Accord brought significance to credit scoring models, models that combine different information that may affect default probability in order to assess probability of default. The purpose of this paper is to illustrate some techniques in credit risk management, illustrating a scoring model, application of a scoring model and the application of a probability of default model and presenting how they work.

Keywords: Credit risk, credit risk management, scoring model, probability of default model

THE ECONOMIC FUNCTIONS OF WORKING DERIVATIVES MARKET IN NAMIBIA AND ITS CONTRIBUTION TO THE ECONOMIC STABILITY

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Abstract

This study's goal is to evaluate the contribution that banks' use of derivatives to their economic growth. For the period of January 2012 through December 31, 2019, data from four commercial Namibian banks will be gathered to assess the impact of derivative contracts on bank lending to support Namibian economic growth. The gathered data will then be analyzed to assess how banks' usage of derivative instruments increases their capacity and willingness to offer more commercial and industrial loans, and links those outcomes to the macro-economy. The strength of such industries determines how well the country's economy performs, and small and medium-sized businesses depend on bank financing to increase capacity. To determine the effect of bank lending, the size of each bank's derivatives market is taken into account, and the notional value of those derivatives are regressed along with bank-specific factors. Furthermore, this study examines the importance of traded derivatives help banks in managing risks associated with the market volatility.

Keywords: Derivatives, Financial Integration, Economic Functions, Economic Stability

DETERMINANTS OF EHEALTH LITERACY AND HEALTH PROMOTING BEHAVIORS AMONG UNAM-SCHOOL OF SCIENCE STUDENTS

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Abstract

Inaccurate and misleading health information is not uncommon on the internet which requires students' capabilities to both operate Electronic health (eHealth) tools and evaluate eHealth quality to empower students to make informed health decisions. Individuals must promote and put health behaviors such as healthy nutrition, restful sleep as well as regular exercise into action and acknowledge it as an important determinant of health. The aim of this study is to determine the correlation between eHealth literacy and health promoting behaviors (dependent variable). Assess the effect that eHealth literacy level has on health promoting behaviors and analyze the factors contributing to the level of eHealth literacy and health promoting behaviors. The study used multiple regression analysis to analyze the results. A total of 323 responses were received from students in the Science department of which the majority were female 191 (59.1%). A total of 229 (70.9%) students reported that they use the internet daily. Only 10 (3.1%) have a very good eHealth literacy level with a score of 80% and above. Approximately 80% (258) of the students scored above 50% or better for health promoting behaviors. The significant contribution of this study is our finding that eHealth literacy

and health promoting behaviors have a weak negative correlation of -0.264 and significantly associated with p-value < 0.001 and an Adjusted R-square of 0.074.

Keywords: eHealth literacy, Health promoting behaviors, Unam-Science students

FORECASTING RAND EXCHANGE RATE VOLATILITY USING HIGH FREQUENCY DATA: DOES ESTIMATOR ACCURACY IMPROVE FORECAST EVALUATION?

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Abstract

In this literature we contrast different forecasts of the volatility of the South African Rand to the United States Dollars exchange rate to other less likely sources of measures of ex-post volatility. And by applying a simple test for the betterment in the capability of loss functions to distinguish between forecasts when the volatility estimator is increased. Hence, we find that realized variance and the daily high low range provide a significant improvement in loss function convergence as compared to squared returns. This literature also finds that a model of stochastic volatility when compared to a set of GARCH models, does better at providing the best forecast and that the GARCH(1,1) being second best model.

Key words: Volatility Forecasting, Exchange Rate, South African Rand, US Dollar, Stochastic Volatility, Realized Variance

THE PREVALENCE AND DETERMINANTS OF INTIMATE PARTNER VIOLENCE AGAINST MOTHERS OF CHILDREN UNDER THE AGE OF FIVE YEARS IN NAMIBIA

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Abstract

Although violence against women is a major public concern, a violation of human rights and linked to a variety of negative physical, mental, sexual, and reproductive health outcomes, Intimate Partner Violence (IPV) is one of the most prevalent type of violence against women as it involves physical violence and causes primarily serious effects on women. Despite the high prevalence of IPV worldwide and in Namibia, no study has been done to investigate the extent and related determinants of IPV against mothers of children under the age of five years in Namibia. For this reason, this study aimed to examine the prevalence and determinants of IPV against mother of children under the age of 5 years in Namibia using a cross sectional quantitative study design of the 2013 Namibia Demographic Health Survey and a binary logistic regression technique. Results from this study showed that majority of mothers with under-5 children did not experience emotional violence and sexual but majority experienced physical violence. In addition, characteristics such as marital status, child currently residing with the husband/partner, cohabitation duration, husband/partner drink alcohol, experience physical abuse, husband/partner employment status and husband /partner controlling behaviour of the mothers with under-5 children as well as the age and sex of head of household had a significant association with the mothers' IPV experience status. Moreover, mothers with under-5 children who were not married, shared custody of their children with their husbands/partners, lived in a household headed by a person aged 40-69 years old and lived in a household headed by a female had lower odds of experiencing IPV, while those whose husbands/partners were employed and were alcohol drinkers had higher odds of experiencing IPV. It is therefore recommended that Namibian government as well as organizations centered on women's right, advocacies and development should urgently implement intervention programmes on IPV against women primarily focussing on altering cultural norm that promote man dominance over women as well as promoting women empowerment of mothers with under-5 children.

Keywords: Intimate partner violence, mothers with under-5 children, IPV experience, Namibia

A CLOSE LOOK AT SEIR MODELS

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Abstract

In this research we are going to define what mathematical modelling is, importance the models has brought into different aspects of life that are used in analyzing the spread and control of different infectious diseases. The main purpose of our work is to look at how Mathematical modeller s use the SEIR model to control and fight infectious diseases. With this said we explain what the SEIR model is all about and find out the infectious diseases that are controlled using the model. In addition , this model consist of four compartments in which individuals are divided into the four groups.

Keywords: Susceptible Infectious Recovered (SIR), Susceptible Exposed Infectious Recovered (SEIR) , Mathematical modelling

MATHEMATICAL MODEL OF THE SPREADING RATE OF COVID-19 USING RUNGE-KUTTA METHODS

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Abstract

This work will use Mathematical models to determine the spreading rate of Corona Virus (Covid-19) in Namibia. Despite the complexity of the pandemic, a modified version of the Susceptible-Exposed-Infected-Vaccinated-Recovered (SEIVR) model will be used to anticipate and evaluate the evolution of the epidemic. The model's solutions will then be determined using the Runge-Kutta methods, which are the Euler method, Runge-Kutta 2 and Runge-Kutta 4, to solve the problem. Additionally, besides the positivity, existence and uniqueness of the solution, biological viable areas are provided. A theoretical approach is then used to estimate, and asses the relationship between the parameters and the rate of the spread, while considering vaccination to be the main focal parameter. In the numerical simulations, the parameter values taken from the literature and estimated are used to perform the solutions of the proposed model. We also examine how our model's outputs behave when we take partial reported data into account then compare the results to be able to estimate the error produced by the model

FEMALE HEADED HOUSEHOLD CHARACTERISTICS AND POVERTY LEVELS IN NAMIBIA: AN ORDERED PROBIT ANALYSIS OF THE 2015/16 NAMIBIA HOUSEHOLD INCOME AND EXPENDITURE SURVEY

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Abstract

Incidences of poverty in Namibia, although multidimensional, is higher amongst female headed households (with a rate of 46%) compared to male headed households (with a rate of 41%), yet this situation is further worsened by women being alone, having to take care of children, siblings and sometimes parents with no form(s) of assistance. Increasingly, females in households are forced to play multiple, conflicting roles after losing their spouses, and have to work in marginal, part-time, informal, and low-income jobs due to lack of access to high-paying jobs. Despite several redistributive measures and social protection programs put in place by the government, high inequality continues to be evident in the country, reflecting a historical legacy of inequality of opportunity. Thus, this study was aimed at identifying the household characteristics that contributes to poverty among female headed households in Namibia, as well as their effects on the households' poverty levels using a cross-sectional quantitative study design of the 2015/16 NHIES and an ordered probit regression technique. Results from this study showed that majority of the female headed households in Namibia during 2015/2016 were in the Omusati and Ohangwena regions, aged 60+ years and spoke Oshiwambo as their main language. Household characteristics such as region, main language spoken, location, highest level of

education and main source of income had significant impact on the female headed households' poverty levels. Furthermore, female headed households in the Hardap, Otjozondjupa and Zambezi regions, whose main source of income were commercial farming and others in the urban areas with a head having a secondary and tertiary education level and spoke English, German, Other (African and European) and Zambezi languages were less likely to be severely poor and more likely to be not poor. However, female headed households in the Karas, Kavango East, Kavango West, Khomas, Kunene, Ohangwena, Omaheke, Omusati, Oshana and Oshikoto regions were more likely to be severely poor and less likely to be not poor. It is therefore recommended that the Namibian government and policy makers need to further improve the livelihood for women, especially those heading households in the Karas, Kavango East, Kavango West, Khomas, Kunene, Ohangwena, Omaheke, Omusati, Oshana and Oshikoto regions, in terms of comprehensive social development of strategy that covers the immediate needs for short term and long-term needs of these women.

Keywords: female headed household, poverty levels, household characteristics, ordered probit, Namibia

AN APPLICATION OF EXTREME VALUE THEORY TO MODELING EXTREME TEMPERATURES

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Abstract

Temperature extremes (commonly referred to as cold spell and heat waves) are regarded as the most significant climate events and have been extensively studied over the last several decades. The heat waves and drought during the summer of 2017 in Namibia sent shock waves to the energy industry, farming and water resources infrastructures and health system in terms of system vulnerability and management. This paper focuses on modeling of extreme temperatures using Extreme Value Theory (EVT). The aim is to explore the frequency of occurrences of extremely low and extremely high temperatures. The dataset consists of 1489 daily maximum temperatures and 1505 daily minimum temperatures from 1990 to 2019. Block maxima (BM) approach is used to fit the Generalized Extreme Value Distribution (GEVD) while the Peak Over Threshold approach is employed to fit the Generalized Pareto Distribution (GPD) model which analyzes the upper and lower tails of the distribution of the data. The Maximum Likelihood Estimation (MLE) technique is used to estimate the parameters in two distributions. The model's goodness of fit is assessed graphically means, such as probability plots, quantile-quantile plots and mean excess plots as well using some empirical goodness-of-fit tests. Results indicate that, the models under consideration provide overall good fits for the data.

Keywords: Extreme Value theory (EVT), Block Maxima (BM), Extreme Temperature (EV), Generalized Extreme Value Distribution, Generalized Pareto Distribution (GPD), Maximum Likelihood Estimation (MLE), Peak Over threshold (POT)

A COMPARATIVE ANALYSIS OF UNAM MAIN CAMPUS STUDENT'S PERFORMANCES IN FACE-TO-FACE VS ONLINE TEACHING FOR MATHEMATICS MODULES FROM 2018 TO 2021

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Abstract

The study is aimed at comparing face-to-face and online teaching; to determine whether there is any significant difference in students' performances between face-to-face and online teaching concerning some year-level mathematics modules. This will help to determine which instructional modality between face-to-face versus online teaching generates better students' performances. The study used secondary data from UNAM Main Campus for students' final marks in two modules, Algebra 2 and Basic Mathematics, for 2018-2021. The study used simple random sampling to select a sample size of 36 students in Algebra and 420 in Basic Mathematics. One-way ANOVA results found that there was a significant difference in students' performances between face-to-face and online teaching in both modules and it was determined that face-to-face teaching generated better

students' performances than online teaching. Although, an extra Kruskal-Wallis test found that the mean ranks of students' final mark scores across the groups were not the same for Basic Mathematics only.

Keywords: Face-to-face teaching, Online teaching, Significant difference, One-way ANOVA, Kruskal-Wallis

INVESTMENT AND FINANCIAL ANALYSIS OF LISTED AND UNLISTED BUSINESSES IN NAMIBIA

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Abstract

In the last few years in Namibia, it has been observed that the market has been flooded with too much money looking for safe and sound investments, and this has been confirmed in 2019 by the oversubscription of Standard Bank's shares at the Initial Public Offering (IPO). We can't talk about the economic growth of Namibia without talking about safe and sound investments. Long-term economic growth of Namibia can be aided by access to secure, solid, and affordable investments for everyone, including low-income households. The purpose of this study is to analyze investment prospects in Namibia using analytical approaches, fundamental analysis, and financial ratios to analyze financial instruments that are available in Namibia and evaluate a stock or industry to determine how it will perform and which investors it will attract. As a result, this study will help investors in Namibia make informed investment decisions by providing quantitative information on inclusive, safe, and sound investments. In the end, this study will allow those who are currently unable to use financial instruments due to a lack of information to do so.

SOLVING STIFF ORDINARY DIFFERENTIAL EQUATIONS

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Abstract

In this work, we first attempt to define a stiff ODE, by means of various graphical presentations of a stiff ODE. In order to overcome the challenge of obtaining analytical and/or numerical solution, we demonstrate our main aim by providing examples of two significant stiff ODEs and present our finding for discussions. In case of numerical solution, a stiff ODE is discretised and implemented in MATLAB to enable us visualize the solution and enable future application of stiff ODEs to a real life situation.

IMPACT OF CREDIT RISK (NPLS) AND CAPITAL ON LIQUIDITY RISK OF NAMIBIAN BANKS

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Abstract

Liquidity and credit risk are known to be key sources of default risk in banking institutions and bank capital is a buffer against financial risk. The purpose of this research is to study the effect of capital on liquidity risk as well as investigate the relationship between liquidity risk and credit risk in the form of NPLs in Namibian banks. The study uses bank specific data over the period of 2011-2021 from the four banking institutions in Namibia as well as economic data provided by Namibian Statistics Agency. The study was conducted by use of the Generalized Auto-Regressive Conditional Heteroskedasticity (GARCH) models which allowed us to identify reasons that were behind the shocks in liquidity in Namibia. To further identify changes in prohibitive linkages over the long term, the Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity (DDC-GARCH) was employed. The empirical findings highlight the changes in the banking sector during the economic downturn experienced in the last 10 years. The finding also provide lessons for Africa as a whole and bring light to the suggestion that banking sectors in developing nations should strengthen their fiscal policies and make essential modifications to maintain bank profitability.

Keywords: Liquidity Risk; Credit Risk; Banking Capital; Generalized Auto-Regressive Conditional Heteroskedasticity; Dynamic Conditional Correlation

PRINCIPAL COMPONENT ANALYSIS: APPLICATION ON THE CROP PRODUCTION DATASET

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Abstract

Principal component analysis is a multivariate data (quantitative) dimension reduction technique that was applied on the crop production dataset that has eight variables. PCA was used to reduce the dimensionality of the Crop production dataset, while increasing the interpretability of the Crop production dataset and minimizing the information loss. It did this by creating new uncorrelated variables that successively maximizes the variance. Eigen values and variances was the first approach used to determine the number of PCs to be retained with the help of the Kaiser-Guttman criterion which stated that PCs with eigen values not less than one should be retained, which forced to reduce the data into 5 dimensional dataset from 8 dimensional dataset. The scree plot and the abline work together, which also had retained 5 principal components. The loadings clarified which variable weighted the most per PC, and Quantity NO, Seed, Unit Cost, Weight and Total Production were the uncorrelated variables. This study had only used two approaches: The scree plot abline and the Kaiser-Guttman criterion. This study had recommended the use of the following approaches when studying PCA, the broken stick model, the components with λ s totaling to the fixed amount of the total variance, Bartlett's test of sphericity, Bartlett's test of homogeneity of correlation matrix, Lawley's test of second λ , bootstrapped confidence limits of successive λ s and bootstrapped confidence limit of eigenvector coefficients.

TREND ANALYSIS OF HOUSEHOLD SIZE IN NAMIBIA

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Abstract

The study will aim at observing trends of household size in Namibia. The major objectives of the study will be; (1) To examine the trends of household size in Namibia; (2) To determine the socio-demographic factors contributing to household size. The study used data from the Namibia Demographic Health Survey (NDHS) for 2000, 20003 and 2013. The sample comprised of a total of 14 946 respondents for 2000, 5168 respondents for 2006 and 4481 respondents for 2013 that were interviewed during the surveys. Ordinal regression applied and showed that at 5% level of significance, we have a statistically significant result for type of residence, age of the head of the household, sex of the household head and educational attainment for 2000, 2006 and 2013. Since their p-value <0.05 shows that there is statistically significant impact on the household size. Further, Chi-Square test carried out by using cross tabulation in SPSS program at 95% confident interval to test association within variables. The study will be equally significant for policy makers and will be of imperative use to the Namibia's planning functionaries. Furthermore, the study will be significant in adding to the body of knowledge that looks into trends in household size and related demographics.

Keywords: Household Size, Ordinal Regression, NDHS

PREDICTION OF THE PERCENTAGE OF LUNG INFECTION AMONG POST-COVID-19 CASES

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Abstract

The recent coronavirus (COVID-19) pandemic has caused many health crises across the globe and there are patients sustaining the SARS-COV-2 infection who are developing symptoms that do not resolve over the course of many months. Following the emergence of COVID-19, technologies such as Artificial Intelligence (AI) and Machine Learning (ML) are being used as responsive measures to the

pandemic. These include the detection of COVID-19 using chest X-ray (CXR) imaging, prediction of outbreaks, analysing the rate of vaccination uptake. The primary motivation for this study is the need to raise awareness of the post-COVID-19 syndrome (PACS) and to aid in its diagnosis. The research was a quantitative experimental approach. This is because the research aims to quantify the percentage of lung infection in a patient, post-COVID-19 recovery. Data related to post-COVID complications were collected from the Kaggle COVID-19 and IEEE 8023 datasets. The Machine Learning Development Life Cycle was followed by the stages of data collection, data pre-processing, model building, training, testing, and deployment. CXRs along with ML algorithms have recently become a worthy choice for early COVID-19 screening, in this paper, the researchers extrapolate those algorithms to predict lung infection severity in patients that have recovered from COVID-19. ResNet-50, the proposed model was able to detect the severity of lung infection and to identify patients that healthy lungs. i.e. had not previously been infected by COVID-19. For visual explanations and interpretation purposes, we implemented a gradient class activation mapping technique to highlight the regions of the input image that are important for predictions. The model was validated on publicly available CXRs to determine its accuracy. This study will be useful for researchers to think of the design of more effective Convolutional Neural Networks (CNN) based models for the detection of the post-COVID-19 syndrome. Overall, we conclude that there is still a shortage of data on PACS, limited awareness of the syndrome, and a need for researchers to dive deeper into this domain.

INTERNET OF THINGS – MACHINE LEARNING (IoT-ML) BASED MODEL TO DETECT THE INCIDENTS OF ANIMALS ON NAMIBIAN HIGHWAY ROADS

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Abstract

A collision between a motor vehicle and an animal has dreadful consequences. Not only does it cause destructive damage to the vehicle, but it can also serious injuries to both the humans involved and the animal and in the worst case, death. In Namibia, there are currently no systems being developed to mitigate such accidents. The conventional way of doing things is having the driver simply rely on their reflexes and pray that they can avoid the animal in time. If the driver however knew beforehand that they were approaching an animal or be alerted of their presence on the road, then the chances of them avoiding collision would significantly increase. Machine learning together with computer vision can achieve the goal of detecting the animal in real-time and using Internet-of-Things, alerting the driver so that they have enough time to prevent a collision, which is the main focus of this research paper. Using machine learning – deep learning algorithms, we are segregating the animals with the help of open-source datasets and transfer learning. The algorithm used was YOLOv3 which is extremely fast and accurate, processing images at 30 frames per second (fps). Transfer learning is used to utilize pre-trained models, reducing training time, and amount of training data, and improving the accuracy of our model. This research project used quantitative research designs and the machine learning life cycle. Data was obtained from Kaggle in the form of datasets containing hundreds of pictures of animals, mainly focusing on those that can be found on Namibian roads. To evaluate the model, the mean average precision (mAP) was used. The mAP compares the ground-truth bounding box to the detected box and returns a score. To test the model, a separate dataset containing pictures of animals was used. A prototype using an ESP-32 camera module was used to test the object detection model in real-time. The model was able to detect, i.e., identify the location of the animal and classify it, with an accuracy of 80% and higher. Using the ESP-32 camera module, we configured it to make a sound (alert) when an animal has been detected. For future studies, we aim to implement binocular lenses in the camera module to identify animals at a much longer distance and use an algorithm to calculate the distance between the vehicle and the animal located, giving the driver the information, thus further reducing the chances of collision. In conclusion, an object detection model using machine learning, and later connected to an Arduino Uno to alert when an animal has been detected, making it IoT, was developed.

Keywords: Collision, Machine Learning, Computer Vision, Internet-of-Things, object detection

THE ROLE OF NON-PERFORMING LOANS IN ECONOMIC AND BANKING INSTABILITY IN NAMIBIA

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Abstract

This study examines the role of non-performing loans in economic and banking instability in Namibia from the year 2016 up to the year 2022. Non-performing loans are those loans which are ninety days or more past due or no longer accruing interest. loan is considered a non-performing loan if default or close to being default. In 2016, The banking institutions assets continued to grow, although at a lower rate, while the (NPLs) improved slightly from 1.6 percent in 2015 to 1.5 percent in 2016, this was both well below the 4.0 benchmark. In 2017, the banking sector continued to be sound and well capitalized, with consistently low level of non-performing loans ratio of 1.5 percent which improved slightly compared to the previous year which was 1.6 percent. In 2018, non-performing loans(NPL) ratio which increased from 1.5 percent to 2.5 percent in December 2017. In 2019, the financial system continued to function efficiently and effectively. Asset quality as measured by the non-performing loans deteriorated further in 2018, the NPLs ratio of total loans increased significantly, from 2.5 percent as at December 2017 to 3.6 percent in 2018 Despite the low interest rate environment. In 2020, the financial system remained sound and stable during 2019, but risks increased in 2020, due to the spread of COVID-19. The NPL deteriorated from 3.6 percent in 2018 to 4.8 percent in 2019. In 2021, Asset Quality worsened as the banking sector's NPLs ratio rose above the new trigger of 6.0 percent for time of crisis and stood at 6.4 percent during the period under review, a significant escalation 4.8 percent registered in 2019. In 2022, Asset quality in the banking sector deteriorated beyond the crisis trigger point of 6.0 percent. As it can be observed that the NPL ratio has been increasing exponentially from the year 2016 up to the year 2022, then this is a problem that needs to be looked at. In my methodology I will collect data from the Bank of Namibia (BoN), and use the Vector Auto Regression (VAR) Model to forecast and stress test the result to see how economic indicators and financial indicators affect NPLs in Namibia.

A REVIEW OF THE RELEVANCE OF EFFICIENT MARKET HYPOTHESIS (EMH) AS AN INVESTMENT STRATEGY: A CASE STUDY OF THE NAMIBIAN STOCK EXCHANGE

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Abstract

Around since the 1970s, The Efficient market hypothesis is a one of the most investigated hypotheses, yet there is still no consensus among researchers as to whether it holds. This paper reviews the Efficient Market Hypothesis (EMH) and its relevance to the Namibian capital markets. The EMH puts forth that all available information is reflected in the price of a security. The consequence of this for investors and portfolio managers is that speculation is not a prudent approach. Therefore, a passive strategy is expected to be more profitable than an active one, where an active strategy is characterized by seeking to take advantage of mispriced assets relative to a benchmark that is risk adjusted. To test whether the EMH is viable as an investment strategy, the paper aims to show which of the two strategies yielded the highest return. Historical data from the Namibia All Share Index was used to represent passive funds as well as the benchmark of the study. Funds that held a significant portion of exclusively Namibian securities were chosen to represent actively managed portfolios. By using regression analysis and observation of historical returns this study will ascertain which method is more prudent and in turn inform how relevant the EMH is in the Namibian context.

Keywords: Efficient Market Hypothesis, Passive investment, Active investment, Capital Markets, Namibia

A VIRTUAL MENTAL HEALTH SOLUTION FOR UNAM STUDENTS IN THE SOCIAL MEDIA ERA

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Abstract

Mental health has become a major concern, worldwide among the youth including university students. Social media usage is one of the contributing factors in the mental health decline of young people today. The University of Namibia through the UNAM Health Care Service (UHCS), provides counselling and mental wellness services to the students, but over the years students have aired their complaints about the inaccessibility and inflexibility of the service. This study investigates the accessibility of mental health services provided at the University of Namibia in the social media era. A qualitative approach was utilized and data collection happened in two methods, namely, semi-structured interviews and electronic questionnaires. A sample of seventy (70) participants participated in the electronic questionnaire and 7 members of the UNAM mental health society and UHCS were interviewed. The results were organized into two categories: social media's effect on participants and awareness of the counselling services provided by UHCS. The results of this study demonstrate that social media usage has negative effect on most students, even though some positive effects in others have been recorded too. Participants reported among others having developed increased anxiety and lack of focus as a result. The university counseling system is not designed to cater for a large number of students, it is physically located on campus which limits its accessibility. The study concludes that a virtual counselling platform can increase accessibility and flexibility of the services provided by the UHCS.

Keyword: University of Namibia, mental health, online counseling, mental wellness, social media, virtual counseling

THE DEVELOPMENT OF CLIMATE AGRO METEOROLOGY APPLICATION FOR FARMERS IN NAMIBIA

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Abstract

This is comprehensive study on utilizing agro-meteorology application according to the profile of small scale farmers in Namibia. The study has completed important critical step in developing climate services for farmers that are truly integrated with user-centric design into the development process in an African context. The study has done a literature review and design prototype for the application. This led to the co-design, development and integration of a mobile application that provide climate and weather information as well as agricultural information for the main crops such millet, maize and sorghum. The research applied using qualitative research using interview with 3 farmers in the field using random sampling with the approach to inform the study. A survey has been administered to find out how people understand climate services, agro meteorology and help enhance the mobile application's user experience. A Results shows that farmers are determined ready to use and excited with the application. A hypothesis was set that there is a need for integrating Chatbot into a farmer's application for making farming process more efficient to farmers and the integration of Market Place (MP) for farmer's application to market and sell their product the integration of notification system that allows farmers to receive real-time data through their mobile phones and the use of IOT. The research proved it to be right based on the information collected and the survey executed. The study aims for the application to become scalable, durable and fault tolerance. Keywords: Climate services for farmers, Co design, Africa, MP (Market Place), IOT

A SHONA MOBILE APPLICATION TO FACILITATE READING AMONGST DYSLEXIC LEARNERS

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Abstract

Dyslexia, a neurological learning disorder affecting one's ability to read, write or speak, is the most common learning disability experienced by children and adults. Various reports have reported on the high illiteracy rates amongst dyslexic adults in Zimbabwe due to the inadequacy of the existing intervention programs. This research was then conducted to explore the benefits of integrating assistive technological solutions with existing intervention programs so as to alleviate some of the effects of dyslexia. A Shona Android mobile learning application for primary school learners with dyslexia was developed with the goal of fostering learning and helping children improve some of their fundamental skills, such as reading comprehension and orthographic coding. The application achieves that, through the use of dyslexic friendly styles and interfaces for content accessibility and text to speech functionalities for compensatory learning that emphasises repetition. The learners' mother tongue, Shona was used as the medium of instruction, since past researches have established the overwhelming benefits of mother-tongue based learning. The application helps teach orthography, grammar and phonology of the Shona language with the use of the alphabet and its character sounds, vowels, consonants and parts of the Shona speech such as nouns, verbs and adjectives. The Rapid Application Development methodology was used for application development, ensuring user involvement and frequent iterations. A mixed method of both quantitative (questionnaires, observations) and qualitative (interviews) sampling techniques was used to ensure that this study uncovers statistically significant information about learning outcomes and discover more conclusive findings. Assistive technological solutions proved to hold promising prospects in learning.

Keywords: Dyslexia, Shona language, Mobile learning Application, assistive technological solutions, primary school, reading

A GAME BASED APPROACH TO TRAIN SOFT SKILLS AMONGST COMPUTING STUDENTS AT THE UNIVERSITY OF NAMIBIA

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Abstract

The graduate employability criteria are shifting from resume credentials to behavioural, personal and organisational skills and capabilities. Changes in the curriculum need to be made in order to deliver graduates that meet these new demands. These requirements referred to as soft skills are important attributes organisations require from employees. They enhance the development and performance of individuals and organisations. In tertiary education the emphasis on soft skills training is limited in comparison to hard skills. The research looks at the application of different methods and techniques in order to assist training of soft skills of tertiary students. This study incorporates game-based learning to support training of soft skills among computing students at the University of Namibia. In a survey conducted with start-up companies, problem-solving skills prevailed as the main skill that employers found students to be lacking. Thus, through co-design with computing students, a serious game was designed and developed to assist with training problem-solving skills. Initial evaluation provided feedback from students who played the game on a voluntary basis. The feedback included improvements to the game with regards to its quality and effectiveness in the training of soft skills. Most students expressed that the game stimulated a desire to complete the initial level leading to further excitement to progress to the next stage of the game. The findings of the study indicate that game-based learning occupies the interests of the students and creates a valid environment to train soft skills.

Keywords: soft skills, game-based learning, problem solving

OTJIHERERO (OTJIHIMBA) MOBILE LANGUAGE LEARNING APPLICATION

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Abstract

Learning a foreign language is essential. In the northern part of Namibia, you find a group of indigenous people from an ethnic group called Himba Tribe in Kunene region, Kaokoland. This tribe of 68 000 inhabitants has a unique culture of its own which often attracts local and international tourists across the globe that comes to explore more about OvaHimba people, their distinct culture, and customs. However, only a few speak and understand English, as result of low education and semi-nomadic lifestyle. Therefore, causing a language barrier during interaction with visitors. As a result of a growing tourism industry in the region, which has become a main source of income after colonialism and recent developments. It is essential that the Himba, local and international tourists learn to communicate. Hence, this study aimed at developing an android based Otjihimba learning application with the purpose of improving the communication between the natives of Ovahimba community and anybody who wishes to interact with them. The study applied a qualitative research approach which gave an in-depth understanding of the user's perspectives and experiences regarding the learning application. An Agile software development model was used in the application development. A survey with closed and open-ended questions was administered to potential respondents and study findings shows that the application proves to be helpful toward other people from various tribes. It followed a spoken translation model of Google Translate, to translate from Otjihimba to English. Further, it has option that allows users to asses themselves.

INTERNET OF THINGS – MACHINE LEARNING (IoT-ML) BASED MODEL TO DETECT THE INCIDENTS OF ANIMALS ON NAMIBIAN HIGHWAY ROADS

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Abstract

A collision between a motor vehicle and an animal has dreadful consequences. Not only does it cause destructive damage to the vehicle, but it can also serious injuries to the humans involved and the animal and in the worst case, death. Machine learning together with computer vision can achieve the goal of detecting the animal in real-time and using the Internet-of-Things to alert the driver The algorithm used was YOLOv3 which is extremely fast and accurate, processing images at 30 frames per second. This research project used quantitative research designs and the machine learning life cycle. Data was obtained from Kaggle in the form of datasets containing hundreds of pictures of animals, mainly focusing on those that can be found on Namibian roads. To evaluate the model, the mean average precision (mAP) was used. To test the model, a separate dataset containing pictures of animals was used, and an ESP-32 camera module to test the object detection model in real time. The model was able to detect, i.e., identify the location of the animal and classify it. Using the ESP-32 camera module, we configured it to make a sound (alert) when an animal has been detected. For future studies, we aim to implement binocular lenses in the camera module to identify animals at a much longer distance. In conclusion, an object detection model using machine learning, and later connected to an Arduino Uno to alert when an animal has been detected, making it IoT, was developed.

Keywords: Collision, Machine Learning, Computer Vision, Internet-of-Things, object detection

A TIME SERIES REGRESSION MODEL FOR THE EFFECT OF DIESEL FUEL PRICES ON FOOD AND NON-ALCOHOLIC BEVERAGE PRICES CPI IN NAMIBIA 2017-2021

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Abstract

Fuel is an energy source that plays an important role in the economy of most countries and its fluctuating prices affect most sectors in the economy. This study investigated the effect of diesel prices on food and non-alcoholic beverages CPI in Namibia. Statistical descriptive summaries were computed, time series regression model was used to investigate the relationship between food and non-alcoholic beverages CPI and average diesel prices, time series plots and time series decompositions to establish the components, Autoregressive Distributed Lag (ARDL) model was used to test for cointegration and Auto Regressive Integrated Moving Average (ARIMA) model was used to forecast future values upon monthly time series data for the period 2017 to 2021. The study found that an increase in diesel prices is associated with an increase in food and non-alcoholic beverages CPI according to the regression equation $Y_t = 99.68 + 3.85 X_t$. The results also suggested that there is a long-run relationship between diesel prices and food and non-alcoholic beverages CPI. Furthermore, there is an upward trend in both diesel prices and food and non-alcoholic beverages CPI with repeating patterns in the seasonal component. Additionally, the study predicted a forecast showing an increase in both diesel prices and food and non-alcoholic beverages CPI. The study suggested an introduction of new policies to protect individual consumers and relief provision when fuel prices increase exponentially.

Keywords: diesel prices, CPI, Namibia, time series forecasting

PREDICTION OF THE PERCENTAGE OF LUNG INFECTION AMONG POST-COVID-19 CASES

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Abstract

The recent coronavirus (COVID-19) pandemic has caused many health crises across the globe and there are patients sustaining the SARS-COV-2 infection who are developing symptoms that do not resolve over the course of many months. The primary motivation for this study is the need to raise awareness of the post-COVID-19 syndrome (PACS) and to aid in its diagnosis. The research was a quantitative experimental approach. It aims to quantify the percentage of lung infection in a patient, post-COVID-19 recovery. Data related to post-COVID complications were collected from the Kaggle COVID-19 and IEEE 8023 datasets. The stages of data collection followed the Machine Learning Development Life Cycle, data pre-processing, model building, training, testing, and deployment. CXRs along with ML algorithms have recently become a worthy choice for early COVID-19 screening, in this paper, the researchers extrapolate those algorithms to predict lung infection severity in patients that have recovered from COVID-19. ResNet-50, the proposed model was able to detect the severity of lung infection and to identify patients with healthy lungs. We implemented a gradient class activation mapping technique for visual explanations and interpretation purposes. The model was validated on publicly available CXRs to determine its accuracy. This study will be helpful for researchers to think of the design of more effective CNN-based models for the detection of the post-COVID-19 syndrome. Overall, we conclude that there is still a shortage of data on PACS, limited awareness of the syndrome, and a need for researchers to dive deeper into this domain.

A STUDY ON THE IMPLEMENTATION OF AN AUTOMATED MANAGEMENT SYSTEM FOR THE UNAM STAFF CAFETERIA

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Abstract

Lunch Services at the University of Namibia staff cafeteria tend to be a cumbersome process as the waiters at times get overwhelmed by customers' requests which are mostly done all at once during on-site ordering during lunch time. Hence, an online food and table ordering has the potential to provide convenience for the UNAM staff members and food preparing control to chefs. This study intends to resolve most of these issues by developing an off-site online menus and food ordering system for the staff cafeteria to increase the market, grow revenue and ease the burden of long queues. The system categorizes meals according to their frequent orders, give coupons and send out notification via email and short text messages as a reminder to customers on delivery, pickup, and takeaway orders in real time. The system will be deployed on both user-friendly web and mobile application.

AN APPLICATION TO FACILITATE JOB SEEKING/RECRUITMENT OF SCHOOL TEACHERS IN NAMIBIA

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Abstract

One of the main reasons why teachers in Namibia find it challenging to obtain jobs in Namibia is due to the inaccessibility of available teaching vacancies. The vacancies do not have a strong enough outreach to reach all teachers in the country. As technology continues to advance, it is important to aid this process by digitizing the current methods of recruiting teachers. Job portals are a convenient, economical and efficient source of accessing job opportunities. This study developed a job portal to facilitate the job application and recruiting process of teachers in Namibia, aiming to digitise the recruitment methods used. Qualitative research was implored to carry out the study. With the targeted population of schools and teachers in Namibia, a sample population was drawn out using the two-cluster sampling technique. Using a survey and questionnaire as the main research instruments. For data analysis, Thematic Analysis and Interpretive Phenomenological data analysis method were implored. Results from obtained data found that the current recruitment methods were physically and financially taxing, confirming the need for the digitalization of this process. By investigating the effectiveness of similar systems and how one could be implemented in Namibia, the teacher's job portal 'NamEduHire' was using the Personal Extreme Programming (XP) development methodology. NamEduHire allows teachers to search and apply for jobs and for schools to post jobs and view applicants. Results of the study correlates to the design and development of working software 'NamEduHire' thus, the main research objective was achieved. Keywords: job portal, recruitment, employers, job seekers, unemployment, teachers, schools.

DEVELOPING A WEB-BASED E-WASTE MANAGEMENT APPLICATION SYSTEM FOR THE UNIVERSITY OF NAMIBIA

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Abstract

E-Waste Management System (EMS) is a web-based application created to offer a simple method of online e-waste management for the University of Namibia (UNAM). The disposal of e-waste, which is either domestically produced or imported presents enormous issues in developing countries. If not appropriately treated, toxic components included in e-waste could have an adverse effect on both the environment and human health. At UNAM, e-waste is occasionally collected by informal recyclers therefore, there is no assurance of correct disposal since there is insufficient infrastructure to manage it safely. Thus, e-waste requires proper management following international best practices. Universities

are massive generators of e-waste and the University of Namibia is not an exception. The purpose of this study is to address some of the key challenges of managing e-waste at the UNAM main campus. Hence, solutions to manage the record keeping of e-waste, foster re-use by lengthening the life of electronic equipment as well as educating UNAM community became essential. A mixed methods approach was used to gather information through the use of survey questionnaires and interview guides. The current system is a manual system that will benefit from automation of major processes. Additionally, unavailability of a reliable platform that fosters re-use, stimulates donations and promotes recycling was indicated. The researcher developed EMS to manage the collection, reuse, and channel e-waste to formal recyclers to ensure sound recycling of e-waste as well as educate the UNAM community on e-waste matters.

Keywords: E-waste management, recycling, waste management, electronic waste

A DIGITAL LOGBOOK FOR THE OCCUPATIONAL THERAPY DEPARTMENT AT THE UNIVERSITY OF NAMIBIA

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Abstract

Occupational Therapy students at the University of Namibia currently use a manual system to capture information on a day-to-day basis at their respective internships. The process of recording into a manual logbook is time-consuming and can lead to many errors and undetailed records. Students handover their logbooks to the supervisors at certain periods throughout the year so that the supervisors can evaluate the students' performance during the internship. The supervisors are not always able to assist or take note of how students are performing at the internship due to limited access to student logbooks. In this study, a digital logbook was developed to assist the Occupational Therapy department to improve the quality of their students' internship program. To get a comprehensive opinion of the acceptance rate of the digital logbook, focus groups and interviews were used to collect data from the students and supervisors. The digital logbook was found to have improved the level of interaction between students and their supervisors.

A STUDY ON THE DEVELOPMENT OF AN ONLINE WEB-BASED TICKETING SYSTEM FOR DISABLED STUDENTS SUPPORT

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Abstract

Challenges exist in university settings, particularly in the online teaching and learning due to the aftermath of a Covid 19 global pandemic. As a result, to understanding learning needs of differently abled students' interaction is needed as they may have special needs with regards to e-assessments, and study materials format. Therefore, a dedicated communication channel is needed between the lecturers and the disability unit at UNAM to facilitate support for students with disability. This paper will discuss the development of a web-based ticketing system aimed to assist disability unit in notifying lecturers of students with disability and their specific needs in real time. The system proposed allow staff members at disability unit to log tickets with a unique identification number on behalf of students with disability as an opportunity to engage with lecturers and report students' incidents via seamless integrations of web forms and third-party tools such as email, and SMS on a single user interface. These message alerts are sent to individual lecturer's dashboard, cell phones and copied to their email as support request. Based on the findings the proposed solution supports learning needs of students with disabilities which in the long run may increase retention and passing rates. Further, it encourages collaboration in real time, ensure ticket prioritization and accountability as ticket queue or matters will be logged and indicated as resolved or not within the ticketing system

LINKING WATER INSECURITY TO HEALTH AND WELLBEING: A CASE STUDY OF WINDHOEK INFORMAL SETTLEMENTS

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Abstract

For many years water insecurity has been a major concern, specifically in Windhoek's informal settlements. Water insecurity is defined as the lack of sufficient and safe water for a healthy lifestyle. This study aimed to examine the relationship between water insecurity and wellbeing among households in Windhoek's informal settlements by making use of secondary data collected by the Future Resilience for African Cities and Lands (FRACTAL) in 2017. Confirmatory Factor Analysis was used to link water insecurity to wellbeing, as well as to three manifest variables, income, housing type and household structure. The results revealed that there was a positive association between housing type and water insecurity, as well as wellbeing. Additionally, the relationship between income and water insecurity, together with wellbeing also appeared to be a positive one. Furthermore, there was a negative association between household structure, water insecurity and consequently wellbeing. Lastly, the study also found that there was a positive relationship between water insecurity and wellbeing. Therefore, the study concluded that all factors associated with water insecurity had a direct impact on the wellbeing of residents in informal settlements. The study proposed City of Windhoek to put interventions (such as providing taps that are closer to the residents' yards and decreasing the cost of prepaid water) in place to make water and basic sanitation more accessible and affordable to people in informal settlements.

Key words: Water Insecurity, Wellbeing, Informal Settlements, Windhoek, Structural Equation Modelling, Health

ONLINE BOOKING AS A MARKETING STRATEGY: A SURVEY ON MAKE-UP ARTIST IN NAMIBIA.

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Abstract

This research aimed to understand how makeup artists manage their businesses and customers. Furthermore, this study aimed to identify challenges related to, as well as improving booking efficiency for clients. The study used both the quantitative and qualitative design methods for data collection. A total number of 32 respondents participated in online survey which contained 7 questions, ranging from multiple choice questions to in depth structured questions. The research found that a majority of makeup artists still use manual processes to deal with their management processes. The use of manual diary bookings is a time-consuming process, and has led to overbookings. Clients tend to also cancel on the last minute or not show up at all, which has led to loss of potential revenue. In addition, Namibian make-up artist actively use social media such as Instagram, Facebook or WhatsApp, as a form of communication and advertising. This finding suggested that web based technologies could be harnessed as a marketing strategy for makeup artists in Namibia. The research thus surveyed open-source booking system available in the industry today, but found that they lack user-friendly interfaces and the hidden costs of the open-source software that is free upfront but later costs money can be a major burden to makeup artists. Based on this finding, the study thus developed a system that facilitates interaction between the service providers of Make-up artist with customers. It is our hope that the makeup artists will find this website useful for managing their businesses and customers as well as using it as a marketing strategy to improve their service offerings in future.

A GRAPHICAL SIMULATION OF FIVE BASIC ALGORITHMS AND COMMONLY USED DATA STRUCTURES

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Abstract

As we further progress into the digital age, the focus has further shifted into the realm of Technology and programming. Many students have developed interest in learning programming and taking up computer science related courses at Tertiary level. However, learning programming concepts has proven to be difficult which is evidently shown by the passing rates of Object Oriented Programming students at the University of Namibia. The objective of the research was to provide a web based user-friendly system that assists struggling students to better understand data structures and algorithms that they encounter during their studies. An analysis was done to determine which of the data structures and algorithms the students struggled with and this analysis yielded that most students struggle with the following data structures and algorithms; summing, counting, maximum, minimum and search algorithms; and the following data structures: arrays, linked list, graphs, binary tree, queues and stack. This system was developed using the Personal Extreme Programming, the first iteration was tested with a few students and improvements were made based on the feedback provided. The results and findings show that this research can then be helpful in aiding students that are learning how to program. The development implementation of the following system will indeed help students learning how to program.

DEVELOPING A GYNECOLOGY CHATBOT

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Abstract

According to research, a lot of females in Namibia are battling with diseases that infect their reproductive system. These diseases include endometriosis, infertility, vaginal infection, and pelvic pain. This type of diseases become worse once they are not treated on time. The study followed a mixed method approach where questionnaires and structured interviews were used for data collection. It was noted that a lot of females in Namibia are not aware of all the symptoms and treatment of this type of diseases and sometimes gynecologists are rare to find, far from them or they just don't know where to find them. Therefore, to improve the life of females in Namibia the researcher developed a chatbot that will give answers to gynecology basic questions. The chatbot also allows females to book appointments with gynecologists. This Chatbot is designed specifically for gynecologist and females in Namibia.

DEVELOPMENT OF A PROTOTYPE FOR CENSUS AND ENUMERATION IN NAMIBIA

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Abstract

Population census is the most complex and massive exercise a national statistical office undertakes. It requires mapping an entire country's population, mobilizing and training a huge number of enumerators, conducting a comprehensive publicity campaign, canvassing all households to participate. This study shows that the traditional tablet-based census process used by the Namibia Statistic Agency(NSA) has many shortcomings, including the loss of data and the long duration of the process. To solve this problem, this study aimed to develop a web-based prototype to demonstrate how to aid the current system used by NSA. This study used a qualitative research method, and the descriptive research design was used to elicit the challenges and viewpoints from participants. The web-based prototype was designed using the Incremental Model as a Software Development

Lifecycle (SDLC). This study further used simple random probabilistic sampling to select 20 NSA employees as participants. A questionnaire with both closed- and open-ended questions was used to collect data from the sample. The findings of the research revealed that the web-based prototype for census will reduce time spent on data entry, collections and the budget for the census will decrease. Finally, the study recommends that the NSA consider using the web-based system for its next population census. Future work in this field should focus on the development of a mobile application for census and enumeration in Namibia. The application is expected to generate additional cost savings.

Keywords: Population, Statistical, Enumerators, Namibia Statistics Agency, Prototype.

EVALUATING THE EFFECT OF DREAMS PROJECT PRIMARY INTERVENTION ON HIV INCIDENCE AMONG ADOLESCENT GIRLS AND YOUNG WOMEN IN WINDHOEK KHOMAS REGION

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Abstract

Adolescent girls and young women (AGYW) face an increased vulnerability of HIV acquisition when compared to their peers. Globally, there are 20 million women living with HIV, and young women aged 15-24 are two to 14 times more likely to acquire HIV than males of the same age, dependent on the country. Annual HIV incidence among adults in Namibia was 0.84% (0.65% among women and 0.19 among men) (NAMPHIA 2017). This corresponds to an estimated 5000 new cases of HIV per year. Overall incidence was higher among women than men. However, HIV incidence among young people represented the greatest contrast. Young women aged 15-24 years were disproportionately affected, with an incidence of 1.06% compared to young men with an incidence of 0.03%. The study's primary objective was to identify a change that DREAMS has contributed to reducing rates of HIV among adolescent girls and young women in Windhoek. The models were applied to secondary data from Project Hope Namibia (Khomas). The study participants were aged 10-24 years (referred to as Adolescent girls and young women) in the DREAMS project in Windhoek health district in Khomas region, Namibia, between February 2018 to December 2020, giving a total population of 21786 A GYW. The data were analyzed in two parts, namely, the descriptive analysis and logistic regression analysis. Results from this study showed that more girls aged 20-24 years (37.6%) were HIV positive and out of 6499 AGYW, 97.3% were HIV negative and 1.9% out of 6622 AGYW were known to be HIV positive before joining DREAMS and 2.7% out of 6499 were HIV incidence. Therefore, it is recommended that there is a need to develop a PrEP initiation plan for young women. The project must accelerate the implementation of attendance strategies models that are AGYW-friendly, and service-focused to retain girls who have been on the program for a shorter duration and to avoid incomplete sessions

BILINGUAL EDUCATION: A SHONA AND ENGLISH MOBILE APPLICATION DISSEMINATING PROGRAMMING CONCEPTS

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Abstract

Learn Python programming concepts using Shona (LPyQ) was commissioned to meet the need to incorporate the theory that learning in general using mother tongue/native language is a more effective way of learning and understanding concepts, especially if it is in conjunction with bilingual learning. Moreover, applying and adding it to the learning of programming and related concepts. The developmental process for LPyQ flowed from the requirements stage, and as a result the application is well suited and aimed at closing the gap that exists in Zimbabwe, where there are no resources to learn programming available in the native language Shona or any of the other languages in the country. With that being said, programming in general, is the process of creating and developing instructions that tell a computer how to perform a task or tasks. The development of LPyQ utilized the following methods: the prior start and final stages employed the use of convenience sampling and survey questionnaires at both the requirements and testing stages. Despite the

limitations that were encountered during the application design and implementation, delimitations were applied using the prototyping methodology to counterbalance them. Applying inferential statistics from the collected data, it can be stated that the majority of the participants find learning using the mother tongue beneficial with some going as far as to state that it would greatly increase their learning speed especially with regards to learning programming concepts.

DEVELOPMENT OF AN INTERACTIVE WEB APPLICATION TO IMPLEMENT DROUGHT COPING MECHANISMS WITH A PREDICTIVE APPROACH TO AID FARMERS IN THE DAURES CONSTITUENCY

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Abstract

Studies and research on drought early warning systems have been conducted. However the usage of these systems by communal farmers is subpar due to the difficulty interpreting the data provided by the system and the high implementation cost. This makes their use in communal farming, as shown by the negative effects of the drought in the Daures Constituency, where communal farming is practiced, ineffective. For this reason, the purpose of this study is to create a low-cost interactive system that includes indigenous knowledge in drought forecasting and drought-coping techniques in order to assist farmers in the Daures Constituency. The SCRUM development methodology was used to create the interactive system because it promotes flexibility. An initial concept served as the basis for later system designs as more knowledge and data were amassed. The researcher was interested in how farmers in the Daures Constituency foresaw droughts and what they did when they did. In order to accomplish this, a quantitative technique was employed to identify the most popular method(s). The findings showed, among other things, that most farmers favoured using traditional approaches that utilised weather patterns. Rainfall measurements are commonly used to determine the carrying capacity of land area relative to rainfall over a certain period of time, this is described by those in the agricultural field as the simplest way to detect drought. This finding allowed the researcher to develop an algorithm that would determine the carrying capacity of Daures Constituency.

Keywords: Daures Constituency, drought, farmers, systems, communal farming, low-cost interactive systems, early warning systems,

CROP RECOMMENDATION WEB APPLICATION

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Abstract

Research shows, agriculture is a fast-growing industry, but a challenge for small-medium scale farmers in Namibia when it comes to selection of crops to grow. At times inputs such as water are over-utilized or under-utilized. There is no platform that avails clear information about crops that a farmer has interest in growing. This research has made use of the mixed method approach, consisting of both qualitative and quantitative research methods. Structured interviews and well formulated questionnaires were done for data collection of this research. Through this we got to find out that farmers are challenged when selecting which crops to grow. Thus, they highly recommend a systemized crop selection/recommendation system. Hence this research has developed a crop recommendation system to help farmers easily select optimal crops to grow and the optimal Agri-inputs (water and fertilizers) to use for their selected crop. This web application will require farmers to only input their soil type, region, water supply quantity and climate conditions in their area. This then gives them which crop suits them according to the above inputs.

DEVELOPING A SMART ROBOTICS TOY FOR KIDS

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Abstract

Nowadays, parents struggle to keep their children off their phones and the internet, as they get addicted to the mobile devices. When children have access to the internet, they can at times be exposed to malicious content and material that parents sometimes cannot control or prevent. Parents spend less attention on children's toys as the children don't want to play with these toys anymore. At the same time, they want their children off their phones and mobile devices, hence a robotics smart teddy bear was designed and developed to play and interact with children. A combination of both qualitative and quantitative research was used in this study. The developed smart teddy bear will allow children to partly be exposed to technology without negative impacts that parents are usually concerned with such as having negative effects on their eyes, sleeping routine, social interaction as well as them being addicted to the screens.

A CAREER SELECTION MOBILE APPLICATION FOR HIGH SCHOOL LEARNERS IN NAMIBIA

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Abstract

Over the past years, the lack of career guidance and counselling for high school students has led to students registering and studying courses they have no interest in at tertiary institutions. This results to most students either dropping out or changing courses until they find a course they have interest in and enjoy studying. The research focused on developing a career guidance mobile application with a chatbot integrated, and it was conducted through a mixed mode approach. Questionnaires were used to collect data. The data collected was used to develop the Android mobile application and a chatbot developed using few other technologies namely, TensorFlow for the neural network of the chatbot to train it on the data that has been collected; Python for repository installations; Flask for the Framework (Skeleton of the application); HTML for the site layout; JavaScript for the chatbot queries and JSON for the Chatbot Intents (Chatbot responses). Based on the results, it can be concluded that the system developed can help high school learners with career choices i.e. the course of study and suggest the best institutions where these courses can be studied locally.

AN ANALYSIS OF THE EFFECTS OF EDUCATION ON THE DELAY OF FIRST BIRTH AND SUBSEQUENT BIRTH AMONG WOMEN OF REPRODUCTIVE AGE IN NAMIBIA

M. Bernadin

Abstract

Back ground: Young women continue to face diverse challenges that threaten their health and wellbeing, their reproductive health and rights. Teenage pregnancy continues to be an issue too. It is a major concern in any health-care system because early pregnancy can have negative consequences for a girl's physical, psychological, economic, and social standing. This study aims to investigate the characteristics that may help in the delay of first birth among teenagers and women who already had their first birth and their desire to have more children. Objectives: The study aimed at investigating the effects that education has on the delays of having a first birth among adolescents and the delays of having a second or more children among women who already had their first birth in Namibia. The dependent variables were derived as follows: delayed first birth if such did not happen under the age of 20 years and subsequent birth was derived from women having two or more children. Binary logistics regression model was used to assess the association between main outcome variables (delayed first birth, subsequent second or more birth), with main independent variable educational attainment adjusting for other independent variables. The results showed that education does indeed

have an effect on the delays of first birth and subsequent births. Respondents from rural areas, with no educational attainment showed the highest first births in adolescents, (OR=1.192, 95% C. I: 0.956, 1.487), which could be that these individuals are less informed on the matters of sexual reproductive health and consent. The study also showed that among those who already have at least one child majority have attained at least secondary education, (OR= 0.206, 95% C.I: 0.141, 0.301) and preferred waiting longer to have more children. Conclusion: Education plays an important role in all life aspects. Delaying the first childbirth could improve women's educational and economic opportunities, their health, and the health of their future and properly planned children. One would argue that adolescents need to be encouraged to stay longer in school, as this would prevent teenage pregnancies, which is how they would delay first birth at a young age. Keywords: education, women, children ever born, logistic regression, Namibia, delayed first birth, subsequent second or more births, urban area, rural area

INTEGRATING A MACHINE LEARNING BASED INTRUSION DETECTION SYSTEM WITH A SITE TO SITE VIRTUAL PRIVATE NETWORK (VPN) IN AN ORGANIZATION

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Abstract

The devices that use the internet are becoming more vulnerable as it grows and the devices' vulnerabilities may be exploited by attackers. To transfer information safely through the internet, organisations utilize a site to site virtual private network (VPN) connecting two intranets of a single organisation. However, the information may not be secure as after it exits the site to site VPN tunnel, onto the internal network. The main goal of this study is to integrate a machine learning based intrusion detection system with a site to site VPN to predict potential attacks. Furthermore, other goals of this study are to acquire and utilise the CICID2017 dataset to test and train the model. This study will utilize the Machine Learning Development Life Cycle as the development methodology. An assessment of how accurate the model is in predicting the attacks contained in the aforementioned dataset as well as network features from a database, will be made. From which the results of the research will be taken. This paper may also be used as a baseline for further research as the model will only simulate its machine learning aspects when predicting attacks. Since this research's output is a Site to Site VPN IDS with machine learning integrated, it may anticipate any attempts to exploit the information upon its entry into the internal network from the site to site VPN tunnel. In return, knowing the type of attack that is about to occur.

Keywords: Machine Learning, Intrusion Detection System, Virtual Private Network

IMPACT OF FINANCIAL LEVERAGE ON STOCK RETURNS: EVIDENCE FROM SELECTED STOCKS ON THE NSX FROM THE MINING SECTOR

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Abstract

In an attempt to maximize returns and reduce the level of risks in Investments. Investors have raised questions on the relevance or significance of a firm's capital structure in the selection of stocks and its effect on stock returns. This paper focuses on modelling the Impact of financial leverage on stock returns. Using Ordinary Least Squares (OLS) to study the relationship between leverage and stock returns, GARCH models namely GARCH (1, 1) and EGARCH models are incorporated to model the volatility in stock returns when considering the portion of equity and debt that makes up a firm's capital structure.

Keywords: Financial Leverage, Stocks, Returns, Ordinary Least Squares (OLS), GARCH (1, 1) and EGARCH Models

PRICING IN THE INSURANCE INDUSTRY-THE CASE OF MOTOR AND FUNERAL INSURANCE IN NAMIBIAN MARKETS

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Abstract

Pricing in the insurance industry-the case of Motor insurance and Funeral insurance in the Namibian markets. There is public perception that the insurance prices in Namibia are unjustifiably higher than in comparable markets. Insurance products are complicated for a majority of Namibians and it is easy for them to be treated unfairly and never know that they have been unfairly treated. On the other hand, it is possible to be treated fairly and still feel unfairly treated. It is not easy for individuals to understand what is contained in the insurance premium that they pay and may be difficult to understand even if it is fairly priced. This study discussed how Motor and Funeral insurance products are priced using Generalised Linear Models (GLMs) and risk factors, as well as to see whether premiums charges are over or under priced. The importance of understanding possible consequences of errors in pricing of insurance products is also highlighted/discussed in details. These errors affect not only the financial results of the provider, but also the emerging insurance markets.

Keywords: Premium, Risk factors, Claims, Insurance, Models, Policy, Motor insurance, Funeral insurance, Generalised Linear Models (GLMs)

DEPARTMENT OF ENVIRONMENTAL SCIENCES

THE ROLE OF BIODEGRADABLE WASTE IN GROUNDWATER QUALITY- A CASE STUDY OF THE KUPFER BERG LANDFILL SITE IN WINDHOEK, NAMIBIA

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Abstract

Biodegradable waste (biowaste) is made up of a variety biological byproduct of consumption or previous left over from production. Agriculture, forestry, food industry, and, of course, urbanized regions are the most common producers of biodegradable waste. Biodegradable waste is rarely retrieved and is instead transferred to landfills with another household waste. Without treatment, biowaste becomes the primary source of gas emissions, soil and groundwater pollution at the disposal site. Groundwater pollution by leachate from landfills that are not properly engineered or have leaky liners is a subject which has already been studied and known by most researchers. The goal of this study is to look into the quality of leachate derived from biowaste fractions and its possible impact on groundwater quality in the Kupferberg area, as well as to aid in the development of water pollution remediation strategies for the area and to contribute to the long-term management of the area's groundwater resources. In order to carry this study successfully, four different scenarios where biowaste was slowly added in percentages of 0 % biowaste, 25 % biowaste, 75 % biowaste and 100 % biowaste to the residual waste fractions (without biowaste) was modelled in the laboratory, using the Elusion method, which compares chemical and biological analyses in two different waste fractions (residual and bio-waste). A number of factors must be determined in order to characterize leachates (i.e. pH, electrical conductivity, TOC, DOC, COD, BOD, etc). When comparing the biodegradable waste fractions scenarios to the residual waste fractions, this study has shown that the analyzed components such as Cl, EC, SO₄²⁻, COD, NH₄⁺, TKN-N, and DOC were increasing with the increase in the biodegradable waste fractions scenarios. As a result, several studies have also concluded that while pH, EC, TOC, DOC, COD, BOD, and other indicators can be useful, they do not give information on the presence of harmful pollutants and their potential environmental impacts. Organics assessed

as BOD, COD, or TOC, on the other hand, can influence groundwater quality by causing taste, odour, and oxygen depletion.

SEASONAL FORAGE SELECTIVITY AND DIET PREFERENCE OF SPRINGBOKS IN ETOSHA HEIGHTS PRIVATE RESERVE, NORTH-WEST NAMIBIA

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Abstract

Namibia's arid conditions makes it one of the most vulnerable countries to climate change. Any slight increase in drought duration, intensity or frequency can severely lower forage resource availability and quality, thus ultimately threatening animal survival. Understanding seasonal diet preference and forage selectivity of small antelopes is a crucial step towards their effective management in arid savannas susceptible to frequent droughts. This study aimed to determine diet preference and forage selectivity of springboks during the wet and dry seasons in Etosha Heights Private Reserve in north-west Namibia. The study used a quantitative, stratified systematic sampling approach. A total of 34 sampling sites were selected where isolated springbok groups were foraging. At each sampling site, two 60m transects running parallel to each other and 25m apart, were laid down. Browsing on trees and shrubs was assessed in 10m x 10m and 5m x 5m plots respectively, while grazing on grasses and forbs was assessed in 1m x 1m plots along the transects. The diet of springboks consisted of 40 plant species (out of 74 plant species recorded) during both wet and dry seasons. During the wet season, 2 out of 11 woody species were browsed ($\chi^2 = 11.51$, $df = 10$, $p > 0.05$) and 14 out of 54 herbaceous species were preferred ($\chi^2 = 282.70$, $df = 53$, $p < 0.05$). Springbok browsed only on 2 woody species compared to the wider variety of herbaceous species grazed because of high availability and accessibility of herbaceous plants. During the dry season, 4 out of 11 woody species were preferred ($\chi^2 = 30.24$, $df = 11$, $p < 0.01$) and 10 out of 21 herbaceous species were preferred ($\chi^2 = 237.06$, $df = 20$, $p < 0.001$). Amongst the woody plants, springbok browsed on *Monechma cleomoides* (% frequency = 58.8) more than expected during the wet season and during the dry season *Catophractes alexandrii* (% frequency = 32.1) was browsed more than expected. Due to its high nutritional value and availability, *Enneapogon desvauxii* was significantly grazed more than expected during both wet and dry season ($\chi^2 = 237.06$, $df = 20$, $p < 0.001$). As expected, springbok preferred herbaceous plants over woody plants during the wet season ($\chi^2 = 191.11$, $df = 4$, $p < 0.001$). However, during the dry season springboks surprisingly still selected herbaceous plants over woody plants ($\chi^2 = 202.53$, $df = 4$, $p < 0.001$).

ASSESSING THE STRUCTURE AND SPECIES COMPOSITION OF MOPANE WOODLAND AT OGONGO CAMPUS

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Abstract

Information about species diversity and vegetation structure is useful in determining the ecosystem health and stability as well as extent of forest deforestation and land degradation. However, the information about vegetation structure and species diversity of Ogongo forest have not been determined. In this context, this study analyzes the species composition and vegetation structure of mopane dominated woodlands at Ogongo protected forest under the management of the University of Namibia - Ogongo campus, Omusati region, Namibia. In addition, the study was carried out to determine the diameter distribution of trees in Ogongo to establish woodland utilization options. The study used a systematic sampling design covering 11 plots in the Ogongo campus field site. The sampling intensity that was use is 4.88%. Findings revealed that the study area has an average tree height of 6.18 m, average diameter of 14.24 cm and vegetation cover accounting for 47.8 % of trees and 25.8% of shrubs of the *C.mopane* species within the sample. The study area is an open woodland dominated by mostly *Colophospermum mopane* tree species. The field observation show that the few other species found in the woodland e.g. *Acacia* species is dying a natural death may be due to

climate variations. Sustainable forest utilization programs is recommended to promote markets and utilization for forest products as a way of supporting Ogongo forests for generations to come.
Keywords: Ogongo Forest, Mopane woodland, species composition, utilization, vegetation structure.

USING REMOTE SENSING AND GIS TO DETERMINE SOIL NITROGEN CONTENT IN ONGENGA CONSTITUENCY OF OHAGWENA REGION, NAMIBIA

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Abstract

Nitrogen content is essential for crop development. Lack of nitrogen content leads to decreased soil fertility which can later on lead to childhood stunting which is common especially in areas of the northern parts of Namibia. This study will provide a baseline of information that can be used for further studies regarding the content of nitrogen in the soil. The optical data will come from Sentinel-2A, which will be downloaded from the US Geological Survey (USGS). A total of 169 soil samples were collected randomly in which 2 samples were collected (one sample from an area of high crop yield and the other from an area of low crop yield) using a soil auger in order to calibrate and validate the model. ArcGIS 10.3.1 was used to convert environmental variables to raster formats in order to map soil nitrogen concentration. Crop field areas have the highest content of nitrogen which is in the range of 0.0855 Kg/ha-0.1 Kg/ha, the nitrogen content then reduces radially outwards of the of the crop fields. The areas surrounding the crop fields in the southern part of the map have the least amount of nitrogen content ranging from 0.0252 Kg/ha-0.0402 Kg/ha, while areas surrounding crop fields in the northern part of the map show a moderate amount of nitrogen content ranging from 0.0403 Kg/ha-0.0553 Kg/ha. Crop fields have the highest amount of nitrogen content because of the use of fertilizers in crop farming, which can then radially disperse from the crop area following the flow of water.

AN ASSESSMENT OF THE IMPACT OF TREATED INDUSTRIAL EFFLUENT DISCHARGE ON THE CHLOROPHYLL CONTENT OF CULLEN TOMENTOSUM

SN. Heitah, G. Iiputa, E. Kwembeya

Abstract

Photosynthesis of plants exposed to toxic metal contamination is usually compromised, since these elements can reduce the levels of chlorophyll due to the inactivation of the enzymes responsible for the biosynthesis of these pigments. This study focussed on determining the impacts of wastewater pollution on the chlorophyll content of Cullen tomentosum collected from both the contaminated and uncontaminated sites from the Ujams Industrial Waste Water Treatment Plant in Windhoek, Namibia. A sample of 20 plants was measured collected from both the contaminated and uncontaminated sites. The chlorophyll content was recorded in the field using a portable SPAD-502 meter, as well as using spectrophotometric method. Wavelengths of 645nm and 663nm were used to measure both chlorophyll A and chlorophyll B. The results revealed no significant differences between chlorophyll content of leaves obtained from contaminated and uncontaminated sites using both the SPAD and spectrophotometric methods. Additionally, Simple Linear regression revealed no relationship between chlorophyll content and distance from the contaminated water. Therefore, our results do not show any negative effects of the Ujams Industrial Waste Water on the chlorophyll content of Cullen tomentosum.

Keywords: chlorophyll, Cullen tomentosum, spectrophotometer, SPAD-502-meter, wastewater

AN ASSESSMENT OF THE STATE OF FOOD SECURITY AMONG LOW INCOME MIGRANTS IN CHOTO, KATIMA MULILO

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Abstract

The purpose of this study was to determine the food security status of households in a settlement called Choto of Katima Mulilo. The research methodology was undertaken in two stages, firstly a literature

review was carried out in order to provide a theoretical point of view on household food security. Secondly a study which included a survey was carried out. The household survey was conducted among 50 participants of the Choto settlement and a snowball sampling technique was employed. Data was gathered using self-administrated questionnaires. Many households are at risk for food insecurity in the settlement of Choto. Food prices, poverty and population growth are some of the causes for food insecurity. Poverty is one of the biggest causes of food insecurity because people do not have enough resources to purchase food their choice. These factors make it difficult for the low-income households to meet their food requirement. Food insecurity are one of the challenges which Namibia faces as a country. This phenomenon has affected the living pattern of the poor who live in urban areas. The study aimed at contributing to a better understanding of the levels of household food security. The results of this study suggest that household size, gender and household income influence the level of food insecurity.

AN ASSESSMENT OF TREE PLANTING ACTIVITIES IN RESIDENTIAL AREAS OF ONDANGWA TOWN, NAMIBIA

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Abstract

In Namibia trees outside forests are primarily found in agricultural areas, in human settlements (urban forestry), and scattered formations in savannas and arid zones. Trees in urban areas provide several benefits such as food, shade, beautification, and also act as windbreakers. There is a need to promote urban forestry to derive or enhance these benefits. Unfortunately, in Namibia, not much has been written about urban forestry. This paper presents the results of a study carried out in Ondangwa Town to generate baseline data on urban forestry at Ondangwa. The objectives of the study were to determine the percentage of homesteads where at least one tree exist, the tree species planted and uses, asses if homeowners are irrigating trees, and challenges homeowners/occupiers face in growing trees. The data was collected by interviewing 30 households each from Oluno, Okangwena and Omwandi Estates through the use of questionnaires and additional information was gathered by direct observations in homesteads. Overall 80 % of homesteads were having at least 1 tree. The most common tree species were Guava 60%, Mango 54%, and Neem 47% frequency of occurrence. Majority of the respondents 73 % do irrigate their trees. The most reported hindrance to tree planting was the lack of space with 80 %. It is concluded that majority of the respondents are interested in growing trees in their homesteads and there is need to assist them grow trees.

Keywords: Ondangwa town, Namibia, Urban forestry, Tree species, Tree management

IMPACT OF CLIMATE CHANGE ON LIVELIHOOD IN RELATION TO ENVIRONMENTAL JUSTICE: A CASE STUDY OF THE THREE NORTH EASTERN REGIONS OF NAMIBIA

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Abstract

The aim of this study was to assess the degree to which vulnerable small-scale farming communities in Zambezi, Kavango East and Kavango West regions are differently affected by climate change. A survey was conducted in the three northeast regions targeting vulnerable small-scale farmers that are or were previously supported by the Climate Resilience Agriculture in the three Vulnerable Extreme Regions. The study adopted a two-stage probability sampling method of which a total of 205 farmers were interviewed using a semi-structured questionnaire. The study reveals that climate change affects farmers disproportionately across the three regions. In terms of gender, the study reveals that Zambezi is affected more with 39%, followed by Kavango west with 32% and Kavango east with 29%. In terms of economic status is affected more with 41%, followed by kavango west with 31% and kavango east with 28%. The study concludes that there is only a slight difference in how farmers are disproportionately affected by climate change in terms of gender and economic status across the three regions.

Keywords: Climate change, environmental justice, vulnerable small-scale farmers, livelihood

ASSESSING NITROGEN CONTENT IN CROP FIELDS IN ONGENGA CONSTITUENCY, OHANGWENA REGION

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Abstract

Nitrogen (N) is one of the primary macronutrients required for crop growth and yield and it plays an important role in crop plants due to its involvement in several significant processes. This study aims to quantify nitrogen content in crop fields in the Ongenga constituency, Ohangwena Region in Namibia. A total of 169 soil samples were randomly selected then collected and tested in a laboratory. A multiple regression model was constructed, which used the results from the samples and pixel values extracted from sentinel 2 images. Results from the regression model were used to estimate the nitrogen content at areas that were not sampled. This shows the nitrogen content in the soil throughout the whole crop field and the results can be used by crop farmer owners to make better decisions about their soils in their crop fields.

DISTRIBUTION OF SOIL MAGNESIUM WITHIN SMALLHOLDER CROP FIELDS IN THE ONGENGA CONSTITUENCY OF THE OHANGWENA REGION, NAMIBIA

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Abstract

Magnesium deficiency in soil is a contributor to childhood stunting. There is, however, uncertainty to whether soil magnesium deficiency does contribute to stunting in the northern Namibian region of Ohangwena where stunting is most prevalent in the country. Using soil samples collected from 60 preselected crop fields within the Ongenga district of the Ohangwena Region, magnesium content was determined for each of the crop fields. Samples were taken at high and low yield areas as indicated by the owners of the fields. The fields were randomly selected using four enumeration areas as strata for selection. Additional information about the history, cultivation methods and yields were obtained by further questioning the owners. A total of 168 soil samples were taken. It was found that in low yield soils the magnesium was generally low, averaging 36ppm. In high yield soils the average was higher at 66ppm. The total average of all sampled fields is 51ppm, however, there is a large difference in Mg count between fields. By comparing the results to the recommended magnesium count in soil (40 to 50ppm), a deficiency in 42% of the sampled fields were identified. This suggests that soil-based magnesium can be a contributor to stunting in the area. Further study may be required to say with certainty whether soil mineral deficiency is a major contributor to stunting in that area.

DETERMINATION OF HEXAVALENT CHROMIUM CONCENTRATION IN HELICOLENUS DACTYLOPTERUS SPECIES IN THE BENGUELA CURRENT

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Abstract

Heavy metals are life essential natural occurring metallic elements which become toxic when there is a high accumulation of these substances in the environment such as water, soil and also in organisms' which are termed as heavy metal toxicity. This study looked at hexavalent chromium (Cr VI), one of the common pollutant heavy metals. Hexavalent chromium is carcinogenic, it can be inhaled, ingested with food or water and enter the body through direct contact with the organisms' skin. The study focused on hexavalent chromium accumulation in *Helicolenus dactylopterus* (Blackbelly rosefish). The Namibian fishing industry serves a large local population and the Blackbelly rosefish one of the most consumed fish in the country. This study aimed to compare hexavalent chromium accumulation in the liver and muscle tissues of the Blackbelly rosefish, it also compared the concentration of hexavalent chromium in Blackbelly rosefish to the standardised consumable limit of

hexavalent chromium by the World Health Organisation (WHO). Blackbelly rosefish liver and muscle were dried and crushed in preparations for digestion using a heating mantle, the analysis was done using a Direct Atomic Absorption Spectroscopic Method. This study showed a high concentration of hexavalent chromium in the muscle of *H. dactylopterus* compared to the liver, it also showed that the liver and muscle have a higher concentration of hexavalent chromium than the WHO's standard limit. Therefore, there is a need to address these high concentrations in Blackbelly rosefish in Namibia as it could pose a threat to the health of fish consumers.

Keywords: Blackbelly rosefish, hexavalent chromium, heavy metals, *Helicolenus dactylopterus*, Benguela current, Namibia

NITROGEN ISOTOPES THROUGH THE NASEP MEMBER AND NUDAUS FORMATION OF THE LOWER NAMA GROUP: CONSTRAINING THE DAWN OF COMPLEX LIFE AND THEIR PALEOENVIRONMENT

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Abstract

The Ediacaran Period (635 to 541 Ma) was a time of immense biological change and records the transition from a planet dominated by microscopic organisms to a Cambrian world teeming with complex animals. Nitrogen is a macro-nutrient needed by all living organisms for growth and development and there may be a direct link between the occurrence, past marine nitrogen concentrations, and the evolution of complex, multicellular organisms. Investigating this geological period and nitrogen isotopes may help our understanding of how and why the earliest animals evolved and diversified. This research aims to investigate nitrogen isotopes through the Nasep Member and Nudaus Formation of the Lower Nama Group in southern Namibia using the recently drilled cores obtained by the international Geological Research through Integrated Neoproterozoic Drilling (GRIND) project. The objectives of the study are to evaluate the pattern, timing and implications of bioavailable nitrogen across key intervals of this stratigraphy. Using the sedimentological data paired with additional published geochemical and paleontological data, this research seeks to investigate links between biological evolution and environmental change associated with the availability of nitrogen. 30 samples were collected and analyzed for $\delta^{15}\text{N}$, $\delta^{13}\text{C}$ and, TOC.

Keywords: Ediacaran, nitrogen, Nama Group, evolution, multicellular organisms

SEASONAL VARIATION IN FORAGING BEHAVIOUR OF CATTLE IN THE COMMUNAL AREAS OF THE GREATER WATERBERG LANDSCAPE

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Abstract

Forage selection and forage intake of domestic herbivores are major processes influencing vegetation dynamics and structure. Understanding the animal forage selection is not only an important aspect in livestock management but also in sustainable use of range resources. Despite that, little is known about seasonal variation in forage selection by cattle in Namibia, and as such, this study aims to fill that research gap by assessing seasonal variation in forage selection of cattle in one of the areas in the country with the largest group of pastoralists. The study was carried out in the communal areas of the Greater Waterberg Landscape, central Namibia. The foraging behaviour of cattle was observed and compared between the growing and dry season in three villages and a minimum of 10 cattle were observed per village. Each animal was observed for 5 minutes, during which the number of bites and steps were recorded. In addition, the characteristic of the grass swards grazed on by the cattle were also determined during both sampling seasons. As expected, the preliminary findings show that cattle selected for taller and greener grass during the growing season, than in the dry season. Furthermore, the bite rate was higher during the growing season but lower in

the dry season while the step rate showed the opposite result. The preliminary results, indicate that food availability is the major determining factor in the foraging behaviour of cattle, with more searching efforts being employed during the dry season due to limited food quality and availability. Keywords: Foraging effort, Step rate, Bite rate, Communal areas, The Greater Waterberg Landscape

THE INTEGRATION OF ENVIRONMENTAL SUSTAINABILITY WITHIN THE NAMIBIAN SCHOOL SYSTEM

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Abstract

There has been an international drive for environmental sustainability with several sustainable development goals to it such as goal 6 – clean water and sanitation; goal 7 – affordable and clean energy; goal 11 – sustainable cities and communities; goal 13 – climate action. The ultimate goal is to conserve natural resources while also developing more energy efficient projects and processes. The implementation and awareness of environmental sustainability continues to be a slow progress within the Namibian school system and neglects opportunities of Namibia to achieve the environmental sustainability development goal. A non-experimental quantitative dominant and qualitative complimentary design was carried out for this study. Group discussions with students from grades 5-7 and 8-12 to measure understanding and awareness of the importance of environmental sustainability. Questionnaires were handed out to teachers to understand views on how the Namibian school system can improve on environmental sustainability. The desk review conducted analyzed topics of environmental sustainability in the school curriculum in biology, life science, natural science, geography, agriculture and development studies. Results show majority of learners learn about environmental sustainability from television and the internet and only a few involved in environmental clubs or practice horticulture understand from school. Majority of the teachers recommended that Environmental sustainability be taught as an independent study. Desk review reveal that subjects fail to cover environmental sustainability extensively. Further improvement can be done to the school curriculum to hone in the importance of environmental sustainability.

Keywords: environmental sustainability, school curriculum

EFFECTS OF DROUGHT AND FLOODING STRESS ON GERMINATION AND GROWTH OF CLEOME GYNANDRA L.

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Abstract

Cleome gynandra L. is consumed throughout southern Africa as a leafy vegetable, either as a meal or a supplement due to its nutritional value. However, the existence of this vegetable may be under threat due to the climatic variations which are evident throughout the world. The aim of this study was to determine the effects of simulated drought and flooding conditions on germination and growth of Cleome gynandra L. The study was conducted in a greenhouse at the University of Namibia, Windhoek Campus, under three different treatments which are control, drought, and flooding. The watering regimes for the treatments were based on the rainfall pattern of central Namibia targeting a 45% decrease (drought) and a 45% increase (flooding) scenario. Using plant pots of a mean diameter of 20 cm and height of 20 cm, average rainfall was simulated at (250 mm), from which a 45% drought was calculated as (140 mm) and 45% flooding (360 mm). Each treatment was replicated with 50 plant pots, totalling 150 pots for the entire study. Each plant pot was seeded with 60 C. gynandra seeds. The results revealed a significant difference in germination rate, germination percentage, plant height, number of leaves, peak germination day, number of days it took for leaves to reach maximum number, and leaf length among the different watering regimes. However, the results revealed that there was no significance in the plant height among different watering regimes.

Key words: climate change, Cleome gynandra L, drought, flooding, leafy vegetable

AN INVESTIGATION OF TEXTILE INDUSTRIES AND POTENTIAL WATER AND SOIL POLLUTION IN NAMIBIA. A CASE STUDY OF WINDHOEK TEXTILE INDUSTRIES

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Abstract

This research aimed to investigate the possible pollution the textile and leather tannery industries present to nearby surrounding streams and river, and what mitigating factors are in place to combat these conditions when this may occur. The Old Ramatex textile factory, in an on-desk review still under litigation in the Windhoek, Namibian high courts, did not fully comply and adhere to environmental planning conditions at the time. At the same time the City of Windhoek did not have sufficient measures in place and the environmental management act was not yet promulgated to direct affluent wastewater and chemical discharge to the industrial affluent wastewater treatment plant in Brakwater, Windhoek. The quantitative methodology fieldwork data collected water and soil sample tests taken from the environment near the textile and leather tanning industries including the wastewater works treatment plant. The qualitative methodology was a case study design and consisted of face-to-face interview questionnaires and an observation record schedule of the procedures followed at the different sites observed. The laboratory chemical analysis soil sample tests results indicated, chromium textile and dye pollution traces in the river located behind their premises, to which treated affluent wastewater are directly discharged in. In conclusion the research proposes a possible new solution for the industry to continue operations without polluting water courses and the environment, with the re-use of affluent wastewater and re-injecting chemical wastewater back into the textile factory operations, for this wastewater not to be dispersed near the watercourses in the water proclaimed area in Otjomuise.

Keywords: Toxicity: Sweatshop: Wastewater: Laboratory Analysis: Textile Manufacturing: Water Pollution

EFFECT OF LAND DEGRADATION ON DENSITY, DIVERSITY AND COMPOSITION OF SEEDLINGS ARISING FROM SOIL SEED BANKS: A CASE OF KUNENE REGION IN NAMIBIA

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Abstract

The Kunene region is one of the worst drought-affected and most degraded regions in Namibia. The purpose of this study was to compare the seed bank characteristic (seedling species diversity and composition) of soils collected from 3 sites with differing levels of degradation. Sites reflecting the various levels of degradation (low, moderate, high, and protected) were identified, and two belt plots were randomly set up. In each belt plot five plots were demarcated. Within the plot, soil cores of 9.7 cm in diameter and 5 cm in depth were collected using a soil drill and a total of 90 soil samples were collected. The findings demonstrates that there is low species composition similarity between degradation stages in the above-ground vegetation. Overall, 63 plant species (59 identified and 4 unidentified) germinated from some of the soil samples. The SSB differed significantly in terms of species richness and diversity ($P=0.001$). Seed densities differed significantly between the three degradation locations ($P=0.001$). There is a low similarity in terms of species composition of seedlings established from soil seed banks collected from three areas with varying degrees of land degradation. The result also shows that there is a low similarity in terms of species composition of seeds extracted from soil seed banks in varying degrees of land degradation. The standing vegetation's species composition shared very little in common with the soil seed banks, and there are big variations between the soil seed banks' species composition and that of the actual vegetation. Overall, there was little overlap between the existing aboveground vegetation and the soil seed bank. Herbaceous and two woody species dominated the soil seed bank, indicating that many woody species are not accumulating in the soil. The findings underscore the present and foreseen risks the study region confronts and serve as the basis for further restoration research.

Keywords: Land degradation, Kunene region, soil seed banks, species composition, and soil seed bank

ASSESSING THE ABUNDANCE OF MACRO PLASTIC ON NAMIBIAN BEACHES ALONG THE CENTRAL AND NORTHERN COAST

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Abstract

In order to determine the sources of litter and survey the abundance and dispersion of macroplastics, it is important to address the growing problem of waste plastic in the oceans across the world. Large plastic debris is now highly regarded as one of the most serious marine contaminants that may have the ability to significantly affect marine food webs. Countries such as South Africa offer a helpful model system for understanding some of the elements that are impacting the spread of beach plastic trash. The purpose of this study was to compare the number of macroplastics originating from local land-based sources and macroplastics originating from marine sources throughout the central and northern coasts of Namibia. The study also compared the mass amount of microplastics on beaches near urban centers and those remote from such centers, and how the distance of getting away from urban areas affected the debris distribution. The sampling was conducted at 13 representative sites at accessible beaches around Swakopmund, Walvis Bay, and Henties bay. All macro plastic litter (>2cm) were collected from a 50 m transect at each sampling site, along the shore at open sandy beaches. The length of the coastline sampled at each site ranged from 1-10 km. The abundance and mass of the macroplastics were recorded from all 13 beach sites. The statistical analysis was carried out with paired t-test for abundance, since data are normally distributed, and it revealed a significant difference in abundance between macroplastics from land-based sources and from sea-based sources with (p-value < 0.05) of both land-based (0.01) and sea-based. The difference between the mass amount of plastics found at sites close to urban areas and sites remote from urban areas was examined, and comparing mass of macroplastics from land-based and sea-based using the Wilcoxon-Signed rank test. In conclusion, more plastic debris were commonly found on beaches where people are using beaches for recreation and shore fishing. The study showed that the number of plastic debris from two sources (land and sea) was quite the same, especially on beaches close to urban areas. The results also showed that some sites had a low abundance of microplastics, which may be influenced by beach features such as slopes.

Keywords: Macroplastics, beaches, abundance, urban areas, land-based, sea-based

COMMUNITY PERCEPTION OF THE CONSERVANCY'S IMPACT ON LIVELIHOODS AND DEVELOPMENT IN UUKOLONKADHI

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Abstract

Community-based natural resource management is based on the assumption that community members will better manage natural resources if they benefit from it. The formation of conservancies in Namibia had received mixed reactions as it brought some benefits and negative impacts which affects communities' livelihoods differently. The aim of this study was to assess local communities' perceptions about the impacts of Uukolonkadhi conservancy towards livelihoods and community development. A survey was conducted in Uukolonkadhi conservancy targeting conservancy members and committee members. The study adopted a purposive sampling method whereby a total of 78 conservancy members, 11 from each of the seven conservancy centers were interviewed using semi-structured questionnaires. The study reveals that conservancy formation has a positive effect on community development, although there is variation in development across the centers. Furthermore, the study reveals that the benefits are not equitably shared amongst the conservancy members in the conservancy. The study concludes that conservancy establishment have impacted community livelihood and development. The study recommends that the conservancy committee

should comply with the benefit distribution plan to ensure equitable sharing of benefits from the conservancy.

Keywords: Benefit distribution, Uukolonkadhi, Conservancy, Community development, livelihood

THE ROLE OF SELECTED WOODY SPECIES ON SEEDLING RECRUITMENT AND SURVIVAL IN THE COMMUNAL AREA OF THE GREATER WATERBERG LANDSCAPE

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Abstract

Bush encroachment remains a challenge in different parts of the world. This phenomenon has resulted in reduced foraging areas and low agricultural productivity. In effort to fight bush encroachment, various de-bushing projects have looked at the potential to reduce the increase of encroaching plant species. However, the roles of facilitative woody plant species have not been considered. The aim of this study was to investigate the role of two commonly occurring woody species on seedling recruitment and survival in the communal area of the Greater Waterberg Landscape. Sampling was done at two villages, under and 5 m away from the canopies of 15 individuals of the two selected tree species, per village. At each sampling point, 0.5*0.5 m plots were placed and the number of seedlings- recruitment (growing season)- in each plot were counted and identified to species level. To determine recruitment survival for the year, sampling was repeated in the same plots during the dry season. Species composition was compared between the area under the tree canopies and the adjacent open area, and preliminary results indicate a high similarity in species composition between the two areas. Seedling recruitment seem to be higher under the canopies. This could be a result of better growing conditions under the tree canopies. Furthermore, most of the recruited woody seedlings under the tree canopies did not survive to the dry season, which could be an indication that the facilitative effect of woody plants does not last long in these seedlings' life cycles.

Key words: Bush encroachment, recruitment, survival, species composition, facilitation

ASSESSMET OF THE IMPACCS OF HUMAN-WILDLIFE CONFLICT ON THE LIVELIHOOD OF OMUTHIYA SUBSISTANCE FARMERS IN OSHIKOTO REGION

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Abstract

Human-wildlife conflict is a serious issue in Omuthiya subsistence farmers, particularly those near Etosha national park. This study was carried out to provide the Namibian government and other relevant stakeholders with useful background information to address the impacts of human-wildlife conflict on the livelihood of Omuthiya subsistence farmers. The study was further carried out to assist the MEFT in understanding the factors that contribute to human-wildlife conflict in Omuthiya, so that best methods of mitigating the problem can be developed. The data were collected from historical data (pre-collected data) collected over the years (2021-2022) at King Nehale conservancy. It is concluded that lions, leopards, caracals, hyenas, jackals etc. have been and are still the most troublesome problem animals in the King Nehale conservancy area, during the above mentioned years. Elephants are ranked second among the wildlife species that cause damage to infrastructures, and crop fields in King Nehale conservancy areas. Keywords: Human-wildlife conflict, impacts, livelihood, and Omuthiya subsistence farmers.

ASSESSMENT OF COVER CHANGE, WOODY PLANT SPECIES DIVERSITY OF FOUR MAJOR PLANT COMMUNITIES AND COMMUNITY PERCEPTION ON DEFORESTATION IN IMPALILA ISLAND, ZAMBEZI REGION, NAMIBIA

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Abstract

The global environment is currently threatened by significant damage to many natural resources, including fisheries and forests. Deforestation has affected the Zambezi Region for several years now and the pace at which reforestation initiatives are implemented is slower than the pace of deforestation. The focus of this research was to (i) determine vegetation cover change to illustrate the decline in vegetation over the years from 2017 to 2021, (ii) determine woody plant species diversity to highlight the major species that have declined and if they are tied to any ecological, cultural or economic significance, as well as (iii) identifying the perceptions of Impalila island's community members towards deforestation. Vegetation cover change was achieved through applications such as Google earth satellite imagery, whereas woody plant species diversity was determined using the Point Centre Quarter (PCQ) method across all four vegetation zones, and analyzed using Shanon-Weiner Diversity Index in excel sheets. Structured questionnaires (50) were distributed to determine community perceptions, which was analyzed using SPSS software. These three above components contributed to understanding the possible causes of deforestation on Impalila island and how this can possibly be mitigated. The outcomes of this research have showed that total diversity of woody plant species in the island is 3.1, and the most abundant species in all four zones are *Dichrostachys cinerea*, *Colophospermum mopane* and *Acacia* species. Considering the invasive characteristics of *D. cinerea*, it is evident that the ground has been left barren for this species to thrive. Respondents stressed that vegetation has declined and one of their alternative sources is purchasing construction poles from Zambia. This therefore, shows us the significance of preserving Impalila's woody plant species before the last species is cut down.

Keywords: Diversity, PCQ, SPSS software, Shanon-Weiner Diversity Index

GEOMETRIC MORPHOMETRIC VARIATION IN THE GENUS RHABDOMYS THAT OCCUR IN NAMIBIA

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Abstract

Phylogenetic relationships can not be reliably asserted unless comparable properties for all organisms considered are established. Skull size and shape have been widely used to study variations in animal populations. In this study, geometric morphometric method was used to assess the variations among the genus *Rhabdomys*. The use of geometric morphometric combined with multivariate statistical methods is an efficient way of to characterize shape and size, thus allowing greater understanding of locally adapted species. The aim of the present study was to determine the geographic variation that occurs between two different adult populations and non-geographical variation that occurs between adult males and females of genus *Rhabdomys* by using landmarks-based geometric morphometric method. This study's findings could be used to study factors affecting the skull morphology of rodents. 149 dry skulls obtained from the National Museum of Namibia mammalogy department were examined and separated into two age groups (adults and juveniles) based on molar eruption and tooth wear. Specimens were also categorised into females and males. The 109 skulls were selected for image capturing and 55 were used for landmarking. The landmarking measuring error testing was done. 13 cranial landmarks were digitized using tpsDig software and data analysis was done with tpsRew software. This study found out that there is no geographic variation between adult individuals of the genus *Rhabdomys* and no variation was found between adult males and females of genus *Rhabdomys*. Future studies on geometric morphometrics should also consider taking the mandible view of skulls.

Keywords: Rhabdomys, Geometric, Morphometric, Variation, Skull, Landmarking, Geographic, Non-Geographic, Molar

ASSESSMENT OF HYDROCHEMISTRY AND HEAVY METAL CONTAMINATION IN THE GROUNDWATER AROUND AN ABANDONED COPPER MINE AREA IN KLEIN AUB, NAMIBIA

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Abstract

Approximately 60% Namibia's population depends on groundwater. Despite the huge dependence on groundwater, there is still a lack of documented scientific data on the environmental status of abandoned mine pits and tailings and overall water quality in relation to heavy metal concentrations in water bodies near abandoned mine sites in Namibia. The aim of this research was to assess the hydrochemistry and contamination of heavy metals in groundwater around Klein Aub abandoned copper mine where groundwater is used for domestic purposes. A total of 13 groundwater samples were collected and analysed for their physical, chemical and heavy metals content, as well as stable isotopes. Preliminary results of the onsite parameters reveal that pH ranges between 6.82-7.80 and electrical conductivity ranges between 678 - 2270 $\mu\text{S}/\text{cm}$, dissolved oxygen ranges between 1.4 -5.77 mg/L. With an exemption of two samples, the onsite parameters indicate that water is of excellent quality (Group A) according to the Namibian guidelines. The stable isotopic composition ranges from -7.26 to -5.82 ‰ and -45.1 to -35.9 ‰ for $\delta^{18}\text{O}$ and $\delta^2\text{H}$, respectively. The groundwater plots on and above the Global Meteoric Water Line, an indication that there is no evaporation effect. The correlation coefficient for latitude effect, for $\delta^{18}\text{O}$ and $\delta^2\text{H}$, is 0.0206 ‰ and 0.0978 ‰ and for longitude effect is 0.0337 ‰ and 0.1969 ‰ respectively. The continental effects; latitude and longitude versus $\delta^{18}\text{O}$ and $\delta^2\text{H}$ values of groundwater of the study area exhibits no statistical significance and show no correlation. Based on the onsite parameters the groundwater is safe for human consumption.

DELINEATING GROUNDWATER POTENTIAL RECHARGE ZONES IN NORTHERN NAMIBIA USING REMOTE SENSING AND GIS THROUGH ANALYTICAL HIERARCHY PROCESS (AHP) IN DEGRADED RANGELANDS NORTHERN NAMIBIA

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Abstract

Groundwater accounts for 98% of the earth's available freshwater and has therefore been regarded as a crucial natural resource. In arid countries such as Namibia where surface water is scarce, groundwater is the main source of water supply as it is to be found in large parts of the country. Ruacana and Omaipanga Focal Landscapes are in areas with undulating topography with low mean annual rainfall ranging between 100 and 400 mm however they also have little soil moisture retention. Therefore, understanding the groundwater dynamics including recharge rates and mechanisms in these areas is crucial to avoid drying of boreholes. Additionally, the areas are characterized by large gullies resulting from sheet erosion causing worries as most of the fertile soil is washed off into the rivers and eventually into the ocean. In recent years Remote sensing and GIS have become a powerful tool in groundwater recharge studies especially in delineating potential recharge zone for groundwater. Delineated areas can then be protected to ensure the little rainwater being received is retained to support the ecosystem. In this study, ArcGIS was used to analyse satellite images and extract key parameters that influence groundwater recharge i.e land cover, geomorphology, slope, soil, lineament density, drainage density and geology. Subsequently, these parameters were overlaid using Analytic Hierarchy Process (AHP) to delineate groundwater potential zones. Results shows some areas have excellent potential and some area indicating poor. It is therefore important that the areas with excellent to good potential be protected and restored in order to return this lanscapes to be able to retain their mosture and support the ecosystem.

MAPPING AND EVALUATING SOIL CALCIUM USING REMOTE SENSING TECHNIQUES AND MULTIVARIATE REGRESSION MODEL

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Abstract

Soil Calcium is an important nutrient in soil quality and plays an important role in soil productivity, especially for plant growth. The current study was employed to evaluate and map the soil calcium using space-borne satellite data (Sentinel-2A) and ground verification in four Enumeration Areas (EAs) in the Ongenga constituency, Ohangwena, Namibia. In total, 169 soil samples were collected randomly from the areas according to field surveys and locational data was derived using a Global Positioning System (GPS) unit to evaluate Soil Calcium concentration in the laboratory. Normalized Difference Vegetation Index (NDVI) and Bare Soil Index (BSI) were explored from Sentinel-2A data. The satellite data derived indices were used to estimate spatial distribution of Soil Calcium using multivariate regression model. The regression analysis was performed to determine the relationship between Soil Calcium and spectral indices (NDVI and BSI) and compared observed Soil Calcium (field measure) to predict Soil Calcium (estimated from satellite images). Machine learning will be performed to determine the significance of the relationship between observed and predicted soil calcium level. The results of regression analysis between observed Soil Calcium and NDVI values are expected to show a significant relationship. A significant statistical relationship is also expected to be observed between Soil Calcium and BSI. Finally, our model will then be expected to show the percentage of the variance of Soil Calcium distribution that will be explained by Soil Calcium and NDVI values. The information from this study will advance our understanding of the on-going ecological development that affects soil nutrients (Calcium) dissemination and might be valuable for effective soil management in the EAs.

Keywords: Soil Calcium; Normalized Difference Vegetation Index; Satellite data; Bare Soil Index; Namibia.

INVESTIGATING DIETARY AND CONSUMPTION PATTERNS OF RECENT MIGRANTS AND ITS IMPLICATIONS ON HOUSEHOLD FOOD SECURITY. A CASE STUDY OF KUISEBMUND, WALVIS BAY

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Abstract

The study looked at health trends among various migrant families in relation to the foods they ate and whether a change in diet had a significant effect on migrants' health after they moved to cities. Restrictive dietary choices cause physical and mental stress, poor health outcomes, and ongoing issues with food security for disadvantaged urban people in developing countries. Urbanization and migration from rural to urban areas have an impact on risk factors, especially for noncommunicable diseases (NCD), and this must be considered when developing globally effective preventative interventions. This research intends to investigate the dietary patterns of migrant households before and after migration in Kuisebmond, Walvis. In Kuisebmond, 20 households were interviewed using a semi-structured interview guide. One major finding was that some migrant workers still had challenges, whether they were employed or not, while very few people's lifestyles improved. Another important reason was the growing prevalence of noncommunicable illnesses in these populations. Food security has had a modest influence in Namibia, despite its inclusion in different planning projects, policies, and decision-making. Many of the participating households have shifted their diets away from organic foods and toward adding huge amounts of processed foods to their daily meals. Many individuals also acquire NCDs that can be linked to regular consumption of processed foods. The reason is that many of the participants who faced these various issues had some form of high school education, and the lack of this can be attributed to the food insecurity and health issues in the country.

ASSESSMENT OF LOCAL COMMUNITY PARTICIPATIONS ON THE GOVERNANCE AND SUSTAINABLE UTILIZATION OF FOREST RESOURCES: A CASE OF UUKOLONKADHI COMMUNITY FOREST IN NAMIBIA

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Abstract

Uukolonkadhi community forest is one of the few protected woodlands in the north Central of Namibia. Most of the residents within the region survive mostly on woodlands resources as they use as their source of energy in terms of firewood, construction of houses (timber for poles), thatching for their houses roofs and area also serves as a grazing habitat for their animals. In order to achieve sustainable forest management, forest governance is the key in woodlands that are inhabited with people. This study examines the local communities' participation on the sustainable utilization of forest resources in the Uukolonkadhi community forest, by looking at aspects of equitable sharing of resources, involvement of local communities in resource monitoring, management and decision making. Six villages were purposely selected in the Uukolonkadhi community forest. Structured questionnaires were used to collect data from 59 households and were randomly chosen. The preliminary results shows that although there are many benefits that can be obtained in the forest, the most benefits that is mostly available to local communities is grazing, thatch grass, firewood and poles for fencing. Although the local communities do attend the annual general meetings to participate in decision making, the communities are of the view that the lack of resources at the Directorate of Forestry which has led to few forest monitoring and inventory activities have hindered the participation of local communities in the community forest resource management and monitoring. Key words: Community forests, Forest resources, Participation and Uukolonkadhi community forest.

ASSESSMENT OF URBAN FORESTRY IN HOMESTEADS IN OSHAKATI TOWN

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Abstract

Urban forestry is the art, science, and technology of managing trees, forests, and natural systems in and around cities, suburbs, and towns. Trees in urban areas are important sources of ecosystem services such as fruits, shade and beautification among others. However not much literature exists on urban forestry in Namibia, denying promotion of this sector of forestry essential information for planning. This paper presents results of a study conducted in Oshakati Town to generate baseline information on urban forestry in the town. The aims of the study were to assess urban forestry in Oshakati Town and the views of homeowners/ occupiers on the tree holdings in their homesteads. Data was collected from three estates, Oshakati East, Uupindi South and Ehenye of Oshakati Town deemed to represent the town well. Forty (40) homesteads in each estate chosen at random was assessed and their owners/occupiers interviewed by means of questionnaire. 60-85% of respondents have planted at least 1 tree in their homestead. Key tree species being grown are *Mangifera indica* and *Psidium guava* with, 90 and 98% frequency of occurrence respectively. 80% of respondents are irrigating their trees. The most cited hindrance to growing trees in homestead was lack of seedlings with 73% of respondents citing the problem. It is concluded that, residents of Oshakati Town have embraced urban forestry but there is limited understanding on tree management, therefore there is need to create more tree planting awareness and assistance in tree husbandry. Keywords: Oshakati Town, Namibia, urban forestry, Tree species and management.

THE EFFECTIVENESS OF REMOVAL OF PROBLEM-CAUSING ANIMALS AS A MITIGATION STRATEGY FOR ADDRESSING HUMAN-WILDLIFE CONFLICT IN KUNENE REGION: A CASE OF ELEPHANTS

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Abstract

Human-wildlife conflict refers to the conflict between wild animals and humans. This ranges from the destruction of crops and water installations to the loss of livestock, homes, and in some cases loss of human lives. Competing for land uses such as farming and cattle grazing becomes more important as the human population grows. There is a conservation reason for limiting lethal removal to those instances where it is necessary. Interactions between humans and wildlife are a defining experience of human life and these interactions might be beneficial or harmful. The Ministry recognizes that the removal of problem-causing animals either by lethal removal does not always solve the problem. There are times when animals persistently cause problems or when conflict becomes an intolerable burden on resident people. In the case of elephants, the study is specifically based on human-elephant being conducted in Kunene region, Okangundumba conservancy. This study was carried out to determine whether the removal of problem-causing elephants is effective enough to eradicate or reduce the conflict between humans and elephants. An interview was carried out through a questionnaire to collect information that can help us analyze this matter. Results show that elephants destroy water points compared to the invasion of gardens. The majority of people see no value in elephants being in their areas, they do not benefit from them. They believe that the government should sell the elephants to develop their areas or informal settlements. Keywords: Human-wildlife, problem-causing, conflict, removal, human-elephants

EVALUATION OF GROWTH RATE OF CITRUS LIMON L. SEEDLINGS GROWN IN PAPER WASTE GROWING MEDIA, OGONGO CAMPUS, NAMIBIA

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Abstract

Citrus limon (Rutaceae) is widely known for its flavouring and acidification characteristics and prefer warm climatic conditions and grow under a wide range of soil pH. Namibia is a country with low population but still facing pollution issues which can be reduced if paper waste can be turned into growing media. This study was conducted at Ogongo Campus of the University of Namibia in the nursery. The aim of the study was to establish if there is any potential for raising Citrus limon seedlings under different treatment ratio of a mixture of soil and paper waste namely: a) Vachelia erioloba soil b) paper waste only c) soil and paper waste (80:20) and d) soil and paper waste (50:50). A Complete Randomized design was used with four treatments replicated nine times for a period of 12 weeks. The results showed that seeds emergence was 100% in all treatments after 5 weeks. Furthermore, diameter did show any significant difference across treatments ($p < 0.05$). However, the height and number of leaves showed a significant difference across treatments ($p > 0.05$). The study concludes that paper waste can be used as an alternative growing media.

Key words: Citrus limon, paper waste, pollution, growing media.

FORAGING PATTERNS OF COLLARED KUDUS IN REGARDS TO REMOTE SENSED CANOPY WATER CONTENT IN ETOSHA HEIGHT PRIVATE GAME RESERVE, NAMIBIA

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Abstract

Understanding the driving forces behind Kudus distribution and movement is important for informing management approaches, since Kudus are of great economic importance in Namibia. This Study will make use of MSI (Moisture stress Index) to analysis how canopy water content effects the foraging

efficiency of Kudus in the wet and dry seasons of Etosha Heights Private Game Reserve. To obtain the results, the study used Four sentinel_2A images that were downloaded from Earth explore with an additional criteria of cloud cover less than 10%.The four images consisted of two images of the wet months of February (02/16/22021) and December (12/10/2020), while the other two images were of the dry months of July (07/23/20202) and September (09/21/2020).This images were analyzed for MSI values by dividing Band 11 with Band 8 in Qgis. The MSI data of sentinel images were analyzed in relation to the movement data of the Kudus that was collected from through the GPS collaring of Kudus by the ORYCE group from the month of July 2020. The results proved that Kudu movement was mostly detected in areas with a high canopy water content which indicates healthy vegetation. The MSI values of the month of July ranged from 0.55388 to 3.8771, while December 0.49143 to 2.94857 , February 0, 0.47729 to 2.86374 and September 0, 0.59804 to 3.58824. MSI has proved to be one of the most sensitive and suitable for canopy water content analysis compared to other several index.

ASSESSMENT OF PODS PRODUCTION IN VACHELLIA ERILOBA AND WHETHER IT IS ASSOCIATED WITH, TREE TRUNK DIAMETER AND CROWN SURFACE AREA IN AND AROUND OGONGO FARM

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Abstract

Vachellia erioloba is a valuable species to farmers. Its leaves and pods are eaten by livestock and are a valuable source of fodder in the dry season. Utilization of pods as fodder is increasingly gaining importance in northern-central Namibia where community members are collecting pods for own use and some for sale. This paper presents results of a study aimed at estimating the number of pods produced by a single Vachellia erioloba tree in a season and determine whether there is an association between the numbers of pods produced and tree trunk diameter and crown surface area as well as estimate the average weight of sun- dried and oven dried pods. 20 trees of each of the following size classes, Small (≤ 20 cm) Medium ($20\text{cm} < 30$ cm) and Big (≥ 30 cm) were randomly selected for the study. Measured parameters were, number of pods, trunk diameter, crown surface area and crown area. Ten pods were collected under each of four tree of each size class and were used to estimate sun and oven- dried weight. Kruskal Wallis Test showed that there was significant difference between mean number of pods produced by trees of different diameter size classes ($p=0.006$), There was a strong positive relation (Kendal's Tau coefficient= 0.79) between tree trunk diameter and crown surface area. Correlation between number of pods and tree dimensions was also positive but not very strong; (0.27) between the trunk diameter and number of pods and (0.21) between the crown surface area and the number of pods. Standard errors for mean number of pods per tree size class were high and may be partly attributed to the method used to estimate number of pods. It is recommended that future studies could explore different methods of estimating number of pods.

Keywords: Vachellia Erioloba, Pods Production, Correlation to Tree Size, North- Central Namibia

ASSESSMENT OF MICROPLASTICS ALONG TO COAST OF NAMIBIA

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Abstract

Assessing mesoplastic on coastlines has been and still is a challenge globally, therefore there are very few published articles on this of which none is published in Namibia. Beach mesoplastic littering is a global problem; therefore, it is important to understand, the sources of the mesoplastic and develops techniques to mitigate the problem. This can be very challenging because the mesoplastics do not reveal their sources and are difficult to identify, leading to more people studying macroplastics in previous studies. South Africa, Chile, and Kenya provide good baseline mesoplastic data from previous studies to understand how to conduct this study. With the knowledge of the proven studies, we have identified Namibia as having good coastlines to understand the distribution of the mesoplastics on the beaches because of the coastal towns, coastal roads, ports, and rivers that wash into the ocean. We sampled mesoplastics with an approximate size range of 2mm-25mm at Namibian

beaches. This study aimed to estimate the abundance of mesoplastics at different sites, the abundance of different categories, and the estimate of the weight(mass) at different sites plus the weight of different mesoplastic categories(types) on Namibian beaches. The data was collected by sieving the top 2mm sand in a ten-meter line transect across the face of the beach profile. The data were recorded from 10 beach sites and the mass, composition, and abundance. The statistical analysis was done with a Kruskal Wallis and it revealed a significant difference in the abundance between the sites with p ($0.001 < 0.05$). The same can be concluded for the abundance of different types of mesoplastics with the p -value of 0.008. Kruskal Wallis also revealed a significant difference in the mass between the sites with a p -value of 0.01 and the same can be concluded about the mass of different categories with a p of 0.006. Studies show the Benguela currents' effect on mesoplastics, despite a vast number of rivers that run into the sea bringing in inland mesoplastics. It is also suggested that most of the mesoplastics on beaches are produced locally which is indicated by higher proportions of mesoplastics at beaches close to urban areas than those far away. Overall, studying mesoplastics will help us to identify the sources of mesoplastics as litter and helps governing bodies make decisions and imposes implications on local litter control bodies.

SPATIAL AND TEMPORAL VARIATION IN RANGELAND CONDITION IN THE COMMUNAL AREAS OF THE GREATER WATERBERG LANDSCAPE, CENTRAL NAMIBIA

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Abstract

Namibia is one of the driest countries in sub-Saharan Africa, but despite its aridity, 70 % of the population depends on agriculture for subsistence of which 46% is pastoralism. However, changing climatic conditions and human population growth continue to increase the degradation of rangelands, especially in the communal lands. Understanding the rangeland conditions is essential for improving management strategies to combat the loss of productive rangelands. Unfortunately, there are no attempts to intentionally reduce livestock numbers, and very little information about the current condition of communal rangelands. The communal areas of the Greater Waterberg Landscape (central Namibia) were used as a case study to assess possible variation in rangeland condition using herbaceous plant dynamics as the main indicators. The comparisons were done at two levels; temporally, between the growing and dry season, and spatially by comparing two areas (one with cattle present and another without cattle) within each season. Three 100 m transects were sampled at each site. The transects were placed 200 m apart, and five 1m x 1 m quadrants were sampled every 20 m along the transects. As expected, preliminary results indicate that the condition of the range deteriorates from the wet to the dry season as the land becomes drier with less herbaceous vegetation for livestock. Additionally, the area where cattle were present had higher cover and height of herbaceous plants, suggesting that the range condition varies across the study area and that cattle seem to select for better foraging areas.

Keywords: Rangeland Condition, Communal Areas, Seasonal Variation, Greater Waterberg Landscape, Spatial Variation

INVESTIGATING DIETARY AND CONSUMPTION PATTERNS OF RECENT MIGRANTS AND ITS IMPLICATIONS ON HOUSEHOLD FOOD SECURITY. A CASE STUDY OF KUISEBMUND, WALVIS BAY

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Abstract

The study examined health trends across diverse migrant families in relation to the foods they were consuming and whether a change in diet had a significant effect on migrants' health after moving to urban areas. Restrictive dietary choices cause physical and mental stress, poor health outcomes, and ongoing issues with food security for disadvantaged urban people in developing countries. Urbanization and migration from rural to urban areas have an impact on risk factors, especially for noncommunicable diseases (NCD), and this must be considered when developing globally effective

preventative interventions. This research intends to investigate the dietary patterns of migrant households before and after migration in Kuisebmond, Walvis. In Kuisebmond, 20 households were interviewed using a semi-structured interview guide. One major finding was that, some migrants still had challenges, whether they were employed or not, while very few people's lifestyles improved. Another important reason was the growing prevalence of noncommunicable illnesses in these populations. Food security has had a modest influence in Namibia, despite its inclusion in different planning projects, policies, and decision-making. Many of the participating households have shifted their diets away from organic foods and toward adding huge amounts of processed foods into their daily meals. Many individuals also acquired NCDs that can be linked to regular consumption of processed food. The reason is that many of the participants who faced these various issues had no form of high school education and the lack of this can be constituted to the food insecurity and health issues in the country.

DEPARTMENT OF GEOSCIENCES

APPLICATION OF GEOPHYSICAL METHODS IN THE ASSESSMENT OF THE LATENT SEDIMENTARY RECORDS IN NAMIBIA'S ENDORHEIC ROTER KAMM CRATER BASIN

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Abstract

Namibia's paleoclimate history is unknown because of its low precipitation, especially before the present warm period. This is despite the fact that sediments from large endorheic drainage basins like the Roter Kamm Crater located in the southern part of the Namib desert in Namibia have the potential to offer long-term sedimentary records of tectonic and hydro-climatological information needed for paleoclimate and geodynamic studies. This study aimed at applying geophysical methods to estimate the sedimentary thickness of the endorheic Roter Kamm Crater. Two geophysical approaches were employed in the investigation namely the Transient electromagnetic technique (TEM), and the refraction seismic. The TEM method was set up with transmitter loop arrays and the fixed loop each had a transmitter of 200m by 200m and 40m by 40m respectively, both inside and outside the crater's visible perimeter. Seismic refraction was used as a complementary method to correlate the TEM results. In summary, the results of the study suggest that the Roter Kamm Crater has a bowl-shaped structure and is composed of five separate horizontal strata, which are inferred to be 350m in depth. In conclusion, the geophysical methods managed to be a success by providing an estimate of the sediment thickness of the Roter Kamm Crater. It is recommended that deep drilling be employed for in-depth analysis of the sediments to determine the carbon content for dating.

Keywords: Transient Electromagnetic; Refraction Seismic; Roter Kamm Crater; Paleoclimate, Endorheic

THE DEPTH OF FORMATION AND VOLATILE CONTENT OF THE DEFORMED GARNET LHERZOLITES IN COMPARISON WITH THE UNDEFORMED GARNET LHERZOLITES, KIMBERLEY MINE, SOUTH AFRICA

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Abstract

The investigated garnet lherzolites have been collected at the Kimberly diamond mine, South Africa. These lherzolites occur together with dunites and harzburgites and has been brought up by a type II kimberlite (orangeneite). In general, the investigated garnet lherzolites can be subdivided into non-deformed and deformed variety. The deformed garnet lherzolites are sandwiched between the crust and the granular lherzolites. In some localities they are intercalated by eclogites, suggesting the

involvement of oceanic crust along the Colesberg filament in South Africa. The deformed garnet lherzolites can be subdivided into Mg-rich low-T, Mg-rich high-T and a Fe-Ti high-T variety depending on the degree of mantle metamorphism/metasomatism in the studied area caused by a compressional orogenic event. We used Electron Micro Probe Analyser (EPMA) to determine the mineral chemistry and XRF for bulk rock chemistry. Mineral chemical analyses have been used for mineral classification followed by geothermobarometry and the bulk rock chemistry has been used for the construction of a phase diagram. Synchrotron based FTIR analyses show a very restricted fluid activity during the formation of the sheared garnet lherzolites as well as the infiltration of melt seen in melt inclusions.

Keywords: Garnet –lherzolites, Kimberley Mine, Geothermobarometry, Melt inclusions

STUDY OF THE PETROGRAPHY AND PETROLOGY OF SPINEL LHERZOLITE FROM KORO, FIJI ISLAND

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Abstract

The active Fiji –Tonga –Kermadec arc extends for ~2500 km from New Zealand to Tonga as a result of the westward subduction of the Pacific beneath the Australian plate, however, much of the Fiji island region remains inaccessible thus leading to many outstanding questions that need answers with regard to the volcanic rocks and the depth at which they are formed and occur, emplacement of spinel lherzolite as a residuum of basaltic/andesitic melt brought up by a mantle plume as a result of a beginning cold avalanche and mantle turn over (Sommer et al., 2021). In this study, I investigated very unique spinel lherzolites from Koro island. (i) the investigated samples contain spinel and Cpx bearing "symplectites", which are indicative for low aH₂O during mantle metamorphism/metasomatism. (ii) after recalculation of the "symplectites", a garnet was identified. This observation gave new evidence, that the studied lherzolites as well as the associated basalts/andesites has been formed deeper in the Earth upper mantle as previously thought. (iii) very narrow exsolution lamellae of spinel in Opx and Cpx indicate a fast uplift of the lherzolite bearing basaltic/andesitic melt. To quantify our observation, we used EPMA (electron microprobe analyser) for major oxide elements analysis and XRF for whole rock chemistry. The oxide elements have been used for mineral classification and afterwards for multi equilibrium thermobarometry (MET) and additionally a P-T pseudosection has been calculated in the NCMFAS system. In summary, our results throw new light on the formation of these spinel lherzolites, which are formed originally within the garnet lherzolite stability field, followed by a fast uplift from the Earth mantle to the Earth surface.

CHARACTERIZATION OF THE RESERVOIR POTENTIAL OF THE H-T FIELD, OFFSHORE WALVIS BASIN, NAMIBIA

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Abstract

Well log analysis and interpretation are useful in distinguishing the reservoir petrophysical parameters like porosity, water saturation and locating hydrocarbons zones. This approach has been successfully used in exploration and well development, to offer information and greater accuracy of reserve evaluation. In addition, it can be used to identify the depth and thickness of productive zones, to differentiate between oil, gas, and water in reservoir and to estimate hydrocarbon reserves. Chongwain et al, (2018) employed the well logs data to delineate reservoir depositional features and environment, and evaluate reservoir properties in four wells, M-Field, offshore Douala Sub-basin, Cameroon. The Walvis Basin is located in the West African sub-Saharan part of the Atlantic margin, and in the eastern of the Walvis Ridge offshore Namibia. Good quality 2D and 3D seismic have been shot covering the entire offshore Namibian margin from shallow coastal waters to the abyssal plains. The Basin is underexplored with only eight exploration wells drilled in the basin to date. Drilling have successfully proven all elements of a working petroleum system but the right combination to produce a large discovery and unlock a new petroleum province remains elusive. In addition, light oil 380 to 420 API was discovered in several thin sandy lenses within the Aptial interval (Intawong et al., 2017),

but no commercial discovery of hydrocarbons has been made to date. According to Domingos (2018) some of the reasons the wells failed discovering economic quantities of recoverable hydrocarbons include lack of one or two petroleum system elements and or process; with the absence of reservoir or charge being the common reasons of failure. Previous studies on the potential reservoir intervals in the Walvis Basin include the unpublished Master and PhD thesis (Domingos, 2018; Kukulus, 2004). Domingos (2018) focused on reservoir unit prognoses from seismic profile and comparing them to those of volcanics. Kukulus (2004) examined the potential reservoir intervals developed in the central and northern Walvis Basin and discussed a schematic play concept to aid further exploration activities. Although there is an in-house study by oil and gas company on the petrophysical evaluation of a block in the Walvis Basin, there is still a gap in the published literature on reservoir characterization of the Walvis Basin. The depositional environment of the Walvis Basin is not clearly understood, and the reservoir characteristics have not been clearly defined.

INVESTIGATION OF SEAWATER INTRUSION INTO THE LOWER KUISEB AQUIFER

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Abstract

Coastal aquifers are extremely prone to salinization due to seawater intrusion. This is a rising issue for the availability of clean drinking water in coastal communities around the world. Residents and industries of Walvis Bay, a portion of Swakopmund, and Rossing Mine predominantly depends on groundwater from the Lower Kuiseb River. Namibia's aridity together with the growing population in the coastal area, increases the demand for freshwater which might exert pressure on the aquifers and cause seawater intrusion. 31 groundwater samples were taken from NamWater and Gobabeb Research Centre production and monitoring boreholes. The samples were analyzed for stable isotopes and major ions. The results shows pH between 7.54 and 7.98 and all within the range of WHO drinking guidelines. Salinity shows that most of the groundwater is freshwater, with total dissolved solids (TDS) ranging from 560 mg/L to 5660 mg/L, of which 5 boreholes have values above the WHO-recommended guideline threshold. The high TDS values observed in some boreholes can imply either seawater intrusion or dissolution of evaporites. The $\delta^2\text{H}$ and $\delta^{18}\text{O}$ isotopes show depleted values and they plot along the GMWL, indicating potential recharging from rainfall. Results indicate groundwater in this area is mostly fresh. The findings of this research will contribute to improving the understanding of seawater intrusion occurrence in the Kuiseb aquifer and aids in providing quality water to the community.

Keywords: Seawater intrusion, stable isotopes, Kuiseb aquifer, Salinity, recharge

THE HYDROLOGICAL CHARACTERIZATION OF THE OMADHIYA LAKES IN THE CUVELAI ETOSHA BASIN, NORTHERN NAMIBIA

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Abstract

Wetlands have been determined as one of the most valuable ecosystems on Earth. They are highly productive and biologically diverse ecosystems that contribute significantly to livelihood and economic development however, they are currently being lost at alarming rates. Restoring and maintaining these lost wetlands can accrue large costs which most developing countries like Namibia cannot afford. In this study, the Omadhiya lakes wetlands, located northwest of the Etosha Pan, were characterised using hydrogeochemistry and earth observation data. This includes mapping and classifying the lake, determining the spatio-temporal variations and evaluating the interaction of the surface water of the lake and the groundwater. A total of 11 surface water samples were collected along the lake at random. These samples were analysed for major ions and stable isotopes. Field observation data yielded temperatures ranging from 19.8°C to 26.6°C, pH values ranging from 7.09-9.5 of which falls in the range of the Namibian guidelines and the electrical conductivity ranging from

2.26 μ s/cm to 1968 μ s/cm which is well above the national and WHO standards. The hydrochemistry results revealed the chloride type to be dominating anion whereas the dominant cations were revealed to be sodium and potassium. 55% of the hydrochemical samples of Cl⁻ and Na⁺ are above the permissible WHO limits whereas all the concentrations of the K⁺ samples are within WHO permissible limits. The water quality according to Namibia guidelines is of high risk and is not suitable for human consumption. The isotopic composition was found to range from -2.54‰ to 3.83‰ and -27.5‰ to 11.1‰ for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ respectively. All samples were compiled in $\delta^2\text{H}$ vs $\delta^{18}\text{O}$ graph and plotted below the Global Meteoric Water Line (GMWL) signifying evaporation. The results attained in this study will aid in supporting effective planning, use and conservation of wetland ecosystems.

AN INTEGRATION OF GEOPHYSICAL METHODS AND STRUCTURAL MAPPING TO INVESTIGATE THE OCCURRENCE OF GROSS BARMEN GEOTHERMAL SYSTEM

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Abstract

The Gross Barmen hot spring, occurring at a single locality along the Okahandja linearment, central Namibia is often associated to be on one of the Pan-African tectono-thermal belts that surround and dissect Africa and dominated by the Damara Orogenic belt. Despite a relatively good geothermal energy potential as indicated by the temperatures which are over 60 °C, there is still a poor understanding on how the occurrence of the Gross Barmen geothermal system is manifesting on one site throughout the whole lineament. This study applied structural geological mapping and geophysical methods in the investigation of the occurrence of the geothermal system around the Gross Barmen area. The purpose of the study was to develop an essential baseline for future studies in the area. Magnetic and natural electromagnetic geophysical surveys were combined with structural mapping to delineate the geothermal system. The quantitative interpretation of total magnetic data was carried out by using digital filtering techniques that included the first vertical derivative, analytical signal and magnetic tilt derivative of the total field map using an appropriate software. In addition, the resistivity data was analysed using an inbuilt software supplied with the equipment. The geological map development was done with the aid of an appropriate Geographical Information System software. The results showed that the magnetic anomalies of the lithology's around the geothermal hot spring coincide with the ENE-WSW, trending contact and alteration fault zones hosted within the Kuiseb schist formation and in the contact zone of amphibolite and pegmatite lineament exposed within the field of study. Based on the regional and local geology, data acquired from the geological mapping, resistivity and ground magnetics, the geothermal system is likely to be found within the highly jointed and fractured banded biotite schists (Kuiseb Formation) and contact of amphibolite and pegmatite terrain, thus coinciding with the different magnetic susceptibility signatures together with the chargeability anomalies in the study area. In conclusion, the integration of geophysical methods and structural mapping managed to infer the structural and geological features controlling the occurrence of the Gross Barmen geothermal system. It is recommended that further studies be done on the origin of the hot spring through a geochemical study on the geo-thermal water.

AN ASSESSMENT OF HYDROLOGICAL PANS USING EARTH OBSERVATION DATA AND HYDRO GEOCHEMISTRY IN THE OKONGO AREA, NORTHERN NAMIBIA.

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Abstract

Some local communities around Okongo area still make use of hand-dug wells for both domestic and livestock watering. This study was conducted to assess the state of hydrological pans using earth

observation data, hydro geochemistry and stable isotopes (^2H and ^{18}O) in the area. Most of the hand-dug wells are extremely vulnerable to contamination as they are typically unprotected and uncovered. A total of 11 villages were sampled for water from 9 hand-dug wells, 3 boreholes and 3 open surface water bodies as well as for soil. Soil samples were collected for determining the soil moisture content, soil density and soil type. During sampling, a Multi 3630 ID SET G was used to obtain the water onsite parameters; temperature, pH, electrical conductivity, and dissolved oxygen. A double-ring infiltrometer was used to determine the rate of infiltration of water while remote sensing data will be used for mapping the hydrological pans. Results show pH values between 7.5 and 8.8, the electrical conductivity ranged from 28.0 mS/m to 94.0 mS/m, and the turbidity ranged from 0.25 NTU to 9.2 NTU. The isotopic composition ranged from -10.30% to 8.87% and -66.8% and 21.6% for $\delta^{18}\text{O}$ and $\delta^2\text{H}$ respectively. The isotopic results plot below the Global Meteoric Water Line (GMWL) revealing an enrichment of heavier isotopes suggesting that the local catchment systems are the source of groundwater recharge to the perched aquifer. The hand-dug wells plot on a regression line with a slope of 4.5 signifying evaporation as a dominant process. Major ions and onsite parameters indicate that the water being consumed in these villages meets the drinking water standards. Results obtained from the study will aid in the continual maintenance and monitoring of water quality and stable isotopes in groundwater.

A SEDIMENTOLOGY AND SEQUENCE STRATIGRAPHY STUDY OF THE NAMA GROUP: REFINING FACIES AND CHRONOSTRATIGRAPHIC BOUNDARIES THROUGHOUT THE EDIACARAN-CAMBRIAN TRANSITION

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Abstract

The Nama Group in southern Namibia represents one of most important geological records in Earth History – the Ediacaran-Cambrian Transition (ECT; 550 to 539 Ma). It was a time that comprises Earth's first major biotic crisis of macroscopic eukaryotic life (the disappearance of the enigmatic 'Ediacaran biota') and immediately precedes the Cambrian explosion of complex life. Therefore, the Nama Group is an exciting target for paleontological and paleoenvironmental research. Yet, these rocks have a remarkable record of stratigraphic misunderstandings. The correlation of the erosional surface from basin to basin and differentiation of the role of eustasy and local tectonics as controlling factors on associated relative sea-level fall is challenging. This work aims to solve the stratigraphic sequence problems in refining the chronostratigraphic boundaries using six drill cores obtained by the international Geological Research through Integrated Neoproterozoic Drilling (GRIND) project that target Kuibis and Schwarzrand Subgroups. Using detailed facies analyses and abundant volcanic ash beds, this work aims to correlate these cores with the surrounding outcrop, as well within and between the Witputs Subbasin and Neint Nababeep Plateau, South Africa. Measurements were done at BGR and further analyses were conducted at the University of St Andrews, Scotland.

Keywords: Nama Group, Ediacaran-Cambrian Transition, sedimentology, sequence stratigraphy

GEOTECHNICAL AND CHEMICAL EVALUATION OF SOILS AND BURNT BRICKS IN UIS

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Abstract

Burned bricks are commonly used in the construction of civil engineering structures. This is mostly due to their geotechnical qualities as they have high compressive strength and can withstand a wide range of harsh weather conditions. Burnt bricks are currently being produced at industrial scale from tailings from Uis Tin mine for construction use. This study focused on evaluating the geotechnical properties and mineralogy of the waste rock produced from the low grade opencast tin-columbium-tantalum mine hosted within pegmatite swarms that serves as the primary raw material of the bricks, as well as the compressive strength of the finished products. The aim was to determine the optimum

conditions under which mine wastes can be converted into raw materials for industry-scale production of bricks in a circular economy. Classification and strength tests were carried out according to BS standards while the major oxides were determined using XRF (X-ray fluorescence). Preliminary results indicate that clay sized tailing is of intermediate plasticity (CM), with good prospects for workability. Al and SiO₂ make up approximately 60 % and 1 % of the minerals present as oxides. The presence of quartz and feldspars indicates good pozzolanic effects for cementation. Loss on ignition was generally below 5 % . The alkali (Na₂O + K₂O) content of approximately 6 % is indicative of the presence of glass forming catalysts. Strength indicators showed low water absorption and low linear shrinkage. Preliminary results of the tests suggest that the tailings have very good potentials for the manufacture of bricks and if properly harnessed. Results will be applicable locally and internationally for the conversion of mine wastes to wealth tailings for sustainability

PETROGRAPHIC CHARACTERIZATION AND DIAGENESIS OF CARBONATE ROCKS IN THE NAMA BASIN OF SOUTHERN NAMIBIA: IMPLICATION AS VALUABLE RESOURCES

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Abstract

Sedimentological, petrographical and geochemical studies were carried out on the several extensive carbonate outcrops of the Nama Sub-basins in order to systematically map out the carbonate rocks and determine their lithological facies characteristics. The study aimed to determine the mineralogy and major constituents of the carbonate rocks, classify them according to the Dunham (1962) carbonate classification system. This was in attempt to infer their depositional environments and assess their economic viability. Outcrops and samples were carefully observed and described in the field and samples were collected for lab analyses. Field studies revealed dominant limestone and dolostone facies with limestone facies divided into dark-grey limestone and light-grey limestone. The limestones are predominantly composed of calcite and quartz veins, while the dolostones composition is dominantly dolomite. Colour alternations observed in the limestone samples indicate changes in microbial activity during the deposition of the limestone.

Keywords: Nama Sub-basins, carbonate rocks, lithological facies, economic viability

RARE-EARTH ELEMENT (REE) COMPOSITION OF MINERAL PHASES WITHIN THE EPEMBE CARBONATITE DYKE, NORTH-WEST NAMIBIA

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Abstract

Rare-earth elements (REEs) are of economic importance due to their application in the manufacturing of electric vehicles, permanent magnets and solar panels. China has been the largest supplier of REE in the last decade, however, due to its stockpiling policy, there has been an increase in REE exploration in other parts of the world, including Namibia. Carbonatites are the major producers of REEs worldwide, however, the enrichment mechanisms (magmatic or hydrothermal) and the REE host minerals are poorly understood. This study used remote sensing (QGIS and ArcMap) and Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) analysis to identify the mineral phases containing the highest concentration of REEs at the Epembe carbonatite, in north-western Namibia. The regional geology of the area comprises gneisses and metasedimentary rocks of the Epupa Metamorphic Complex (EMC) as well as the Kunene Anorthosite Complex (KAC). The carbonatite (calcite-carbonatite) dyke intrudes the EMC and extends for about 8 km with width of about 250 m. The dyke is fine to very coarse-grained and the dominant minerals include apatite, biotite, feldspar, calcite and pyrochlore in varying amounts. The results show that fluorapatite, pyrochlore and monazite contained the highest concentration of light rare-earth elements (LREE) and low heavy rare-earth elements (HREE) followed by calcite, pyroxene, biotite and feldspar. However, zircon displayed

a unique graph with a high concentration in HREE compared to the LREE. Comparing the Y/Ho ratios of the minerals support a magmatic origin influenced by factors such as ionic radii and melt composition.

Keywords: Epembe carbonatite; rare-earth elements; apatite; monazite

GEOCHEMICAL CHARACTERISTICS OF THE HAREMUB (KOTZERUS) GRANITE IN THE KONKIEP TERRANE, NAMIBIA – IMPLICATION FOR MINERALIZATION AND TECTONIC SETTING

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Abstract

Volcano - sedimentary rocks of the Sinclair Super Group and associated intrusive rocks occur in the Konkiep Terrane, along the western margin of the Kalahari Craton. The volcano-sedimentary rocks of the Konkiep Group are thought to have evolved in three magmatic cycles associated with various intrusive rocks. The tectonic setting of the Konkiep Group is still contested with several tectonic models proposes, such as rift or the overriding plate of a subduction, but the long duration of its stratigraphic accumulation suggests a diverse range of tectonic settings. This study investigates the geochemical and petrological characteristics of the Haremub granite in order to constrain the tectonic environments. Past geochronological data will be used to determine the timing of geological events. Field observations and literature review indicate that the Haremub granite is heterogeneous with respect to color, gross texture, modal chemical composition, and contains mafic xenolith. The dominant minerals are quartz, biotite, k-feldspar and plagioclase.

Keywords: Sinclair Supergroup, Haremub Granite, Tectonic Setting

INVESTIGATING SEDIMENTARY RECORDS POTENTIAL IN THE ENDORHEIC AURUS CLAY PAN FOR PALEOCLIMATIC EVIDENCE, SOUTHERN NAMIBIA

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Abstract

The regional climatic history of Namibia is unknown to a certain degree, particularly before the present warm era. Because of the restricted quantity of precipitation, adequate longer-range paleoclimate archives, such as lake sediment or speleothem records, are few. This research is aimed to assess the potential for hosting sedimentary records and study the subsurface sedimentary architecture of the endorheic Aurus Clay Pan situated in the Namib Desert, Southern Namibia. Given that the basin is endorheic in nature, it is ideal for paleoclimate research as it has the potential to host records of past geologic time, particularly of the Pliocene to Quaternary times. The study applied seismic method and electromagnetic geophysical methods, to estimate the subsurface sedimentary thickness and basin architecture. In addition the approximate age of the sediments was determined by radiocarbon dating of samples collected from the Clay Pan. The combined geophysical data was analysed and suggested an estimated sedimentary thickness ranging from 9-20 meters. In particular the seismic results showed the presence of three different sediment layers of varying depths in the Aurus Clay Pan. The layers from top to bottom are sand, clay, and granite as the bedrock. The Transient-Electromagnetic data indicate a thick highly conductive layer above the bedrock. The radiocarbon determination provided a calibrated date of 1534-1399 years calibrated date for one of the collected samples. In conclusion, the study demonstrated that the seismic and transient electromagnetic geophysical methods maybe used as sufficient tools in assessing the subsurface sedimentary architecture of the Aurus Clay Pan.

Keywords: Paleoclimate, Endorheic, Seismic Method, Electromagnetic geophysical method, radiocarbon dating

A STUDY OF THE PETROLOGY OF GARNET, SILLIMANITE, CORDIERITE METAPELITES FROM THE GOIBIB AREA, SOUTHERN NAMIBIA

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Abstract

The investigated samples have been collected within the Goibib area, southern Namibia. The Namaqua Natal Belt forms an orogenic belt along the southern and western margin of the Kaapvaal Craton. The investigated area is mainly composed of high-grade metamorphic rocks such as sillimanite, cordierite and garnet bearing metapelites, gneisses and greenschist facies schists. In this study we concentrated on the granulite facies metapelites and the related migmatization during high-grade metamorphism. Metapelites are Al-rich sediments, deposited at the ocean floor. These H₂O-rich (X_{H₂O} = 0.7) saturated sediments become dehydrated during metamorphism and migmatization as well as the removal of a felsic melt occur before granulite facies conditions taking place about 1.1 Ma ago. We used the Electron Micro Probe Analyser (EMPA) was used to determine the mineral chemistry and all the endmembers of every solution. Our results show, that migmatization of these water saturated sediments took place at ~650°C. High-grade granulite-facies metamorphism took place at a temperature of ~820°C ± 30 and pressures of up to ~5 kbar for the investigated cordierite bearing metapelites.

Keywords: orogenic belt, migmatization, granulite facies

GEOCHEMICAL CHARACTERISTICS OF MESOPROTEROZOIC KOTZERUS AND TUMUAB GRANITES IN THE KONKIEP TERRANE, NAMIBIA – IMPLICATION FOR MINERALIZATION AND TECTONIC SETTING

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Abstract

The Mesoproterozoic Sinclair Sequence in southern Namibia comprises of three volcano-sedimentary cycles with related high-level intrusions. The ca. 1353 Ma Kotzerus farm granite and 1107 Ma Tumuab mountains granites form part of the Kunjas formation belonging to the 1st cycle and 2nd cycle respectively. In this study, the geochemical characteristics of the Kotzerus and Tumuab granites is described and used to assess the tectonic setting for the Konkiep Terrane as well as the mineralization potential. They are largely undeformed and will provide comprehensive geochemistry of the conditions of formation. This will be achieved through the use of tectonic discrimination diagrams, and analysis of Rare Earth Elements patterns. Preliminary petrographic investigations indicates that the Kotzerus granite is hybridised and composed of felsic tuff with glomerophytic clusters of long thin crystals of plagioclase in an aphanitic groundmass. The Tumuab granites are pink coloured felsic with pan-hypidiomorphic holocrystalline grains. This speaks to the conditions of formation and or the sources of the magma being different, which correlates to the differences in their ages.

AN OVERVIEW OF THE RESERVOIR POTENTIAL AND DEPOSITIONAL ENVIRONMENT OF THE OWAMBO FORMATION, MULDEN GROUP, OWAMBO BASIN NAMIBIA

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Abstract

Reservoir characterization is the study of reservoir properties using geological, geophysical, petrophysical and engineering analysis, including uncertainty analysis of geologic and engineering data and spatial variations. The Environment of deposition depicts an environment that has been preserved in the rock record at some time in its past, and it is vital in the reconstruction of earth history, understanding earth processes and identifying possible exploration targets. Five exploration wells (Strat Test-1, Etosha 1-1, Etosha 2-1, Etosha 5-1A and OPO-1) have been drilled, three 2D seismic

acquisition campaigns and numerous aero gravi-magnetic surveys have been conducted in the basin. A series of potential reservoir rocks have been identified including sandstones from the Nosib Group, carbonates from the Otavi Group and carbonates (limestones and dolomites) from the Owambo Formation within the Mulden Group. Soil gas surveys have shown the presence of anomalous levels of methane, ethane, propane and butane. Analysis from 2D Seismic data have revealed ramp anticlines, stratigraphic traps and antiformal traps. Porosity in Otavi Carbonates are widely distributed ranging from 15 to over 37% while the Mulden upper Owambo Formation is characterized by unevenly distributed porosities of about 20%. The Basin is a deep, long-lived sedimentary basin containing thick Neoproterozoic sedimentary rocks, Karoo sedimentary rocks and basalts and thick Kalahari sediments. The Mulden group is interpreted as a foreland basin deposit and consists of conglomerates, quartz sandstones, arkoses and shales. It is recommended that further petrophysical studies be carried out in this basin using more sophisticated methods to properly delineate the various lithologies, facies, porosities, permeabilities so as to be able to propose an appropriate depositional model for the basin.

Keywords: reservoir, environment of deposition, basin, Owambo Formation, Mulden Group

MINERAL PETROGRAPHIC CHARACTERIZATION OF OTJIKOTO AND WOLFSHAG GOLD OREBODIES IN THE CENTRAL ZONE, DAMARA BELT

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Abstract

Known gold mineralization occurs within the Central and the Northern Zones of the Damara Orogen. The Damara Orogeny is a northwest-trending orogenic belt that formed through sequences of spreading, rifting, subduction and continental collision between the Congo, Kalahari and Río de la Plata Cratons between 900 Ma and 450 Ma. B2 Gold Namibia is mining Otjikoto and Wolfshag deposits located in the Central Zone of the in the Damara Belt. Despite this, a few studies have been carried out on the petrographic characterization of gold mineralization. Mine ore and ore petrographic observation were employed in this study, petrographic data coupled with assay data geostatistics. Samples were taken from both the Otjikoto and Wolfshag deposits. Gold analyses give gold values ranging from 1.5 g/t to 8.0 g/t, with the Wolfshag showing higher gold mineralization compared to Otjikoto deposit. The Otjikoto ore body is hosted in the Okonguari Formation. Gold mineralization is associated with sheeted veins hosted in the metamorphosed turbidite units, namely hornfels and albitite. Gold mineralization at Otjikoto is associated with with pyrrhotite, pyrite, chalcopyrite and magnetite. Sulfides veins exhibit a massive texture with pyrite and magnetite cross-cutting the foliation and quartz penetrating the groundmass. On the other hand, gold at the Wolfshag is associated with pyrite, calcite and magnetite with high grade gold associated occurring in brittle veins. Gold can also be associated with pyrite, calcite and magnetite in "shear replacement" veins. The deposit shows that it has been subjected to an array of deformation with catalysis deformation being the last.

TECTONIC SETTING AND GEOCHRONOLOGY OF THE ABENAB SUBGROUP, OTAVI MOUNTAINLAND, NAMIBIA

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Abstract

The Kaoko belt along the western margin of the Angola/Congo Craton records collision with Rio de la Plata Craton during the amalgamation of Gondwana. Previous authors have suggested that the Coastal terrane formed as an arc/back arc on the Congo margin by 650 Ma and collided ca. 590-570 Ma in an upper plate position with the arrival of Rio de la Plata. Others proposed that the south and west Congo margins were passive from Cryogenian through Ediacaran and that the Coastal terrane did not arrive until ca. 590 Ma. To solve this, U-Pb zircon age data were obtained from

autochthonous late Cryogenian strata on the distal western Congo margin in Steilrandberg Mountain and northern Kaoko belt to determine the provenance of western Congo margin sediments. Carbonate samples were also collected within the measured sections of our studies to establish an age model through carbon and oxygen isotope correlation. Our data show clear sources from Angola with distinct ca. 2.7 Ga Archean, and Mesoproterozoic ages ranging from ca. 1.2-1.6 Ga sourced from Kunene complex. The data has also identified 670-960 Ma ages which could be from the West Congo Supergroup consisting of West Congolian, Mayumbian and Zadinian Group. Absence of a distinct ca. 1.1 Ga peak in late Cryogenian successions, which is prominent in the allochthonous sections in the Kaoko belt and Ugab zone discredits models of proximal exotic source on the Congo margin, but minor Cryogenian ages suggest reactivation and magmatism somewhere on the Congo margin, possibly to the north.

Keywords: Kaoko belt, Coastal terrane, Neoproterozoic, Cryogenian, Angola/Congo Craton

GEOCHRONOLOGY AND TECTONIC SETTING OF FRANSFONTEIN, OTAVI MOUNTAINLAND, NAMIBIA

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Abstract

Dropstone-bearing glaciomarine sedimentary rocks of the Ghaub Formation within metamorphosed Neoproterozoic basinal strata (Swakop Group) in central Namibia contain interbedded mafic lava flows and thin felsic ash beds. The end-Cryogenian glaciation (Marinoan) was Earth's last global glaciation yet its duration and character remain uncertain. U-Pb zircon geochronology of an ash layer (AT21 FRAN 24, resampling of Prave et al (2016) ash) constrains the deposition of the glaciomarine sediments to $634.24 \pm 1.33/2.39$ Ma, providing an age for what has been described as a Marinoan-type glaciation, (Marinoan-equivalent Ghaub Formation in Namibia). These finding, for the first time, verify the key prediction of the Snowball Earth hypothesis for the Marinoan glaciation. They also show that glaciogenic sedimentation, erosion, and at least intermittent open-water conditions occurred 4 million years prior to termination of the Marinoan glaciation and that the interval of non-glacial conditions between the two Cryogenian glaciations was 20 Million years or less. U-Pb zircon geochronology of some ash layers also gave some glaciomarine sediments around 1000 Ma-2000 Ma, this tell us that some detrital zircons were part of the Congo craton (as interpreted with highest peaks on the KDE diagrams) that were eroded after the collision between the two cratons namely Kalahari craton and Congo Craton. However, a lot of the detrital zircon are coming from nearest streams, rivers and pans.

Keywords: Neoproterozoic, Glaciation, Zircon, Geochronology, Marinoan

DEPARTMENT OF PHYSICS, CHEMISTRY & MATERIAL SCIENCE

THE ANTIBACTERIAL ACTIVITY OF ENDOGENOUS METABOLITES EXTRACTED FROM GANODERMA LUCIDUM

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Abstract

Ganoderma lucidum, a medicinal mushroom, has several pharmacological activities such as anti-microbial, anti-oxidative, and anti-cancer effects. In this study, the antibacterial activity of cultivated versus wild G. lucidum was compared. The samples underwent phytochemical screening for alkaloids, steroids, phenols, flavonoids, saponins, and terpenoids, as well as quantification of the saponins and terpenoids content. Saponins content was highest in cultivated Ganoderma (57.3%) while terpenoids content was slightly higher in the wild Ganoderma (0.88%). Subsequently, the crude extracts were

subjected to antibacterial testing against Gram negative (*Escherichia coli*, *Klebsiella pneumoniae*) and Gram positive (*Staphylococcus aureus*, *Streptococcus* group D) bacteria using disc diffusion and broth micro-dilution methods. The crude chloroform extract from wild *Ganoderma* showed excellent activity against all the test bacteria, with the highest activity recorded at 2.5 mg/mL against *E. coli* (13 mm), and the lowest against *S. aureus* (2 mm) at 5 mg/mL. Interestingly, all the wild *Ganoderma* extracts exhibited the lowest minimum inhibitory concentration (MIC) of 0.63 mg/mL recorded against *Streptococcus*, while the highest observed MIC was 10 mg/mL (cultivated petroleum ether against *K. pneumoniae*). Overall, the comparative results showed that the wild *Ganoderma* extracts exhibited better antibacterial activity.

Keywords: *Ganoderma lucidum*, cultivated, wild, antibacterial activity

ESIPT-INFLUENCED C3-SYMMETRY, DISK-SHAPED FLUORESCENCE TURN-ON PROBE FOR ZN²⁺ BASED ON MELAMINE-NAPHTHYL MOIETY WITH HIGH AFFINITY TOWARDS CU²⁺ IN CH₃CN

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Abstract

A C₃-symmetry turn-on probe for Zn²⁺ based on the melamine-naphthyl moiety (H) was synthesized via a simple one-step Schiff base reaction mechanism. The photophysical properties were investigated using spectroscopic methods of UV-Vis and fluorescence. The chemosensing properties of H were investigated via colorimetric methods, using heavy metal cations as well as biological anions, in aqueous soluble acetonitrile (CH₃CN). Subsequently, the probe demonstrated that it could discriminate few cations (Zn²⁺, Co²⁺, Ni²⁺ and Cu²⁺) and anions (CN⁻, F⁻, AcO⁻ and OH⁻) via colorimetric methods, observable by naked eye. The colorimetric method was further complemented by spectroscopic methods of UV-Vis, where spectral shifts were observed upon adding molar quantities of these cations and anions, evidencing that, chemical interactions has taken place, between the host and guest. Interestingly, fluorescence analysis carried out, demonstrated that the ESIPT-steered probe was highly selective to Zn²⁺ only, among the cations and anions used, turning the initially non-fluorescent H into a dual emissive H-Zn complex upon excited at 380 nm. The selectivity of H towards Zn²⁺ was based on the geometrical complementarity through coordination induced charge transfer, upon binding. The DFT predictions were carried out to complement the experimental data.

Keywords: Zn²⁺ fluorescent probe, Cu²⁺ and OH⁻ colorimetric sensor, Ditopic sensor, Dual emission probe

REDUCTION OF CARBONYL COMPOUNDS TO AROMATIC ALCOHOLS WITH MnO₂-NaBH₄ HETEROGENEOUS CATALYST: AN ENVIRONMENTALLY GREEN APPROACH

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Abstract

Despite their natural abundance, biocompatibility, and variety of oxidation states, compounds based on manganese have attracted a lot of attention as potential catalytic materials. In the fine chemical and pharmaceutical industries, homogeneous and heterogeneous catalysts based on manganese are essential components. For the oxidation and reduction of carbonyl compounds, MnO₂ is utilized as a catalyst. Due to the vast range of accessible oxidation states of Mn, Mn-based oxides can go through a number of reactions and have a wide range of possible uses, including energy storage, magnetic materials, sensors, and catalysis. Some reactions needed a catalyst in order to produce a product with high yield. By reducing the reaction's activation energy, catalysts accelerate reactions. Under ideal circumstances or a mild atmospheric reflux environment, the MnO₂ demonstrated outstanding catalytic activity and good selectivity. The catalyst was synthesized by coprecipitation method and characterized by BET, SEM and IR instruments. The application of MnO₂-NaBH₄ catalysts for reduction of carbonyl compounds such as acetophenone, benzophenone and with substituted

benzaldehydes in methanol solvent and the reactions were monitored by Thin Layer Chromatography (TLC). It has been demonstrated that MnO₂ catalyzes the hydrogenation of carbonyl compounds into alcohols. In order to overcome the current barriers of limited catalyst usage time and high energy costs for future industrial applications. The alcohol product can be delivered cleanly and quickly using the heterogeneous reduction on a variety carbonyl compounds in 6-25 min. The catalyst ran effectively for several cycles without suffering a substantial loss of activity and was easily recyclable. Keywords: Hydrogenation, Heterogeneous reduction, Co-precipitation method.

SYNTHESIS AND EXTRACTION OF CARBON NANODOTS FROM AMINO ACID DERIVATIVES FOR FINGERPRINTING MATERIAL

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Abstract

Carbon nanodots are fluorescent carbon nanomaterial with significant advantages in terms of being green, low toxicity, chemical inertness, tunable fluorescence and good water solubility. In this work, a pyrolysis method for synthesizing carbon nanodots was used by reacting ammonium oxalate and amino acid derivatives as well as nitrogen-rich chemical species (anthraquinones, alizarin, quinaldic acid, picloram and melamine) as raw materials. The incorporation of a minor amount of carbon nanodots into starch powder imparts remarkable fluorescent color-tunability under UV-lamp illumination. Upon mixing carbon nanodots with natural starch to form a homogenous powder sample in acetone, a strong emission of blue fluorescence in dry solid-state was observed. The fluorescence and UV absorption spectra were measured using the Fluorescence and UV-Vis Spectrometer, complimenting the naked eye observation. The imaging of fingerprints stained by Carbon nanodots fluorescent powder was used on various smooth substrates, including glass, ceramic tiles and aluminium foil. The fluorescence powder labeling fingerprint were irradiated and photographed. The carbon nanodot powder was used as a UV fluorescent label for completely developing whole latent fingerprints. In forensic science area, fingerprints are an important material evidence because of the key function in individual identification and the experimental results showed positive results in this application.

Keywords: Carbon nanodots, fingerprint detection, blue fluorescence

THE CRYSTAL STRUCTURE, CHEMICAL COMPOSITION, SURFACE MORPHOLOGY AND OPTICAL PROPERTIES OF TITANIA THIN FILM

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Abstract

The objective of the study was to determine the crystal structure, chemical composition, surface morphology and optical properties of titanium oxide (TiO₂) thin films fabricated on the microscopic glass. The pure TiO₂ thin film was fabricated using the Molecular Precursor Method (MPM). The thin film was fabricated by heat-treating the precursor solution spin-coated on a microscopic glass at 600°C in air for 30 minutes. The crystal structure, chemical composition, surface morphology and optical properties of the thin film were investigated by using X-Ray diffraction (XRD), Scanning Electron Microscope, Energy dispersive X-ray spectroscopy (EDS), field emission scanning electron microscopy (FE-SEM) and UV/Vis spectroscopy, respectively. On the basis of the XRD results, the TiO₂ thin film was found to consist of a mixture of two phases of titania; rutile and anatase. The correlation between the EDS elemental mapping and EDS spectrum of the thin film, shows the presence of carbon (C), titanium (Ti) and silicon (Si) in the thin films, with which the presence of silicon, oxygen and carbon obviously arise from the microscopic glass and air, respectively. The particles size of the TiO₂ is in the range of

5.0-10 nm is at nano level, the band gap was found to be at 3.2 eV and thin film is crack-free which can make it suitable for the photocatalytic, photochemical, and photovoltaic studies

PHYTOCHEMICAL SCREENING AND ISOLATION OF BIOACTIVE METABOLITES FROM LEAVES AND ROOTS OF MARSDENIA MACRANTHA

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Abstract

Traditional medicinal plants continue to serve as an affordable and accessible treatment for diseases [1]. That is because biological active compounds are present within the plant. The use of conventional drugs is increasingly becoming a concern for health authorities due to their long-term use side effects, costs and lack of efficacy. This is why investing more time and capital into natural product research as part of the drug discovery process is important. Therefore; this project focuses on extraction and isolation of secondary metabolites from the leaves and roots of *Marsdenia macrantha*. Phytochemical screening was performed on both roots and leaf material for presence of Tannins, Alkaloids, Cardiac glycoside, Terpenoid, Flavonoid and phenolic compounds. The root and leaf samples were subsequently extracted with 200 mL of n-hexane, petroleum ether, ethyl acetate, dichloromethane and ethanol in order of increasing polarity while stirring for 24 hours [2]. During phytochemical screening only Tannins were absent with alkaloids showing the greatest concentration and Terpenoids the lowest. Total of 10 extracts were obtained, 5 from roots and 5 from the leaves using the above-mentioned solvents. Purification was done using Thin layer chromatography to determine the components and solvent system for separation of those compounds. Ethyl acetate extract Metabolites were isolated using Preparatory TLC and as a result, 6 pure compounds were obtained of which 3 were in crystalline state. These pure isolated compounds as well as the crude extract will then be tested for anti-bacteria activity and the pure compounds will be submitted for structure elucidation. The crystal-like metabolites are believed to be responsible for the crystal appearance of the crude extract. Two of the crystalline metabolites showed positive result when the TLC plate was sprayed with dragendorff's reagent. Even though only structure elucidation can provide us with this information, the results obtained in this research strongly suggest that the Crystalline compound is an alkaloid. This arises from the fact that alkaloids are known to be crystalline compounds. Phytochemical screening results and the positive results using dragendorff's reagent also contributes towards that conclusion.

BIOASSAY GUIDED FRACTIONATION OF POTENTIAL ANTI-GONOCOCCAL AGENTS FROM THE ROOTS OF STRYCHNOS COCCULOIDES

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Abstract

Strychnos cocculoides, commonly known as monkey orange (English), kahwi (Sifwe), muhuluhulu (Silozi), maguni (Kwangali) and omaguni (Oshiwambo) is one of the indigenous medicinal plants traditionally used to treat gonorrhoea in Namibia. It is commonly found in Namibia's northeastern regions (Kavongo East, Kavongo West, and Zambezi). Traditional medicine has employed the roots, leaves, and bark of this plant to treat ailments such as sore throats, stomachaches, and lower abdominal pain. Of interest to this study is its ethnomedicinal use in the treatment of sexually transmitted infection, gonorrhoea. So, using a bioassay-guided approach, this study aimed to isolate compounds with anti-gonococcal activity from *S. cocculoides* roots. Hexane, dichloromethane, ethyl acetate, and methanol were used in a sequential extraction of crude extracts. Disc diffusion method was used to assess the anti-gonococcal activity. Inhibition zone ranging from 8 to 10 mm were recorded. TLC was used to evaluate the constituents present in the sample and to determine the

suitable solvent for separating these constituents on a preparative TLC. Methanol extract had higher activity, thus was subjected to preparative TLC which resulted in 8 fractions. However, only one had enough quantity of >20 mg to be tested for anti-gonococcal activity. Unfortunately, this fraction did not exhibit any activity, therefore the activity of the crude extract cannot be attributed to this fraction. Hence, other compounds that were not isolated in good quantity in this study, may be the source of the antibacterial activity observed in the crude extract.

Keywords: *Strychnos cocculoides*, ethno-medicinal, anti-gonococcal, gonorrhoea, *Neisseria gonorrhoeae*

IN-SILICO BIOLOGICAL ANALYSIS AND QSAR STUDIES OF COMPOUNDS WITH NEISSERIA GONORRHEA CARBONIC ANHYDRASE INHIBITION ACTIVITY

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Abstract

Neisseria Gonorrhoeae, which causes the sexually transmitted disease gonorrhoea, is one of the prevalent bacteria that has been shown to have antibiotic resistance, it colonizes urogenital, anal and nasopharyngeal tissues. This study aimed to do quantitative structure activity/property relationships (QSAR/QSPR) to develop models using compounds that have been shown to have inhibition activity against *Neisseria gonorrhoeae* carbonic anhydrase (NgCA) an enzyme of *N. gonorrhoeae*. These models will be used to predict other drugs' potential to suppress NgCA activity. Using molecular mechanics, MMFF, and the B3LYP/ 6-31+G(d) functional, the lead structure Acetazolamide (AZM) and 30 analogues were optimized. After correlation analysis, there were only 15 of the original 18 descriptors that were compiled from Spartan calculations and vcl. The stepwise, forward, and backward methods were used to create the models using the Statistical Package for the Social Sciences (SPSS) software. The best model was found to be; $MIC=43.355-0.255\pm 16.913HOMO-0.601\pm 0.150MaxE-0.886\pm 2.186MinLPot$ ($R=0.905$, $R^2=0.820$, adjusted $R^2=0.799$, $F=40.870$). Molecular docking was carried out using Autodock Vina to investigate the interaction between NgCA and the molecules under investigation. The docking score varied from -5.2 - -6.6 kcal/mol, with structure 16 displaying the highest affinity.

Keywords: *Neisseria gonorrhoeae*, *Neisseria gonorrhoeae* Carbonic Anhydrase (NgCA), QSAR, Models, Inhibition Activity

DIVERSITY OF CULTURABLE AEROSOL-BORNE BACTERIA AND FUNGI WITHIN A FIFTY-METER RADIUS OF THE ACTIVATED SLUDGE TANK AT THE GAMMAMS WASTEWATER TREATMENT PLANT: A PUBLIC HEALTH PERSPECTIVE

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Abstract

The activated sludge tank in a municipal wastewater treatment plant is the main site of the suspended-growth aerobic system. The process involves blowing air into raw, unsettled sewage resulting in solids being smashed, and the subsequent discharge of the sewage liquor into an activated sludge chamber. In the process, there is generation of bioaerosols which become airborne. Bioaerosols are a loosely defined group of airborne particles of viable and dead biological particles, including viruses, bacteria, fungal spores, pollen and various antigens, as well as their fragments and compounds. Since wastewater carries different pathogenic and non-pathogenic microorganisms that can be dispersed in the environment as bioaerosols, workers and nearby residents exposed to the bioaerosols are at risk of contracting aerosol-borne infections. The aims of the study were to determine the diversity of culturable aerosol-borne bacteria and fungi within a fifty-meter radius of the Gammams secondary treatment pond through sequencing approaches. Sampling was done within

a fifty-meter radius of the activated sludge tank. Nutrient agar and potato dextrose agar (PDA) plates were used for the cultivation of bacteria and fungi, respectively. The samples were collected from three points of varying distance from the tank as follows; 0 meters, 25 meters and 50 meters. The plates were left open for an hour, after which they were closed and sealed and taken to the laboratory for incubation. Nutrient agar plates were incubated at 37°C for 24 hours whereas potato dextrose agar plates were incubated at 25°C for 48-72 hours. The resultant, mixed colonies were subcultured onto freshly prepared agar medium until pure cultures were obtained. For DNA extraction, the cultures were subcultured into appropriate broth media and incubated for 24 h at 37°C for bacteria and for 48-72 h at 25°C for fungi. Thereafter, the cloudy broth was used for DNA extraction using a Zymo gDNA Extraction Kit following the manufacturer's instructions. This was preceded by PCR using the universal 16s rRNA primers for bacteria and ITS1 and 4 primers for fungi followed by sequencing analysis at Inqaba Biotech Industries (Pretoria, SA).

Keywords: Wastewater, Bioaerosols, culturable, diversity

DETERMINATION OF THE MINERAL CONTENT IN PURIFIED WATER FROM VENDORS IN WINDHOEK.

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Abstract

Knowing the amount of minerals in water is crucial since it is advised not to use water that has more than 500 mg of dissolved solids per liter (mg/L). The goal of the study was to ascertain and compare the content of the four major minerals (Na, K, Ca, and Mg) in filtered water to both the bottle label and the WHO-established global standard limits. Atomic Absorption Spectrometry (AAS) was used in this research to measure the concentrations of these key minerals in 4 bottled water samples of various commercially available brands, water samples from 3 purified water vendors in Windhoek and 1 tap water sample. Two Hollow Cathode Lamps were used, one to determine K and Na and the other to determine Ca and Mg. It was found that in some cases, the determined concentrations of some of the elements were not the same as what was specified on the bottle's label. For all of the samples analyzed, the sodium analysis revealed relatively low concentrations, ranging from 0.39 mg/l (ppm) to 55.1 mg/l. A maximum of 200 mg/l of sodium is recommended, by the World Health Organization (WHO), in water intended for consumption. The magnesium level of the samples ranged from 0.0038 mg/l to 36.6 mg/l, which was much higher in some samples than the WHO limit for drinking water, which is 20 mg/l. The maximal calcium and potassium values were 84.7 mg/l and 11.7 mg/l, respectively. No recommendations for Ca and K are given by the WHO, but the results were compared to those obtained for bottled waters in the literature and only minor variations were found. Keywords: Mineral water, spring water, Atomic Absorption Spectrometry (AAS), sodium, potassium, calcium, magnesium and World Health Organization (WHO)

ACTIVATED CARBON-H₂SO₄ TREATED FROM ACACIA SEEDPODS FOR PHENOL ABSORPTION.

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Abstract

The aim of this research study was to prepare activated carbon from *Acacia erioloba* (*A. erioloba*) seedpods using H₂SO₄ as the impregnating agent and evaluating its application for water treatment. The activated carbon obtained is characterized based on surface functional groups using FT-IR and quantifying organic oxygen containing surface functional groups of the activated carbon using the Boehm titration method. Structural changes in the activated carbon before and after application on water was done using the above stated analytical techniques. Adsorption properties for its application in water treatment. The percentage yield of the obtained activated carbon was in a range of 11.6-17% with ash percentage and percentage moisture being in the range of 4.3-16% and 14-22% respectively. Using the Boehm equation the amounts of carbon functionalities (ncsr) measured were 2.275 mmol/g, 1.625 mmol/g and 1.25 mmol/g for NaOH, NaHCO₃ and Na₂CO₃

respectively. The UV analysis data for phenol absorbance with distilled water was measured at 300 nm. The idea of cleaner production was inspired by the fact that activated carbons, which are used for water treatment, may be made from easily available, inexpensive raw materials with the possibility of reusing activating agents. Water treatment utilities will therefore find this research study interesting, especially those in nations like Namibia who have a water shortage.

EMERGING MATERIALS TOWARD FABRICATION OF EFFICIENT SOLID OXIDE FUEL CELLS

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Abstract

Solid oxide fuel cells (SOFCs) are promising power generation devices with high efficiency (~60 %) and low environmental impact when compared to other power generation systems. The triumphant application of this will be a great significance to eliminate energy crisis whilst simultaneously protecting the environment. SOFCs main components include anode, cathode and electrolyte. SOFCs technology challenge is high temperature operation (700-1000 °C). This tends to impede positive market acceptance without mixed feelings. Therefore, there is a need to focus on material selection and characterization, more importantly, their physical and electrochemical properties in order to fulfill a goal of efficient solid oxide fuel cells, this study presents overview of SOFCs and the ideal materials to fabricate them, specifically the newly available reported. Furthermore, the study judiciously explains SOFCs operating temperature and IT-LT SOFCs materials. Many factors and properties are considered when selecting ideal materials for SOFC component's, Recently, the state-of-the art SOFC cell components materials has been: 8 mol% yttria stabilized zirconia (YSZ, electrolyte), Sr substituted LaMnO₃ (LSM, cathode), Ni-YSZ cermet (anode), Ca-substituted LaCrO₃ (LCR) or metallic alloys (interconnect) and glass or glass-ceramic (sealants). More interestingly, recent studies revealed another alternative emerging material for efficient SOFCs.

Keywords: Solid electrolyte, Anode, Cathode, SOFCs, Nanomaterials

PHOTOMETRIC STUDY OF CHARIKLO

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Abstract

The Centaur object (10199) Chariklo is the only small object of the solar system known to show the presence of a ring system. Several researchers have looked at the photometric study of Chariklo as well as developing disk-integral functions of other bodies such as asteroids, but none have developed a disk-integral function of Chariklo. Knowledge of the disk-integral function of Chariklo is significant as it allows us to study more about its physical properties. This study developed a disk-integral function of Chariklo by making use of its photometric properties. The study utilized data obtained from Cuno Hoffmeister Memorial Observatory (CHMO's) 36-cm telescope, which is from observations taken in 2016. The data were analyzed using the sbpy python code for small bodies. The code provides routines for photometric phase curve modeling of small bodies as well as retrieving sbpy's built-in filter bandpasses. It also defines the classes to implement the adopted disk-integrated phase function models for atmosphere-less solar system objects

ELECTROCHEMICAL PROCESS FOR THE DIRECT PREPARATION OF AQUEOUS PRECURSOR SOLUTIONS INVOLVING Cu^{2+} COMPLEXES, FOR THE FABRICATION OF CU-BASED THIN FILMS

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Abstract

The preparation of precursor solutions needed for the fabrication of copper-based thin films involve multiple steps that requires conversion of copper salts into appropriate complexes via various chemical reaction processes. However, it has been recently reported that the electrochemical process can be used to synthesise metal complexes and salts, whose solid precipitates can be formed in the electrolytic cell or simultaneously dissolved in the electrolytic solution during their formation. In this study, the electrochemical process was used to directly convert metallic copper into precursor solutions and optimizing the reaction conditions for the electrochemical process by varying the voltage and electrolyzing durations. Three electrolytic solutions were used and are as follow, ES1 contained ammonia solution and ammonium formate; ES2 contained EDTA, ammonia solution, and ammonium formate; and ES3 contained EDTA, (and ammonium solution. The Cu^{2+} ions were generated by electrochemical oxidation of copper electrodes. UV-Vis spectroscopy was used to determine and confirm the concentration of Cu(II) complexes in electrochemically prepared solution. The Beer's Law equation was used to determine the concentration of Cu(II) complexes, in the electrolyzed solutions.

Keyword: Electrochemical process, precursor solution copper-based thin films,

FABRICATION OF Sb_2Se_3 THIN FILM SOLAR CELLS

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Abstract

Promising technological and economical photovoltaic devices relying on natural renewable resources have recently attracted a lot of attention. The search for materials that are earth abundant, low costing and non-toxic for energy conversion applications is still in progress. One of the most promising earth-abundant chalcogenides candidates is the Binary Antimony Selenide (Sb_2Se_3) thin film solar cells. We report progress on the fabrication and study of Sb_2Se_3 thin films deposited via a simple route using the spin-coating and thermal evaporation in vacuum coating methods in UNAM's thin film physics laboratory.

Keywords: Chalcogenides, Antimony Selenide, Spin-coating, Thermal Evaporation in Vacuum, Thin film solar cells

THE SYNTHESIS, PARTIAL-CHARACTERIZATION, PHYSICOCHEMICAL AND IN-VITRO ANTIMICROBIAL AND ANTIOXIDANT PROFILING OF QUINOLINE-TRIAZOLE DERIVATIVES

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Abstract

Antibiotics aim to alleviate the symptoms caused by pathogenic organisms through the immobilization or killing of micro-organisms. Over the years, these pathogenic organisms have developed resistance at an increasing rate towards the existing antimicrobial agents such as penicillin. This study aims to

address this issue of microbial resistance with the design and synthesis of quinoline-triazole hybrid compound. All the synthesised compounds will be partially characterized (GC-MS, IR) and tested for in vitro antimicrobial activity (*Escherichia coli*, *Klebsiella pneumonia* and *Candida albicans*) and antioxidant properties. The physicochemical and bioactivity predictions of the compounds were done using open source software, Molinspiration. Physicochemical data of the synthesized compounds reflects on the Lipinski's Rule of Five ($n\text{OHNH} \leq 5$, $n\text{ON} \leq 10$, $\text{MW} \leq 500$ DA and $\text{miLogP} \leq 5$). Five of the 15 target molecules (4a-e) were shown to violate the number of hydrogen bond donor atoms of less than 5. The predicted bioactivity scores was used to classify the compounds as either enzyme inhibitors (kinase and protease) or binds to ligands (G protein-coupled receptor or to the Nuclear receptors). Positive scores values ($0 < x \leq 1$) are considered good bioactivity. Five intermediates (3a-e) have been showed as Kinase inhibitors and compound 2e has a 0.67 enzyme inhibition value. The intermediates 3a-e are worth exploring further and used in the synthesis of potential anticancer drugs, such as melanoma.

PHYTOCHEMICAL SCREENING AND ANTIOXIDANT POTENTIAL OF SARCOCAULON MARLOTHII: AN ENDEMIC MEDICINAL PLANT IN NAMIBIA

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Abstract

Although many Namibian medicinal plants have been subjected to phytochemical studies, very little scientific data on *Sarcocaulon marlothii* is found in the literature to date. The present study assesses the phytochemical content, Total phenolic (TP), Total flavonoid (TF) content and antioxidant potential of *S. marlothii*. Flash column chromatography was performed on the crude organic extract (DCM:MeOH) using silica gel. The eluting solvents were gradually increased from non-polar to polar solvent, to yield six fractions in total. Qualitative phytochemical analysis was performed on the dried plant material and the organic crude extract. Reported qualitative tests were used to determine the presence of the following classes of secondary metabolites: alkaloids, terpenes, anthraquinones, anthranoids, cardenolides, saponins, tannins, polyphenols and flavonoids. The crude extract and subsequent fractions were subjected to quantitative analysis to determine the total phenolic and total flavonoid contents using the assays reported by Saeed, et al. (2012) and Jossipovic, et al. (2016), respectively. DPPH radical scavenging and ferric ion reducing power assays were used to determined antioxidant activity of the crude organic extract and fractions. The presence of tannins, terpenes, and polyphenols were detected. The total phenolic content and total flavonoid content was found to be 132 mg GAE/g and 392 mg GAE/g respectively, whereas the crude extract displayed an IC₅₀ of 5.6027 mg/mL for the antioxidant activity. The reducing power of the crude organic extract is comparable with that of Vitamin C. Flavonoids and polyphenols are statistically significant phytochemical metabolites that are found in abundance in *S. marlothii*, and are most likely responsible for the recorded antioxidant activities.

Keywords: *Sarcocaulon marlothii*, phytochemical studies, total phenol, total flavonoids, antioxidant activity.

REMOVAL OF METAL SALTS FROM ACTIVATED CARBON – DERIVED ACACIA ERIOLOBA SEED PODS BY PHYSICAL ACTIVATION

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Abstract

Activated carbon (AC) was prepared from *A. erioloba* seed pods. The seed pods were collected seeds pods were crushed into fine powder and than sieved into 2 different particle sizes of 50 μm (AC-1), 100 μm (AC-2). AC was characterized by different analytical tools. The characterization of the

adsorbents includes estimation of various parameters such as proximate analysis (moisture content, ash content, volatile matter content and fixed carbon content), bulk density, SEM, pH. Batch Adsorption dynamics and equilibrium studies for the removal of metal salts contaminants from the tap water using indigenously prepared activated carbon from *Acacia Erioloba* has been carried out under various experimental conditions at room temperature ($25^{\circ}\text{C}\pm 1^{\circ}\text{C}$). The main objective of this research is to produce activated carbon and to use it to treat contaminated water and remove Cu, Fe, & Cr from heavy metal contaminated water at different concentrations. The adsorption of metal contaminants by AC(0.5g) differed based on the concentration in the solution. Adsorption of heavy metal salts followed Freundlich adsorption model, showing higher R² values for AC-1, 2 and 3 than Langmuir model. Hence, in conclusion these results revealed that prepared *A. erioloba* can be used for iron removal and also be used for the treatment of contaminated water, which were characterized by UV.

DESIGN OF A STAND-ALONE PHOTOVOLTAIC (PV) SYSTEM FOR A HOUSE CLUSTER AT OTJINENE VILLAGE AND ASSESSMENT OF MODULE MISMATCH ON THE SYSTEM PERFORMANCE

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Abstract

Due to a lack of electricity and bounded knowledge in designing of stand-alone photovoltaic systems in the Otjinene village and lack of knowledge on the effect of module mismatch on the system performance, the aims of this paper is to design a stand-alone photovoltaic system for a house cluster at Otjinene village and to assess the effect of module mismatch on the module power output. A photovoltaic system can be used to provide a safe and non-pollutant electricity through the direct conversion of solar irradiance into electricity. A stand-alone photovoltaic system is a convenient way to provide electricity in rural areas or simply areas that do not have access to a utility grid. The process of designing a stand-alone photovoltaic system involves determining and sizing components involved in the design. In order to assess the effect of module mismatch on the module power output, an indoor experiment was performed to understand how light intensity and temperature affect the output of a solar cell. This was done by varying light intensity of a light bulb (in resemble of a sun) while keeping the temperature constant and also varying the temperature by heating the solar cell with a hairdryer while keeping the light intensity constant. Further, an outdoor experiment will be done to assess how mismatch due to module shading affect the output as well as on mismatch due to mixing up modules of different power rating in one string. From the indoor experiment, the Current-Voltage (I-V) and Power-Voltage (P-V) curves were plotted and the results showed that increasing light intensity and keeping temperature constant yield an increase in the open-circuit voltage (V_{oc}), short-circuit current (I_{sc}) and maximum power point (PMPP), while increasing the temperature and keeping the light intensity constant yield a decrease in V_{oc}, I_{sc} and PMPP. Through literature review knowledge was acquired both on the designing of stand-alone PV system and on assessing the effect of module mismatch on the module power output.

Keywords: Photovoltaic (PV) system, Stand-alone PV system, module mismatch, solar irradiance, temperature

THE SYNTHESIS OF A THIOISATIN-BASED SENSOR AND ITS APPLICATION IN ANIONS AND CATION SENSING IN ENVIRONMENTAL SAMPLES

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Abstract

A Schiffs' base condensation reaction of 2-Aminothiazole and istatin was used to create the thioisatin-based sensor 3-(thiazole-2-ylimino) indolin-2-one, which was then characterized and spectroscopically analyzed using a UV-Vis spectrophotometer. It detected cations (Co⁺³, Cu⁺², and Hg⁺²) and anions (Br⁻, C₂H₃O₂⁻, and OH⁻). Through the use of spectroscopic techniques like UV-Vis of

sensor concentration (1×10^{-5} M) in water soluble dimethyl sulfoxide (H₂O/DMSO, 20:80), the changes in color that are visible to the human eye were detected and confirmed. The ionic species and sensor may react chemically to produce structural modifications or the creation of new chemical species, which could explain the color shifts. The ionic species were detected as a result of a change in their molecular structure, which is signaled by a particular type of indicator, such as spectral shift of the charge-transfer absorbance band, intermolecular charge transfer, and chelating-induced charge transfers between the sensor and specific cations. As a result, the sensor showed dual sensing capability for both anions and cations, but only for ionic species that were compatible with the structure and chemistry of the sensor's surroundings.

Keywords: Chemosensor, UV-Vis Spectroscopy

THE SYNTHESIS OF NAPHTHYL-BASED SENSOR AND ITS APPLICATION IN CATION/ANION SENSING IN ENVIRONMENTAL SAMPLES

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Abstract

A highly selective and sensitive naphthyl-based sensor referred to as K was synthesized, characterized and spectroscopically analyzed. The ion recognition properties towards various biologically important anions and cations were investigated through naked eye observations and spectroscopic methods in water soluble DMSO mixture (8DMSO: 2H₂O). The addition of F⁻, OH⁻ and OCN⁻ as tetrabutylammonium salts to sensor K resulted in naked eye color change which was confirmed spectroscopically via the change in spectral shifts of the intermolecular charge transfer (ICT) absorbance band during UV/Vis analysis. Moreover, the addition of cationic salts of Ni²⁺, Cu²⁺, Fe²⁺ and Hg²⁺ gave distinctive color changes upon interacting with sensor K through naked eye observation due to chelating-induced charge transfers between sensor K and the individual cations, and a spectral shift was also observed confirming the naked eye observations. Therefore, K is a dual sensor which however, is only selective to ionic species which are compatible its structure and chemical environment. Keywords: Dual chemosensor, UV-Vis Spectroscopy, ICT

DETERMINING THE UNCERTAINTY OF UAVs TRANSMISSION PROPAGATION ON CROSS CALIBRATION OF CHERENKOV TELESCOPE ARRAY

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Abstract

The objective of this study is to determine the uncertainty of light transmission in the atmosphere at an astronomical facility. For the calibration of Cherenkov telescopes, a new approach relying on Unmanned Aerial Vehicles (UAVs) is currently discussed. A feasibility study was conducted on the cross-calibration of different telescope size classes, which achieved a systematic uncertainty of 8 – 10%. The airborne calibration platform was based at the High Energy Stereoscopic System (H.E.S.S.) Cherenkov telescopes. On an astronomical night with relatively low dust content and suitable thermal protection for calibration was used to create a simulation of light source transmission by using an elevated UAV with an onboard photodiode to measure absolute light intensity from 1000 m above the telescopes. This calibration system relies on knowing the details of the light transmission from the UAV to the telescopes through the atmosphere. Rayleigh scattering cross section is the fraction of light scattered by scattering particles over the unit travel length which is the number of particles per unit volume N times the cross-section. This scattering cross section forms part of the molecular transmission factor. The simulation for light transmission, absorption, and amount of scattered due to aerosols and

molecular light scattering will be presented for different atmospheric conditions using atmospheric data recorded between 2004 and 2020 from equipment present at the H.E.S.S. site.

Keywords: Light Propagation, Atmosphere, UAV, Calibration, Cherenkov Telescopes

MONTE CARLO TECHNIQUE FOR PREDICTING THE PERCOLATION THRESHOLDS FOR ELECTRICAL CONDUCTIVITY OF METALLIC AG-NPS/TIO₂ COMPOSITE THIN FILMS

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Abstract

The subject of the study described in this research is the percolation threshold of metallic Ag-NPs/TiO₂ composite thin films fabricated by Molecular Precursor Method and Sol Gel Method. The Model was based on analysis of the critical conditions by using percolation theory to predict the minimum number of Ag atoms in TiO₂ insulating matrix having a finite volume. By observation on the Transmission Electron Microscope, the representative volume element with finite dimensions and volume was established. Specifically, Monte Carlo Algorithm was developed to determine the percolation threshold of spherical shaped Ag-NPs homogeneously distributed in an insulating TiO₂ matrix. The Monte Carlo simulation provides the threshold value at which the composite thin film may become conductive and the effect of particle size on the percolation threshold has been demonstrated.

Keywords: Percolation Threshold, Montecarlo Simulation, Silver-Nanoparticles, Titania Composite Thin Film, Molecular Precursor Method, Sol Gel Method

DEPARTMENT OF WILDLIFE MANAGEMENT AND TOURISM STUDIES

AN INVESTIGATION OF FARMERS PERCEPTIONS ON MAJOR DRIVERS OF HUMAN CARNIVORE CONFLICT, THEIR MITIGATION STRATEGIES AND HUMAN CARNIVORE CONFLICT HOTSPOTS IN MAYUNI CONSERVANCY, ZAMBEZI REGION OF NAMIBIA

G. Munyunga

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Abstract

Human carnivore conflict is ranked amongst the main threats to conservation in Africa. A conflict is said to have occurred when the interaction results into negative impacts for either carnivores or humans. Due to severe drought experienced in the Zambezi region in recent years, animals are roaming further into fields and villages in search of food and water causing more conflicts. Livestock kraaling has reduced the chances of livestock attacks in Namibia. However, the use of kraals in the Mayuni Conservancy are traditional built and the effectiveness of such structures has not yet been investigated. Despite the fact that a lot of information has been reviewed on human carnivore conflict. There is still a rise in conflicts, which is why this study aimed to and draw attention to these areas which are susceptible to becoming carnivore corridors. There are 38 registered farmers in Mayuni Conservancy and a stratified sampling approach was used in choosing the participants. A total of 19 farmers were used as the sample population. All farmer which were interviewed use wooden poles for construction of their kraal structures as they do not have enough money to build strong structures. According to the data that was collected, it depicts that live stocks are attacked at different rates by specific carnivores in different areas. Attacks occurs most when livestock are in kraals, waterpoints and grazing areas. The Major drivers of attacks are that, livestock headers leave livestock unattended while grazing, secondly, they do not safe guard them to drinking points and last ones is that carnivores are able to break through the kraals as they are not strong enough. In kraals most attacks are caused by snakes which constitutes of 7.69 %, whereas when grazing in the wild they are attacked by hyenas which constitutes of 23.08% leopards and lions 15.38%. At water points they are attacked by crocodiles constituting of 38.46%.

SPATIAL DISTRIBUTION AND ACTIVITY PATTERNS OF CARNIVOROUS MAMMALS IN MUDUMU NATIONAL PARK, NORTHEAST NAMIBIA

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Abstract

Carnivores are a highly persecuted taxonomic group, due to regular conflict with humans that has resulted in many species becoming endangered and locally extinct. Understanding the distribution patterns of carnivores and the factors influencing them is critical in ecology and conservation efforts. The present study investigated the spatial distribution of meso and large-sized mammalian carnivores in Mudumu National Park, northeast Namibia. A total of 25 remote cameras were placed systematically within 120 km² for 45 days. Species detection data was analyzed using QGIS and the camTrapR package. Twenty-four individuals belonging to 9 carnivore species were detected at 8 camera stations from a total of 931 trap nights. Shannon species diversity per station ranged from -0.01 to -0.34, with 1 species detected at 3 stations, 2 and 3 in 1 each, 5 in 2, and 6 in 1. Spatial recaptures ranged from 1 to 5. The clumped distribution of detection suggests a non-evenly distribution of carnivore species. A potential explanation for this may be resource availability, distance from water points, distance from the roads and interspecific interactions. This information improves our understanding of the spatial ecology of carnivore populations in this park and thus informs the management of the park.

Keywords: Spatial distribution, conservation, carnivores

UNSPECIFIED SCHOOLS/DEPARTMENTS/AFFILIATION

IRON LEVELS IN SAND-TEXTURED CROP FIELDS IN ONGENGA CONSTITUENCY, OHANGWENA REGION, NAMIBIA

G. Muharukua

Abstract

According to the world bank collection of development indicators, Fe deficiency is vastly becoming one of the most spread forms of malnutrition. Recent research has indicated that the prevalence of childhood malnutrition in Namibia is about 24%. However, the severely affected by stunted growth, are those residing in the north especially Ohangwena and Kavango regions as well as in the south especially Hardap and Karas regions. There is now a growing interest in applying spatial prediction methods to produce detailed maps of soil nutrients for SSA, in order to support agricultural development, intensification, and monitoring of the soil resource. Plants growing in soils with limited availability of Fe are not able to accumulate sufficient amounts of Fe in their edible parts, leading to nutrition disorders (Fe deficiency). Iron deficiency is a well-documented problem in cultivated soils and seriously disturbs yield quantity and nutritional quality of crops. The study assessed the spatial distribution of Fe in the soil at the Ongenga constituency. 170 samples were collected and subsequently analyzed in the laboratory for Fe content. The point data were interpolated using the Inverse Distance Weighted (IDW) method. The Fe in soil levels ranged from between 0 ppm and 160 ppm in the area. Fe content in the area is generally optimal and when its high may be due to external factors. Regular maintenance of Fe in soils recommended.

ASSESSING CONTENT OF POTASSIUM IN SANDY-TEXTURED CROP FIELDS IN ONGENGA CONSTITUENCY, NAMIBIA

SN. Dlamini

Abstract

Potassium (K) is one of the primary nutrient elements which plays crucial roles in osmoregulation, cation-anion balance, transport of assimilates, and water balance in plants. This research was elaborated in Ongenga constituency (Northern Namibia) to assess potassium content in sandy textured crop fields. A total of 169 samples were collected randomly by using the soil sampling auger. For the identification of soil sampling points, a Global Positioning System (GPS) device was used. The collected samples were analyzed for potassium following standard methods in the laboratory of the Ministry of Agriculture, Water and Forestry, Windhoek. The nutrient maps of K generated clearly point out the specific locales where deficiency of nutrients constrained crop production. A multiple regression model was constructed from sample results and pixel values from Sentinel 2A images. Soil textures in the study were loamy sand and sandy. The average of potassium content was 4.92 and standard deviation stood at 6.53. Content values for potassium ranged from 0 to 910 ppm respectively. The potassium levels in the soil plays a role in the fertility management practices found in the study area.

THE DEVELOPMENT OF A SMART ATTENDANCE REGISTER FOR UNAM

Egumbo-Metusale

Abstract

In recent times, there has been an increase in the use of smart attendance system in universities. This study focused on designing and developing a QR code-based system for tracking Attendance records at the University of Namibia that supports Lecturers in accessing the required attendance information very fast and also with the production of required reports in the quickest time possible. The attendance method used by UNAM today is not automated. It requires a lot of manual work forces to accomplish it. An automated attendance system can save human labour and increase the efficiency of attendance taking. This will directly help lecturers to save time and spend more time on academic, rather than attendance records. The study employs Design Science Research (DSR) to systematically design and develop a prototype by acquiring knowledge that relates to the functional activities of the prototype. The study was divided into five phases, namely: Analysis Phae; Design

Phase; Implementation Phase; Testing Phase; and Deployment Phase. During the Analysis Phase. A survey was carried out to determine the current trends methods in taking attendance. Results from this survey were then used to design an attendance register application using QR Code which was implemented using strapi and ionic framework. Whereby we used strapi to create our server and database which is our backend API our application and we used ionic to create the application itself which is our front end. The result show that the prototype can record the attendance and manage the attendance data in an effortlessly manner which is beneficial to students and lecturers because they will no longer spend more time on the attendance but have more time for lecture.

MODELLING OF MULTIPLE LINEAR REGRESSIONS FOR PREDICTION OF SOIL POTASSIUM CONTENT IN CULTIVATED ONGENGA'S CROP FIELDS, OHANGWENA REGION

H. Davids

Abstract

Potassium (K) is an essential macronutrient for plant growth. Subsistent crop production is mostly common in the Northern Regions of Namibia. The spatial prediction of soil nutrients is present. However, the prediction of soil Potassium at a local level is needed in order to increase crop yield. Therefore, this study aimed at predicting and assessing the spatial distribution of K content across the crop fields in Ongenga constituency. This study assessed the spatial distribution of soil potassium in crop fields from four enumeration areas in Ongenga constituency, Ohangwena region. One Hundred and sixty-nine samples were collected from the study area. The samples were thereafter analysed in the laboratory for all soil contents. Sentinel 2a images and the sample points were used for model training. A multiple regression model was developed to predict the Potassium content across the study area. Overall, the Potassium content is low, resulting in low crop production. The use of fertilisers is recommended to increase the crop yield.

ASSESSMENT OF TOTAL DISSOLVED SOLIDS AT THE SOURCE AND TROUGH OF WATER IN ETOSHA NATIONAL PARK, ETOSHA HEIGHTS, AND ONGAVA PRIVATE GAME RESERVE

O. Jonas

Abstract

Natural surface water is scarce in semi-arid and arid climates, and the presence of water is critical for animals and humans. In this context it has become imperative to regularly monitor water quality. Water pollution is an acute environmental issue which affects the potability of different sources, and the main purpose of water quality monitoring is to assess the existing levels of pollutants, their identification, estimation of potential impacts and predict future conditions to implement appropriate remedial measures. The acquisition of the data was done through field work, a total of 208 samples was collected in November & December of 2020, in Etosha National Park, Etosha Height and Ongava Game Reserve and in April and May of 2022 a total number of 172 samples were collected during this period. Water quality measurements were carried out during the wet and dry season to allow for spatial and temporal comparisons. This study assessed the Total dissolved solids at the source and trough of waterholes, samples were taken with a global positioning system device (GPS), and a Hach field portable instruments (HQ40d Multimeter and HQ 14d conductivity meter), apart from the EC readings, the temperature of water samples, PH, Dissolved oxygen (DO), were also taken as well as their remarks which stated whether the waterhole was still active or not, the type of soil that surrounded the waterhole as well as the vegetation type in the area. The use of Geographic information System (GIS) modelling is used as a tool as it is less expensive and gives a complete resolution of the study sites, The researcher used Inverse Distance Weighting (IDW) method, to interpolate the unknown points using the TDS values that were calculated from the Electrical conductivity readings

ANTI-BIOFILM ACTIVITY OF MANGIFERA INDICA AND MORINGA OLEIFERA METHANOLIC PLANT LEAVES EXTRACTS ON A RANGE OF CLINICAL VETERINARY BACTERIA

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Abstract

Medicinal plants have been used traditionally due to their ease of use, access and great effectivity over biofilm forming bacteria in the veterinary sector, these plants have proven to be great alternatives for costly medications. This study aims to determine the following: the presence of phytochemicals in methanolic leaves extracts of *Mangifera indica* and *Moringa oleifera*, the biochemical confirmation of bacteria isolated from clinical veterinary samples such as, *Klebsiella pneumonia*, *Escherichia coli*, *Staphylococcus aureus* field strain and *Staphylococcus aureus* ATCC:25923, their biofilm formation capabilities and whether the plant extracts can inhibit or eradicate biofilms. Minimum inhibitory concentrations (MIC) were determined by serial dilution to obtain the lowest inhibitory concentration of the plant extracts against the test organisms. A thin layer chromatography was used to screen the plant extracts for the presence of coumarins, saponins, antraquinones and alkaloids. Bacteria were grown on MacConkey agar and Mannitol salt agar (MSA) to determine if they are lactose positive or negative. They were also grown on Sulfur, Indole, Motility (SIM) media for conformation of the test bacteria. Then, the biofilm formation was determined by growing the test organisms in flat bottom 96-wells microtiter plates that were incubated for 24 hours, stained with crystal violet and optical densities were measured at 595nm. Biofilm inhibition and eradication followed the same procedure but in the presence of plant extracts. The final MIC of 2ml plant extract was used to make 1,0.5, 0.25, 0.125ml dilutions for both plants over 9ml bacterial stock in broth. *M. oleifera* showed a greater growth inhibition over *E. coli* and *K. pneumonia* at an MIC of 1ml but showed no growth inhibitory for both *S. aureus* bacterial strains. *M. indica* showed a moderate growth inhibition for *E. coli* and a greater one for *K. pneumonia* at an MIC of 1ml but no growth inhibition was observed for both *S. aureus* bacterial strains. A high presence of saponins were observed for *M. oleifera* with a moderate presence of antraquinones and coumarins but no presence of alkaloids. *M. indica* had a high presence of saponins with no presence of antraquinones, coumarins, and alkaloids. Biochemical tests confirmed all test bacteria to be the right strains. *K. pneumonia* and *S. aureus* field strains showed a strong biofilm formation ability, whereas *S. aureus* ATCC 25923 showed a moderate biofilm formation and *E. coli* formed the weakest biofilm. *M. indica* showed the highest inhibition against *E. coli*

NAMIBIA'S CAPABILITY TO SCIENTIFICALLY USE ITS FLORAL RESOURCES TO PRODUCE EFFECTIVE MEDICINE WHILE CREATING OPPORTUNITIES FOR MEDICINAL CHEMISTRY AND PHARMACEUTICAL SECTORS

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Abstract

Despite having resources used in making most of the medical drugs and the trained experts who graduate from the University of Namibia as medicinal chemists and Pharmacists, Namibia spends an average of US\$ 147.12 million (N\$ 2.67 billion) per year as of 2020 on imported medicines for the health sector. The public has been for some time exploiting nature by venturing into herbal medication which has seen significant public diversion from scientifically manufactured medicine due to its high cost and this provides evidence that there are plants that can be used in manufacturing the drugs. Herbal medication from the street markets is booming because of affordability despite the fact that they have not scientifically been tested and measured for consumption. On the other hand, the economy does not benefit anything from these street and traditional herbal trades. This study employs both a qualitative and quantitative approaches to gather data that examines Namibia's capacity to venture into medical drugs production by taking advantage of its floral resources and trained experts. Therefore, the study indicates that given the history of tradition treatment using medicinal plants and the booming street herbal medicine market, Namibia is capable of producing its own medical drugs

with scientific measures and knowledge which will save the economy from massive expenditure on medication and at the same time provide an opportunity to medicinal chemistry and pharmacy graduates to use their acquired knowledge in contributing towards sustainable development. There is a threat as to the possibility that a venture in medical drugs production may cause deforestation and contribute to climate change but this study also explores alternatives that maybe employed to avoid such a threat for example an introduction of policies that encourage forestation and limits in medicinal plants harvests.

Keywords: Namibia, floral resources, medicinal chemists, pharmacists, pharmaceuticals, herbs, scientific, medical drugs, medicine, experts

ANALYSIS OF SOIL MANGANESE IN SANDY-TEXTURED CROP FIELDS AT ONGENGA CONSTITUENCY IN OHANGWENA REGION, NAMIBIA

T. Tjituto, A. Amukwaya, M. Hipondoka

Abstract

Soil manganese is an essential micronutrient for plant growth and development and sustains metabolic roles within different plant cell compartments. This study uses GIS and geographical techniques of Multiple linear regression, Inverse Distance Weighted Interpolation and NDVI (Normalised Distance Vegetation Index) to examine the levels of soil manganese in sandy-textured crop fields in the Ongenga constituency and determine the role of agricultural productivity on stunting in the community compared with existing reported studies on stunting. About 171 sampling points were selected from different sandy-textured crop fields, and interpolation was carried out using Rstudio with the help of the R programming language. Bulk density, total nitrogen, CN ratio, electrical conductivity, and soil organic matter were discovered to vary by 15.56%, 30.11%, 35.17%, 75.33%, and 62.00%, respectively. Soil organic matter levels were highly significant and correlated with the total manganese available. These differences in soil properties are most likely related to the various cropping patterns and fertility management practices used in the study area. A multiple regression model was built from the sample results and pixel values from the sentinel 2a images. The model's results were used to estimate the manganese content of the soil in unsampled areas.

Keywords: Interpolation, NDVI, Soil Manganese & Multiple linear regression

HYDROCHEMICAL CHARACTERISTICS AND FLOW DIRECTIONS OF GROUNDWATER IN THE ZAMBEZI REGION, NAMIBIA

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Abstract

The fundamental assurance for social and human sustainable development is clean and safe groundwater. Therefore, in this study, an investigation of groundwater's Upper Kalahari Aquifer (UKA) was carried out in the Zambezi Region, the northeastern part of Namibia. The data was obtained from Division of Water Environment within the Ministry of Agriculture, Water and Land Reform (MAWLR) databases including GROWAS, 34 groundwater samples for physical and chemical analysis and 600 borehole data for understanding the aquifer system. The borehole data was used to determine groundwater flow directions of the UKA and assess the patterns of groundwater types with groundwater flow directions relating to hydrochemical characteristics. The results showed that groundwater in this region generally has low alkalinity to slightly alkaline with pH values ranging from 6.3 to 9.1. Total dissolved solids (TDS) ranged from 28 to 2787 mg/L and 11.78% of samples exceed acceptable limits (1000 mg/L) for drinking purposes. The statistical analysis of hydrochemical parameters shows that the abundance of cations is $\text{Na}^+ > \text{Ca}^{2+} > \text{Mg}^{2+} > \text{K}^+$. The abundance of anion concentrations is in the order of $\text{SO}_4^{2-} > \text{Cl}^- > \text{HCO}_3^-$. The Piper plot suggests that the dominant water-

type is Ca-HCO₃ (26.5%), followed by Ca-Mg-HCO₃ water type (20.6%). Moreover, from the Gibbs diagram, most of the water samples fall in the rock dominance category which indicates that the chemical weathering of rock minerals is the main process controlling the quality of groundwater. The recharge characteristics were observed in the majority of the samples falling in Field 5 (recharging waters: Ca-Mg-HCO₃ type, Ca-Mg dominant HCO₃ type or HCO₃ dominant Ca-Mg type waters), having temporary hardness. Based on the flow net analysis, the groundwater flow pattern in the Zambezi Region is assumed to be moving mostly from the western part of the region to the eastern part of the region. Due to the long-term effects of pollutants migration, it is necessary to stringently monitor groundwater quality, to ensure sustainable water security.

Keywords: Zambezi, Upper Kalahari Aquifer, Hydrochemistry, Anthropogenic

Compiled by Dr. Opeoluwa Oyedele, Mr. Peter Imanuel and Mr. David Nanhapo