Advances and Impacts of Science and Technology Towards Sustainable Future

Faculty of Science
University of Ruhuna

RISTCON 2024

Proceedings of
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Abstracts and Plenary Lectures

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Editorial Note

Thanks to all the authors, we have received a high number of abstracts in diverse disciplines under science and technology for RISTCON-2024. First, all of the initial submissions were screened for novelty and plagiarism. We then used a double-blind review, with each blind (extended) abstract sent to three experts in the relevant field. The final decision of the submitted abstract was made by the editorial board by considering the decisions and comments made by the reviewers. We believe that this unbiased review process has ensured a high quality and standard in the publication of proceedings.

However, the responsibility for the content in each publication remains with the respective authors. No part of this serial publication will be reproduced in any form. When citing the published abstracts, this serial publication can be referred to as 'Proceedings of the 11th Ruhuna International Science and Technology Conference - 2024, Faculty of Science, University of Ruhuna, Matara, Sri Lanka'.

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Message from the Vice Chancellor, University of Ruhuna

As the Vice Chancellor of the University of Ruhuna, it gives immense pleasure to send this message to the 11th Ruhuna International Science and Technology Conference (RISTCON 2024). I wish to extend my best wishes to all of you as we embark on the exciting journey of the RISTCON 2024 centered around the theme "Advances in Science and Technology Toward a Sustainable Future."

In the pursuit of knowledge and innovation, our collective efforts in advancing science and technology play a pivotal role in shaping the trajectory of our shared future. This conference serves as a testament to our commitment to fostering groundbreaking research and creating a platform for the exchange of ideas that can pave the way for a sustainable and harmonious world. The challenges we face in the 21st century demand creative and sustainable solutions. It is through collaborative research endeavors that we can harness the power of science and technology to address pressing global issues, ranging from climate change and resource depletion to public health and social equity. Your dedication to pushing the boundaries of knowledge and finding practical applications for the betterment of society is truly commendable.

I encourage each participant to engage in meaningful discussions, share insights, and forge new collaborations during this conference. The diverse perspectives and expertise represented here will undoubtedly contribute to the generation of innovative solutions that can propel us toward a more sustainable and resilient future. This conference will be a source of fostering intellectual growth, and connections that transcend disciplinary boundaries. I am confident that your contributions will have a lasting impact, influencing the trajectory of scientific and technological advancements with a keen eye on sustainability.

Once again, my sincere appreciation goes to the Dean Faculty of Science, the Organizing committee, and all who contributed to making RISTOCON 2024 a successful and enriching research conference. Wishing you all a very fruitful day, and may this conference be a stepping stone towards a brighter and more sustainable future.

Senior Professor Sujeewa Amarasena
Vice Chancellor
University of Ruhuna

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Message from the Dean, Faculty of Science, University of Ruhuna

It is both an honor and a pleasure to extend my warmest greetings to all participants of the RISTCON 2024, which has been specifically focused on addressing 'Advances and Impacts of Science and Technology towards a Sustainable Future'.

As we gather to explore the cutting-edge developments in science and technology, it is imperative to acknowledge the transformative role these advancements play in shaping a sustainable future for generations to come. The impact of scientific and technological innovations goes beyond the confines of laboratories and research institutions; it permeates into every aspect of our lives, influencing societal progress, economic growth, and environmental conservation. By fostering collaboration and innovation, we can pave the way for solutions that address the pressing challenges facing our planet.

The wealth of knowledge and expertise shared by the esteemed authors in their research and presentations is a testament to the collective pursuit of a brighter and more sustainable future. I extend my heartfelt congratulations to each and every author for their valuable contributions. Your dedication to advancing the frontiers of science and technology is inspiring, and I believe your work will contribute significantly to the global discourse on sustainability.

I would like to express my sincere gratitude to the distinguished guests and invited speakers for their presence and contributions to the conference. Your participation has added immeasurable value to our conference, and your insights have enriched the discussions on the transformative potential of science and technology in building a sustainable future. The success of the conference is a testament to the collective effort and support from sponsors and well-wishers and I thank you for your generosity and encouragement.

I am grateful to the administration for recognition of the importance of the conference and granting permission for discussions and explorations on this timely important topic. To the dedicated members of the Organizing Committee, I extend my deepest appreciation for your tireless efforts in orchestrating such a well-structured and impactful event. Your commitment to ensuring the success of this conference is truly commendable.

Wishing you all a productive and enlightening conference.

Prof. D. H. N. Munasinghe
Dean and Professor in Zoology
Faculty of Science, University of Ruhuna

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Message from the Chairperson – RISTCON 2024

As the Chairperson of the Organizing Committee of RISTCON 2024, it is indeed a great pleasure for me to extend a warm welcome to all of you attending the 11th Ruhuna International Science and Technology Conference (RISTCON 2024). This prestigious event is scheduled to take place on the 24th of January 2024, under the overarching theme of "Advances and Impacts of Science and Technology Toward Sustainable Future." For more than a decade, RISTCON has been a beacon of intellectual exchange, thanks to the continuous guidance and supervision of our esteemed leaders, Vice Chancellor Senior Professor Sujeewa Amarasena, Deputy Vice-Chancellor Professor E.P.S Chandana, and Dean of the Faculty of Science, Professor Hemali Munasinghe and all the dedicated academic staff members of the Faculty of Science. Their unwavering encouragement and consistent guidance have played a pivotal role in ensuring the success of this event. It is a testament to our commitment to advancing knowledge in the realms of Science and Technology.

RISTCON 2024 serves as a vibrant platform, fostering discussions on the latest developments, discoveries, and innovations across a diverse array of subjects encompassing Science, Engineering, Agriculture, Medicine, Health Sciences, Fisheries and Aquatics, Natural Sciences, and beyond. This year, we received about 160 research communications from both local and international scholars, reflecting the global significance of this conference. The rigorous triple-blind reviews, expertly conducted by national and international professionals representing various disciplines, have resulted in the acceptance of approximately 120 research abstracts for presentation at the conference. These carefully selected abstracts, scrutinized by a diligent seven-member Editorial Board for novelty, plagiarism, and language, will be featured in the esteemed proceedings of RISTCON 2024.

My sincere appreciation goes out to all the reviewers who dedicated their valuable time to the meticulous reviewing process. A special thanks go to the Advisory board members who were the pillars of success throughout our journey. Further, I would like to express my profound gratitude to our distinguished Keynote Speaker, Professor Stefan H. Bossmann, traveling from United States, and Katrin Bossmann for accompanying Stefan to embrace us here today. My heartfelt gratitude goes to the Plenary Speakers, Professor Udith K. Jayasinghe, and Prof. C.A.N. Fernando, for graciously accepting our invitations to share their invaluable knowledge and insights with us. A special Thanks goes to the invited academic staff members who will be felicitated today for their everlasting dedication given to the Faculty of Science, University of Ruhuna.

Organizing an event of this magnitude requires meticulous planning and the dedicated efforts of a motivated team. I have been fortunate to work alongside an exceptional group of individuals on the Advisory Board, Editorial Board, and Organizing Committee. Their hard work and unwavering dedication have been instrumental in bringing this event to fruition.

A special note of thanks is extended to our sponsors, Bank of Ceylon, CONIFS Globals (Pvt) Ltd, Nippon Paints Company, George Steuarts Group of companies, and Bandula Hardware (Pvt) Ltd. for their generous financial support, which has significantly contributed to the success of RISTCON 2024. Additionally, I express my gratitude to all members of the Faculty of Science whose immense support has been integral to the realization of this event.

I extend my deepest gratitude to the organizing committee and well-wishers who have played a pivotal role in making this event possible. Your dedication and support have been instrumental in shaping RISTCON into the esteemed conference it is today.

May this gathering be a source of inspiration, collaboration, and empowerment. I eagerly anticipate the insightful discussions and impactful contributions that will emerge from RISTCON 2022.

Thank you, and I look forward to the success of our collective endeavors.

Dr. (Mrs.) H. C. Manawadu
Chairperson / RISTCON2024
Department of Chemistry
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Keynote Speech

Tailored nanostructures for drug delivery and early cancer detection

Bossmann S.H., Covarrubias-Zambrano O., Neri-Sierra R., Kamath D., Payne M.

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Abstract

The Bossmann group at the University of Kansas Medical Center is developing new nanotechnology to address key problems in cancer treatment. 1) With regard to drug delivery, we have developed poly(beta-amino ester)-based nanoparticles that use peptide signaling sequences to circumvent the reticuloendothelial system and to deliver their payload (small molecule drugs or mRNA) with precision to the sites of tumors and metastases. 2) To facilitate early detection of solid tumors, we have developed nanoparticle-based nanobiosensors for protease activities in serum since 2007. Recently, we have adapted a few-layer graphene as core nanostructure. This permits the design of long-term stable nanobiosensors capable of detecting pancreatic, lung, and ovarian cancer with very high precision at stage 1. The lower the cancer stage, the better are current treatment modalities.

Key words

Drug Delivery, Nanomedicine, Chimeric Signaling, Tumor Microenvironment, Graphene Nanobiosensor

Addressing the Challenge of Effective Drug Delivery

The discovery of effective Macromolecule Therapeutics has been significantly prolonged by the physiological differences between mice and (wo)men. Whereas a plethora of macromolecule/ nanodelivery systems exists to date that works very well in mouse models, there has been only limited success in humans [1, 2]. Therefore, “Systematically deliver macromolecules to intracellular targets for therapeutic benefit in cancer” has been declared a Cancer Grand Challenge by the National Cancer Institute (NCI) and Cancer Research UK (CRUK)[3]. We are addressing this challenge by chimeric signaling using attached signaling peptides. We are combining the “Don’t Eat Me Concept” in macromolecule delivery by CD-47 mimicry and by accelerating macromolecule uptake by tumors through the targeting of highly selective surface peptides.

The guiding paradigm of our research is that effective delivery of macro-molecule therapeutics to human tumors requires three consecutive steps. 1) Enhanced Extravasation, 2) Effective Targeting of Suitable Surface Receptors at the Surface of Cancer Cells, 3) Effective Uptake, Endosomal Escape, and Release of the Therapeutic Payload. Effective Macromolecule Therapeutics requires synergy of all three steps. A poly-beta-amino ester copolymer (PBAE) was selected as macromolecule for micro-RNA and drug delivery. The Bossmann group's versatile PBAE technology permits delivery of drugs to all cellular targets [4].

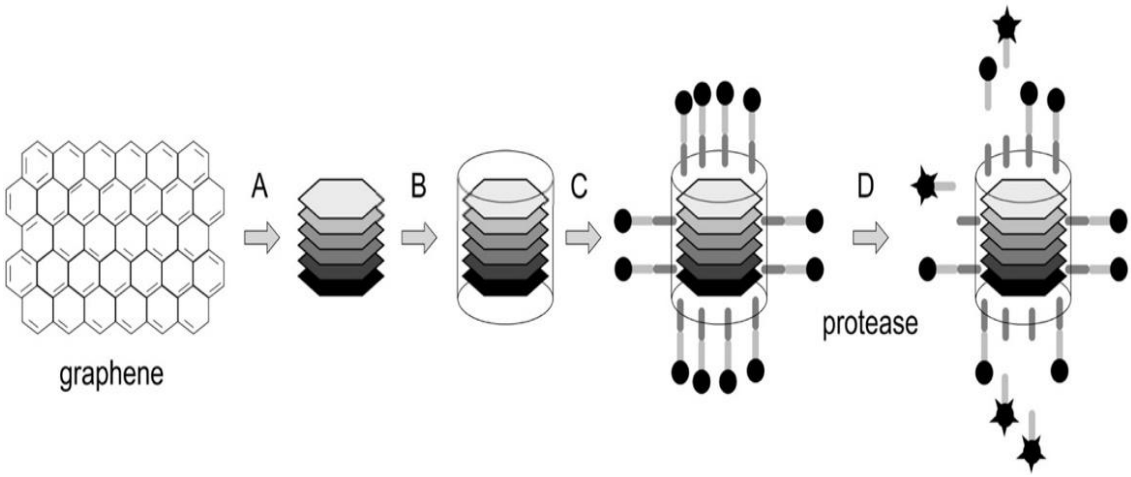
The Challenge of Early Cancer Diagnoses

Biomarkers[5] are biological molecules (enzymes, antibodies, peptides, etc.) that are present in bodily fluids or tissue and can be used for multiple diagnoses based on their expression and activity. The proposed study focuses on *proteases*[6], enzymes that degrade proteins. *Proteases* regulate signaling pathways and play essential roles in disease progression. Furthermore, the proteolytic network interacts with other important signaling pathways in cellular biology, involving chemokines, cytokines, and kinases[6]. Over 600 human proteases are active in regulating processes, approximately two percent of the human genome. For example, matrix metalloproteinases (MMPs) are a family of proteases that can degrade extracellular matrix (ECM), connective tissues, basement membranes, and have increased activity in inflammatory diseases including Cancer. One of the most important characteristics of proteases is that they form a proteolytic network and depend on activation by other proteases. This permits the selection of signature proteases at important nodes of this very complex network that are indicative as disease and/or inflammation markers. By utilizing multiple proteases as biomarkers, a crowd response can be obtained that is indicative of specific diseases or responses to interventions[7, 8].

Development of Graphene-based Nanobiosensors (G-NBS)

In 2020 Hawkeye Bio LLC, a development stage medical technology company based in Torrance, California, gained interest in this technology for lung cancer early detection. When initial collaboration work started, various challenges were faced with this NBS technology, which included poor long-term stability, expensive mass production due to the requirement of two fluorescent dyes (one for Förster Resonance Energy Transfer (FRET) quenching and one for sensing), relatively poor repeatability, and Fe/Fe_3O_4 nanoparticles becoming magnetized during shipping, which significantly reduced its water dispersion properties. For this reason, a newer novel NBS was developed, replacing the Fe/Fe_3O_4 core with detonation graphene. The new derived graphene-NBS has overcome the major challenges faced by the previous Fe/Fe_3O_4 generation. graphene-NBSs are highly water/buffer dispersible, and they have a superior long-term stability.

Explosion graphene's optical absorption properties makes it a very effective quencher for fluorescent molecules. Therefore, only one dye is required for the new novel technology.



Design of NBS (A) Few-layer graphene (n=5-7); (B) Addition of the TEG4amine layer; (C) Anchoring of the consensus sequences + fluorescent dye (tetrakis-carboxycarbonyl-porphyrin, TCPP) via amide bonds; (D) proteolytic activation: The consensus sequences is cleaved, and the fluorescence of the dye is activated.

Graphene-NBS consists of a series of reactions to modify the surface layer of graphene. First, bromovaleric acid is added to explosion graphene to form a carboxygraphene (CG) layered intermediate, which is then further coated with branched polyethylenimine (PEI) to generate G-PEI intermediate, and finally, a TCPP-labeled oligopeptide is linked to complete the graphene-PEI NBS.

To further improve this technology, Covarrubias and Bossmann have developed a newer Generation 2.0 of graphene-NBS, saving steps to modify the surface layer of graphene, which will be the focus of my presentation.

Acknowledgements

Dr. Stefan H. Bossmann acknowledges the intellectual contributions from Drs. Thilani Samarakoon, Dinusha Udukala, Harshi Manawadu, and Madumali Kalubowilage, as well as financial support from NSF (EFRI 2129617) and NIH (R01 CA284065-01)

References:

1. Bertrand N, Wu J, Xu X, Kamaly N, Farokhzad OC. Cancer nanotechnology: the impact of passive and active targeting in the era of modern cancer biology. Advanced drug delivery reviews. 2014;66:2-25. Epub 2013/11/22. doi: 10.1016/j.addr.2013.11.009. PubMed PMID: 24270007.

2. Shi J, Kantoff PW, Wooster R, Farokhzad OC. Cancer nanomedicine: progress, challenges and opportunities. Nature reviews Cancer. 2017;17(1):20-37. Epub 2016/11/11. doi: 10.1038/nrc.2016.108. PubMed PMID: 27834398.

3. https://www.cancer.gov/grants-training/grants-funding/cancer-grand-challenges.

4. Covarrubias-Zambrano O, Shrestha TB, Pyle M, Montes-Gonzalez M, Troyer DL, Bossmann SH. Development of a Gene Delivery System Composed of a Cell-Penetrating Peptide and a Nontoxic Polymer. ACS Appl Bio Mater. 2020;3(11):7418-27. doi: 10.1021/acsabm.0c00561.

5. Aronson JK, Ferner RE. Biomarkers-A General Review. Curr Protoc Pharmacol. 2017;76:9.23.1-9..17. Epub 20170317. doi: 10.1002/cpph.19. PubMed PMID: 28306150.

6. Mason SD, Joyce JA. Proteolytic networks in cancer. Trends Cell Biol. 2011;21(4):228-37. doi: 10.1016/j.tcb.2010.12.002. PubMed PMID: WOS:000290054000005.

7. Kasi A, Sun W, Ehsan S, Covarrubias J, Eschliman K, Neri R, Agarwal D, Zambrano OC, Bossmann SH, Natarajan B. Early detection of pancreatic cancers by novel nanobiosensor-based protease biomarkers using hierarchical decision structure. Journal of Clinical Oncology. 2021;39(15_suppl):e16273-e. doi: 10.1200/JCO.2021.39.15_suppl.e16273.

8. Covarrubias-Zambrano O, Agarwal D, Kalubowilage M, Ehsan S, Yapa AS, Covarrubias J, Kasi A, Natarajan B, Bossmann SH. A New Hope for Liquid Biopsies: Early Detection of Pancreatic Cancer By Means of Protease Activity Detection in Serum Applying a Hierarchical Decision Structure. medRxiv. 2022:2022.10.18.22281240. doi: 10.1101/2022.10.18.22281240.

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Creating a researcher with an entrepreneurial mindset to build-up the science-based & technology-oriented research system of a nation is socially-responsible

Professor Udith K. Jayasinghe

Senior Professor (Chair) of Agribusiness Management

Vice Chancellor, Wayamba University of Sri Lanka

Conventional wisdom has placed a more faith on; out of three social systems exists ('Market', 'Government', and 'Judiciary'), one system, i.e. the Government, in addressing the needs and wants of the society. In this process, the principle "justification" for public policy intervention lies by overly enlarging the "seemingly visible shortcomings" of the private markets and publicly-operating legal systems. Yet, in the arena of research and development, and more specifically on dissemination of the outputs/outcomes generated from which, it is our responsibility, as academics/administrators/professionals attach to various institutions/professional bodies, to bring the right thing and things right to address the problems in the society.

However, a question remains. Don't we see a significant gap with regard to achieving of this well-highlighted dilemma, especially in the context of bringing those outputs/outcomes generated by way of science & technology-oriented research into practice in the locally context'?

Here we point out, and then argue, that there are many 'Reasons' behind these 'Effects', i.e. failure to bring those favorable outputs/outcomes up to the level of doorstep of a local household. Out of numerous reasons cited, a few, yet truly countable, reasons are taken into the discussion. First to consider is: Where our 'Mindset' on research lies? To explain this, the traits of Genetic, Physic and Environmental, which were explored in Determinism Theory, shall be put forwarded. What skills the researchers are lacking by now; thus, need to be supplemented will be explored, i.e. the Cognitive, Psychomotor and Affective skills towards 'piloting' a research into a practice. The multidimensional scales of: Interpersonal, Intra-personal, Bodily-Kinesthetic, Logical-Mathematical, Linguistic, Musical, Spatial, Naturalist are also taken into account. Finally, the importance of bringing the 'Definitions'; 'Thoughts', and 'Words' into an 'Action' through a systematic flow shall be detailed. We conclude that all these collectively generate an "Entrepreneurial Mindset" for a researcher with which he/she can fulfill his/her commitment to the society.

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How nano science technology contributes for a better life

Professor C. A. N. Fernando

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Nanoscience and nanotechnology have the potential to contribute significantly to various aspects of life, leading to advancements in numerous fields. Here are several ways in which nanoscience and nanotechnology contribute to a better life:

1. **Medicine and Healthcare:**
   - Drug Delivery: Nanoparticles can be designed to deliver drugs to specific cells or tissues, increasing drug efficacy and minimizing side effects.
   - Diagnostic Tools: Nanoscale materials enable the development of highly sensitive diagnostic tools for early detection of diseases.
   - Therapeutics: Nanoparticles are used in therapies such as hyperthermia and photodynamic therapy for treating diseases like cancer.

2. **Materials Science:**
   - Stronger and Lighter Materials: Nanomaterials can enhance the strength and reduce the weight of materials, leading to improvements in construction, aerospace, and automotive industries.
   - Smart Materials: Nanotechnology allows the creation of smart materials that can respond to external stimuli, leading to applications in areas such as self-healing materials and responsive textiles.

3. **Energy:**
   - Solar Cells: Nanotechnology can improve the efficiency of solar cells, making renewable energy sources more viable.
   - Energy Storage: Nanomaterials are being used to enhance the performance of batteries and supercapacitors for energy storage.

4. **Environmental Remediation:**
   - Water Purification: Nanomaterials can be employed in water treatment processes for efficient removal of contaminants.
   - Air Purification: Nanotechnology-based filters can capture and remove pollutants from the air, contributing to better air quality.

5. **Electronics and Computing:**
   - Smaller and Faster Devices: Nanoscale components enable the development of smaller and more powerful electronic devices.
   - Quantum Computing: Nanotechnology plays a crucial role in the development of quantum computing, potentially revolutionizing information processing.

6. **Food and Agriculture:**
   - Food Packaging: Nanomaterials can be used in food packaging to enhance shelf life and reduce food waste.
   - Precision Agriculture: Nanosensors can monitor soil conditions and crop health, enabling more precise and sustainable agricultural practices.

7. **Water and Air Filtration:**
   - Nanofiltration: Nanotechnology is used in advanced filtration systems to purify water and air, addressing environmental and health concerns.

8. **Clothing and Textiles:**
   - Stain-Resistant Fabrics: Nanocoatings on textiles can make them more resistant to stains and water.
   - Antibacterial Fabrics: Nanoparticles with antibacterial properties can be incorporated into clothing to prevent the growth of harmful microorganisms.

While nanoscience and nanotechnology offer promising solutions, it's important to consider and address potential ethical, environmental, and safety concerns associated with their widespread application. Responsible development and deployment are crucial for ensuring the positive impact of nanotechnology on society.

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Analysis of insulin-like peptide 3 and testosterone concentrations with selected morphometric attributes in Thamankaduwa white male cattle

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The present study aimed to investigate the serum changes of insulin-like peptide 3 (INSL3) and testosterone in Thamankaduwa White male cattle during development, and to assess the associations among INSL3, testosterone, and selected body parameters, namely, body weight, height at withers, body length, and chest girth of cattle. Morphometric measurements and blood samples (n = 41) were collected under three age categories, i.e. 3 - 6 months (Group I; n = 12), 6 - 12 months (Group II; n = 14), and > 12 months (Group III; n = 15) of bulls in Chenkalady veterinary range, Batticaloa District. Serum INSL3 and testosterone concentrations were measured by using a competitive enzyme immunoassay. Intra- and inter-assay coefficient of variations of INSL3 and testosterone assays were 6.9% (n = 6) and 16.4% (n = 6), and 12.5% (n = 3) and 11.9% (n = 4), respectively. Serum INSL3 and testosterone concentrations ranged between 1.44 - 19.85 ng/mL and 0.003 - 2.81 ng/mL, respectively. The mean INSL3 and testosterone concentrations did not differ ($p > 0.05$) in Group I and II, but were elevated in Group III ($p < 0.05$). There was a strong association ($R^2 = 0.65$; $p < 0.05$) between serum INSL3 and testosterone concentrations. No strong associations were found between the tested hormones and morphometric attributes. In conclusion, the changes in circulating INSL3 and testosterone levels in Thamankaduwa White male cattle showed a similar pattern in the three tested age groups, and strongly correlated with each other.

Keywords: cattle, INSL3, hormone, serum, testosterone

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Development of *Trichoderma* based bulb treatment for the management of anthracnose and white rot in onion (*Allium cepa* L.)

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Onion (*Allium cepa* L.), which belongs to family Liliaceae is susceptible to anthracnose and white rot diseases in fields. Onion farmers rely on fungicides, to manage these diseases despite the high production cost and environmental pollution. Bulb treatment with *Trichoderma* fungus, widely used as a biocontrol agent, could be a sustainable option to manage these diseases in onion. Therefore, an investigation was carried out to develop a bulb treatment protocol before planting to manage field diseases; anthracnose caused by *Colletotrichum gloeosporioides* and white rot caused by *Stromatinia cepivora* in onion. Big onion variety *MIBO* 01 bulbs were treated prior to planting in pots by mixing with *Trichoderma* powder ($4*10^6$ CFU per gram) (T1), by soaking in *Trichoderma* liquid(T2) and soaking bulbs with the fungicide Thiophanate-methyl (50%) + thiram 30% W/W (T3), together with untreated control (T4). The pots (10 replicates per treatment) were arranged in a completely randomized design (CRD). The data was subjected to one-way ANOVA and DMRT using SAS software at a 5% probability level. Anthracnose Disease Severity index (ADSI) and the white rot disease incidence (WDI) were significantly different among the treatments at $P < 0.05$. ADSI and values in T1, T2, T3 and T4 were in the order of 11.1 ± 0.15%, 33.3±0.35%, 39.9±0.45% and 63.3±0.85%, respectively while WDI in T1, T2 are 00%, T3 and T4 were in order 30% and 50%, respectively. These findings suggest the pre-planting application of *Trichoderma* on bulbs as a promising alternative to fungicides in managing white rot infections and the leaf anthracnose of the big onion variety *MIBO* 01. Repetitive field trials would be helpful in order to optimize the efficacy of the treatment.

Keywords: Anthracnose, Big onion, Bulb treatment, *Trichoderma* spp., White rot

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Can leaf micromorphology and foliar anatomy be used to identify cinnamon species in Sri Lanka?

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There are eight *Cinnamomum* species and *C. zeylanicum* is one of the most economically important spice crops, bringing a considerable amount of foreign currency to the country. Flowering time varies among the species and flowers are rare. Plants' morphology is affected by the environmental conditions making it difficult to rely on only morphology to differentiate the *Cinnamomum* species found in the country. In the absence of floral or fruiting materials, it is possible to use anatomical characters to differentiate the species. This study aimed to use light and scanning electron microscopy of leaf micromorphology, petiole and foliar anatomy of Sri Lankan *Cinnamomum* species, *C. capparu-coronde*, *C. citriodorum*, *C. dubium*, *C. litsiaefolium*, *C. ovalifolium*, *C. rivulorum*, *C. sinharajaense* and *C. zeylanicum* to determine the taxonomically informative characters to differentiate the species. The shape and the amount of cuticular materials present on abaxial and adaxial surfaces were different within and between species. Hypo-stomatic stomata and different properties of trichomes (whether unicellular, simple, unbranched, solitary or non-glandular) were observed and in some species, the density of the trichomes was different on abaxial and adaxial surfaces. In the midrib cross-section, symmetrical, asymmetrical, boat, irregular, and saucer-shaped contours were observed. The vascular tissue was one open arch and different shapes of vascular bundles (oval, elongated, irregular, 'V', partially dissected into 2 or 3 segments) were observed in different species. Leaf cuticular features, trichome shape and density, midrib cross-section outline and the shape of vascular bundles are taxonomically informative characteristics that can differentiate the eight *Cinnamomum* species.

Keywords: *Cinnamomum*, Cuticular materials, Microscopy, Trichomes, Stomata

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Evaluation of characteristics of composite blend of Wheat (*Triticum aestivum L.*) and *Angili bathala* (*Ipomoea batatas*) cultivar flour for cake development

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Wheat flour (WF) is the key ingredient of the bakery industry. It is imported spending high foreign revenue. Local sweet potato cultivars like *Angili Bathala* are underutilized. Therefore, the potential of substituting WF with *Angili Bathala* flour (SPF) in cake production was studied. Cake formulas were produced as A (100% WF/ control), B (60% WF and 40% SPF), C (50% WF and 50% SPF), and D (40% WF and 60% SPF). Flour properties of SPF and physico-functional properties of most consumer accepted cake were analyzed using standard methods. Results of bulk density, water absorption capacity, oil absorption capacity, swelling capacity, and foaming capacity were 0.64 ± 0.01 gcm^{-3}, 181.67 ± 0.47%, 250.00 ± 0.01%, 21.50 ± 0.71 ml, and 0.00 ± 0.00%. Formula C with 50% SPF was identified as the most consumer-accepted cake using a five-point hedonic scale. A significant relationship between consumer acceptability and sensory attributes (appearance, color, aroma, taste, mouth feel, after taste) was identified through Friedman test. Moisture, fat, total ash, and crude fiber contents were 15.28 ± 0.01%, 19.38 ± 0.01%, 3.24±0.01%, and 1.39 ± 0.01% respectively. Beta-carotene content, polyphenol content, and IC_{50} value for DPPH radical scavenging activity were 0.05 mg/100 g, 0.008 GAE/ml, and 0.109 mg/ml respectively. Results of textural properties for cake were as follows; Hardness (260.50 ± 0.71 g), chewiness (139.44 ± 0.40 mJ), gumminess (257.70 ± 0.00 g), adhesiveness (0.02 ± 0.01 mJ), springiness (56.31 ± 0.03 mm), cohesiveness (0.97 ± 0.04) and resilience (0.54 ± 0.01). Therefore, results of the research revealed that 50% of wheat flour can be substituted with *Angli Bathala* sweet potato flour in cake production while value addition to the local cultivar.

Keywords: Angili bathala, Antioxidant properties, Bakery industry, Proximate composition, Textural properties

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Comparison of *In vitro* antibacterial activity of *Plectranthus hadiensis*, *Cyperus rotundus* and *Desmodium triflorum* extracts against *Enterococcus faecalis*

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Enterococcus faecalis is an opportunistic pathogen in gastroenteric tract, causes a significant number of antibiotic-resistant infections. This study was conducted to explore the antibacterial activity of *Plectranthus hadiensis*, *Cyperus rotundus* and *Desmodium triflorum* plant extracts against *E. faecalis*. Crude extracts were obtained through maceration with Hexane, Dichloromethane (DCM), Ethyl acetate, Acetone, and Methanol solvents. Crude extract 1mg was dissolved in 1mL of solvent which use for the extraction previously. Antimicrobial activity was investigated by disk-diffusion method. Chloramphenicol disc as the positive control and solvent soaked disc as the negative control were used. Minimum inhibitory concentrations (MIC) in two-fold dilution of DCM plant extracts from 4 mg/mL to 0.125 mg/mL were determined by microbroth-dilution method. Chloramphenicol as the positive control and Muller Higton Broth + DCM as the negative control were used. Breakpoints were confirmed by culturing a loopful from the well on Muller Higton Agar plates as a purity check. DCM extracts of *P. hadiensis*, showed remarkable *in vitro* antibacterial activity by suppressing *E. faecalis* with the highest mean Zone of inhibition (ZOI) (16.67±0.57 mm). *P. hadiensis, C. rotundus* and *D. triflorum* DCM extract showed MIC of 0.25-0.125 mg/mL, 1-0.5 mg/mL and 2-1 mg/mL respectively. According to the results of the present study, DCM is the most effective solvent for solubilizing antimicrobial compounds and *P. hadiensis* is the plant containing most effective active compounds which can be potential sources for the synthesis of novel drugs to suppress *E. faecalis.*

Keywords: Antimicrobial activity, Antibiotic-resistant, DCM extract, *Enterococcus faecalis*, MIC

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In vitro evaluation of acute toxicity of citrus essential oils towards the parasitic mite *Tetranychus urticae*

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Tetranychus urticae is the most important parasitic mite on red worms negatively impacting vermicompost production. The efficiency of vermicompost beds can be severely affected by the occurrence of red spider mites. Although various chemicals with acaricidal effects have been used to control these mites, their frequent use may result in a negative effect on the environment. This study aimed to evaluate the effect of selected citrus peel extracts on the mite population and to assess their toxicity on *Eisenia fetida*. Essential oils were extracted from peels of four fruit species of citrus, namely, *Citrus limon* (lemon), *Citrus aurantiifolia* (lime), *Citrus reticulata* (mandarin), and *Citrus maxima* (pomelo), and tested for their acaricidal and repellent activities at five different concentrations (0.125, 0.25, 0.5, 1 and 2 mg/ml) using *Tetranychus urticae*. Five adult mites were gently transferred into a previously prepared tube using a small paint brush in three replicates for each concentration. Mite mortality, inactive stage, and active stage were assessed. A toxicity study was conducted using *E. fetida*. The findings showed that pomelo oil has the highest level of acaricidal and repellent activity against mites and mandarin oil recorded the lowest activity. Only 20% of mites were active after exposure to mandarin, lemon, and lime, whereas a maximum of 40% of mites were inactive after the treatment. No toxic symptoms were observed on earthworms treated with all types of citrus essential oils. The findings of the present study indicated that lime and pomelo can be suggested as potential agents for controlling mites on vermicomposting beds. These extracts can be formulated with additives and recommended to farmers.

Keywords: Acaricidal activity, citrus fruit, Eisenia fetida, red spider mite, steam distillation

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Isolation of phosphate solubilizing bacteria from soil and its application in plant growth promotion: As a green approach

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Phosphate is an essential nutrient for plant growth, playing a significant role in different physiological and biochemical processes. Phosphate-solubilizing bacteria (PSB) have emerged as eco-friendly and sustainable alternatives to chemical fertilizers, enhancing soil fertility and promoting plant growth. PSB convert the insoluble phosphate into the soluble form by using different mechanisms. The aim of the present study is to assess the application of PSB as a biofertilizer. Pikovskaya's agar medium was used to isolate PSB strains. Isolated bacteria strains were labeled as PSB-A, PSB-B, and PSB-C. The effects of isolated bacteria strains were determined using a pot experiment. Gram stain, motility test, starch hydrolysis test and catalase tests were done as biochemical tests. Isolated bacteria strains were inoculated into the prepared potting medium, which was consisted of soil and compost in a 1:1 ratio. The effect of PSB strains on plant growth was studied using *Vigna radiata* (Mung bean). Plant growth parameters (Shoot and Root length) were recorded after 21 days. The bacterial concentration on plant growth was determined as an optimization study. PSB strains inoculated pots showed a significant increase for both shoot and root lengths in comparison to the control ($n = 9$, $p < 0.05$). Potting media consisting of PSB-A showed the best results; the highest root length (6.9 ± 0.8 cm) and the highest shoot length (27.8 ± 2.1 cm). The optimization study proved that there is a significant effect of the concentration of microbial biomass on plant growth. Hence, isolated PSB-A, PSB-B, and PSB-C are recommended as suitable biofertilizer strains for potting medium.

Keywords: Biofertilizer, PSB strain, Phosphorus, Plant growth

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Determination of growing media for black soldier fly (*Hermetia illucens*) production using organic waste ingredients

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Black soldier fly (BSF), *Hermetia illucens* L. (Family Stratiomyidae, Diptera) larvae are used to substantiate protein supplements in agro-based industries. This study investigated the biology of larval instars, their growth in different organic solid wastes, and the proximate analysis of BSF larvae powder as poultry feed. Different instars were determined by using Dyer's rule. One-way analysis of variance and DMRT were performed ($p < 0.005$). The length (mean ± SD) and width of eggs were 0.93 ± 0.03 mm and 0.012 ± 0.001 mm, respectively. There were five larval instars and the length and width of larvae varied from 1.39 ± 0.01 mm to 18.98 ± 1.29 mm. The length and width of pupa were 19.28 ± 0.99 mm and 5.54 ± 0.34 mm, respectively. Sexual dimorphism was exhibited in males with lower round tails, whereas females had a scissor-like tail. Papaya fruit wastes yielded larvae of 18.47 ± 0.03 mm in length followed by pumpkin (18.24 ± 0.01 mm) and Jack fruit (18.21 ± 0.01 mm). Rice bran was the best substrate among the flour tested. Jack fruit recorded high larval protein (63.15 ± 0.05%) and ash (29.52 ± 0.01%) whereas mango yielded high lipid (4.98 ± 0.01%) and potassium (0.96 ± 0.02%). The BSF larvae powder had a high protein level compared with other poultry feed ingredients tested. Jack fruit and mango fruit wastes reported the best larval growth and therefore those can produce a better protein source for poultry feeds. Future studies can be done by feeding BSF larvae powder to the poultry to test their egg-laying and growth performances.

Keywords: Fruit and vegetable wastes, larval growth parameters, poultry feed

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Development of instant pasta using composite flour mixture of unripe banana (*Musa acuminata) and* jackfruit seeds (*Artocarpus heterophyllus*)

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The application of Jackfruit seed powder in convenience foods could boost the commercial value of Jack fruit seeds while also helping to meet the population's protein needs. Green banana is a food of great value with various therapeutic properties. Therefore, the present study was focused on developing an instant pasta using composite flour mixture of green bananas and jackfruit seeds flour. Composite flour mixtures were prepared with different proportions of UGB and JFS (T1: 15% UGB, 5% JFS, 80% wheat w/w; T2: 20% UGB, 10% JFS, 70% wheat w/w; T3: 25% UGB, 15% JFS, 60% wheat w/w; T4: 100% w/w wheat as control). The proximate composition, physicochemical properties, and shelf life of the developed product were analyzed using standard methods, and 30 semi-trained panelists analyzed the sensory attributes by using a 5-point hedonic scale. The T1 showed the best sensory attributes while it demonstrated higher protein (7.56 ± 0.01%) and carbohydrates (67.44 ± 0.01%) and lower fat (16.07 ± 0.00%) and moisture (5.77 ± 0.00) than the control. The texture profile values of T1 were comparable to the control, and values were 1728.0 ± 110.9 g hardness, 3.03 ± 0.65 mJ adhesiveness, 1.37 ± 0.23 mm springiness, 0.34 ± 0.30 cohesiveness, and 897.3 ± 65 g gumminess. The lower water activity (0.78 ± 0.01) and pH (5.86 ± 0.01) conditions than the control suggesting the higher keeping quality of T1. The instant pasta samples in treatment T3 (0.47 ± 0.21%) exhibit significantly higher TSS than treatments T1, T2, and T4. These findings highlight the potential use of these ingredients as valuable nutritional supplements in the cereal industry while maintaining desirable sensory and textural qualities in pasta products.

Keywords: Green banana flour, jackfruit seed flour, sensory analysis, proximate analysis, and physicochemical properties

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Productive performance of Jersey and Jersey x Holstein Friesian crosses in the dry zone of Sri Lanka under a sophisticated intensive management system

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The study was undertaken to evaluate the productive performance of imported Jersey and Jersey x Holstein Friesian cattle over a period of 9 years (2015 – 2023) at the National Livestock Development Board (NLDB) farm Ridiyagama, located in the dry zone of Sri Lanka. The records on productive traits viz. lactation milk yield, daily individual milk yield, birth weight, lactation length, and calving interval of 4806 records of 1356 cows were used. Data were analyzed using a general linear model with SAS online version. The overall least square means (±SEM) of lactation milk yield, daily individual milk yield, lactation length, calving interval, and birth weight were 3392.97 ± 0.67 kg/lactation, 8.89 ± 0.002 kg/day/cow, 375.58 ± 0.06 days, 16.91 ± 0.003 months and 22.62 ± 0.004 kg, respectively. The overall abortion and stillbirth were 2.99% and 3.48%, respectively. The least-square means (± SEM) of lactation milk yield, daily individual milk yield, lactation length, calving interval, and birth weight of Jersey and Jersey x Holstein Friesian crosses were 3163.77 ± 74.32 kg/lactation, 8.63 ± 0.019 kg/day/cow, 369.55 ± 6.11 days, 15.62 ± 0.51 months, 20.84 ± 0.28 kg; 3430.07 ± 67.59 kg/lactation, 9.30 ± 0.017 kg/day/cow, 375.23 ± 5.54 days, 15.65 ± 0.51 months and 21.62 ± 0.25 kg, respectively. The current study revealed that Jersey x Holstein Friesian crosses outperformed pure Jerseys in key productive traits viz. lactation milk yield, daily individual milk yield, lactation length, calving interval, and birth weight. Breed differences, lactation numbers, calving interval, year of calving, season of calving, dry period, calving to service period, and number of services per conception influenced identified productive traits, and leveraging these differences offers the potential to enhance productive performance at Ridiyagama NLDB farm.

Keywords: Dry zone, Holstein Friesian cattle, intensive management, Jersey cattle strain, productive performance

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A preliminary taxonomic survey of epiphytic cryptogams in selected southern lowland rainforests of Sri Lanka

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Cryptogams represent a diverse array of organisms that do not produce flowers or seeds; instead, they primarily propagate through spores. Cryptogams including algae, lichens, bryophytes, ferns and fungi, are widely distributed in Sri Lankan lowland forests. However, the diversity of epiphytic cryptogams remains poorly studied in Sri Lanka. The present study aimed to investigate the taxonomic diversity of epiphytic cryptogams in three lowland rainforests in Southern Province: Wilpita, Kottawa, and Pituwala. Fresh samples of epiphytic cryptogams from the selected study sites within the forests were collected and stored in labelled zip-lock bags. Collected samples were examined using dissecting and compound light microscopes to study their morphological and anatomical characteristics. Specimens were identified to their generic or specific levels using taxonomic keys and other taxonomic literature. A total of 151 specimens of epiphytic cryptogams were collected from three forest reserves. Selected study sites of Wilpita forest consisted of 7 genera of epiphytic lichens, 26 species of bryophytes and 5 genera of fungi. Pituwala forest consisted of 5 genera of epiphytic lichens, 20 species of bryophytes, 4 species of fungi and 1 genus of ferns. Kottawa forest consisted of 8 genera of epiphytic lichens, 27 species of bryophytes and 5 species of fungi. The study of epiphytic cryptogamic diversity in lowland rainforests in Sri Lanka contributes significantly to our knowledge of the diversity of epiphytic cryptogams and their responses to environmental change. This knowledge is vital for the conservation and sustainable management of Southern lowland rainforests in Sri Lanka.

Keywords: Lichens, Bryophytes, Ferns, Fungi, Diversity, Sri Lanka

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Removal of dissolved copper ions in water by using tea waste and tea waste-derived Biochar

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Various methods are used to remove heavy metal ions from water, but many of these methods are not applicable in terms of cost, materials, equipment, and energy. Therefore, the use of low-cost, non-toxic natural and biological materials in the removal of metal ions dissolved in water is encouraged. Biochar is a substance created by burning biological material to create active carbon structures with high absorption ability. This research investigated the removal of Cu (II) ions from tea waste and tea-biochar, comparing their efficiency with commercial Granular activated Carbon based on the mass of absorbent. Three adsorbents tea waste, tea-biochar and commercially available activated carbon were optimized for best removal efficiency of Cu (II) by adjusting key parameters such as adsorbent dosages, solution pH, contact time, and initial concentration. Under optimal conditions (adsorbent doses of 0.8 g/L, solution pH of 6, contact period of 60 minutes, initial concentration of 5 ppm), Biochar adsorbent achieved 97% maximum removal of Cu (II) while commercial activated carbon and tea waste showed 69% and 44% removal respectively. The study demonstrates an effective method for removing high concentrations of copper from industrial waste, lowering metal waste release, conserving the environment. In comparison to previous studies, this study accomplished approximately 97% copper removal without using any chemicals or an expensive approach.

Keywords: Tea waste, tea-biochar, copper removal, adsorption

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Degradation of synthetic dye wastewater by electrolysis

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A significant threat to humans and the environment is posed due to the contamination of freshwater resources and hence demand for clean drinking water is increasing. Crystal Violet is a triphenylmethane dye, a recalcitrant dye, which has been widely employed as a biological stain in veterinary and human medicine as well as a dye in the textile industry. Methylene blue is frequently used as a synthetic dye to color fabrics in the apparel and textile sectors, as well as to color papers and leathers. Both these dyes can last for a very long time in the environment and is hazardous to both aquatic and terrestrial species. Currently available dye treatment methods such as coagulation and oxidations have their own limitations such as high chemical consumption and the production of toxic sludge. The main objective of this research was to investigate the treatment of wastewater containing crystal violet and methylene blue- by electrolysis using a suitable electrode system. Effects of several experimental parameters, such as current, pH, different electrode systems, and supporting electrolytes were investigated. The optimum conditions for dye degradation were determined at pH = 3 in the presence of Na_2SO_4 as the supporting electrolyte with 300 mA current at a stirring rate of 600 rpm using stainless steel electrodes as the anode and the cathode. A decoloration efficiency of 99% was achieved for both crystal violet and methylene blue under the above optimum conditions after 2 hours of electrolysis. In conclusion, electrolysis with stainless-steel electrodes can be a potent treatment method for wastewater containing crystal violet and methylene blue dyes.

Key words: Textile dyes, Electrolysis, Wastewater,

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Developing a cationic selective membrane with Aloe Vera for the desalination of water

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The scarcity of access to clean water for agriculture is a growing global issue. Desalination techniques such as reverse osmosis, capacitive deionization, and multi-stage flash have been developed and modified to address this crisis. This study focused on electrodialysis and, specifically, the application of cationic selective membranes. For this purpose, carboxymethyl cellulose (CMC) and graphene oxide (GO), with the addition of aloe vera, were used to enhance the anionic functional groups and porosity. The desalination ability of composite series was determined using a permselectivity study and ion exchange capacity study. GO, CMC, and aloe vera were the best combinations in this study which gives the highest permselectivity and ion exchange capacity. Increasing the graphene oxide percentage in the polymer solution enhances the efficiency of the cationic selective membrane, 50% (V/V) of graphene oxide composition gives the highest permselective and ion exchange capacity. This composite was characterized using FT-IR, XRD, SEM, and other techniques. It was identified that the synthesized composite can be used as a cationic selective membrane in the electrodialysis process if the pH value is higher than 4.2. The synthesized composite also proves reusability over 12 cycles, ensuring prolonged durability. The results of this study demonstrated the potential of using bio-filter materials for desalination, which is a sustainable and cost-effective solution for water desalination. The use of aloe vera as a compound in the cationic selective membrane is a promising finding, and they are natural and eco-friendly answers for the desalination process.

Keywords: Desalination; Graphene oxide; Carboxy methyl cellulose; Aloe vera; Cationic-selective membrane.

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Detection of pathogenic *E. coli* O157 along with the chemical monitoring of coastal water from Sarakkuwa to Mirissa coastal belt in Sri Lanka

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Escherichia coli is considered as an indicator of fecal contamination and is found in gastrointestinal tracts of warm-blooded animals. *E. coli* O157 is a pathogenic serotype that produces intimin and shiga-toxins and responsible for severe health circumstances. Recreational activities heighten the infection risk of *E. coli* O157 to the human gut through contaminated waters. The objective of this study is to detect *E. coli* O157 strain and to determine chemical water quality parameters from Sarakkuwa to Mirissa coastal belt, Sri Lanka. The virulent genes *eae*, *stx1* and *stx2* were selected for the screening of *E. coli* O157. The PCR amplification was carried out through standardized protocols. The chemical water quality parameters; N-nitrate, N-nitrite, N-ammonia, and total phosphate were measured following the APHA standard methods. Results showed that all water samples were contaminated with *E. coli* and CFU values ranged between 5.00 ± 5.29 and 157 ± 2.00. *E. coli* of Dehiwala, Mt. Lavinia, Rathgama, and Galle areas showed positive results for *eae* gene while Ambalangoda, Hikkaduwa, Rathgama, and Weligama areas showed positive results for *stx1* gene. Galleface, Mt. Lavinia, Ginthota, Unawatuna, Koggala, and Mirissa areas were positive for *stx2* gene. Altogether, *E. coli* O157 strain was detected in 12 out of 22 sampled locations. The recorded N-nitrate, N-nitrite, N-ammonia, and total phosphate of the study sites ranged within 0.30 - 4.03 mg/L, 0 - 0.64 mg/L, 2.39 - 0.03 mg/L, 0.06 - 3.17 mg/L respectively. The presence of *E. coli* O157 indicates the unsuitability of water for recreation and findings emphasize that continuous monitoring and legislation are essential to upholding the water quality of the studied coastal stretch.

Keywords: Coastal water quality, E. coli O157, PCR amplifications, recreational water

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Value addition to the black tea using leaves of common guava, Ceylon Cinnamon and evaluation of its functional properties

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Innovative tea formulation was developed by introducing an herbal infusion of medicinal plants which enhance the functional properties of the black tea. The leaves of common guava (*Psidium guajava*) and the both leaves and bark of Ceylon Cinnamon were collected from Matara, Sri Lanka (latitude-5.94780N, longitude-80.54830E). Shade-dried plant material was blended to reach the highest sensory quality of the final product (guava leaves: cinnamon bark: cinnamon leaves: black tea in 11:3:3:3 ratios). The tea was tested for antioxidant activity using the ferric reducing antioxidant power assay (FRAP), 2,2′-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assays, total phenolic content (TPC) using the Folin-Ciocaiteu assay, total flavonoid content (TFC) using aluminium chloride colourimetric assay, and anti-diabetic activity using the alpha-glucosidase inhibitory assay. The antibacterial properties were assessed using the agar disk diffusion assay and preliminary cytotoxic effects were examined through the brine shrimp assay. The formulation exhibited significantly high total anti-oxidant activity in FRAP (49.95 ± 0.40 mg Trolox/g) and IC_{50} of 40.01 ± 0.01 mg/ml for DPPH assay (31.59 ± 2.92 mg/ml for the ascorbic acid standard). It also demonstrated high alpha glycosidase inhibition activity with IC_{50} of 1.43 ± 0.08 mg/ml compared to the acarbose standard (IC_{50} 3.28 ± 0.28 mg/ml). The extract contained TFC and TPC at 3.49 ± 0.40 mg of quercetin/g and 162.40 ± 6.12 mg GAE/g, respectively. The extract is safe based on brine shrimp lethality assay. The highest antibacterial activity was noted against *Staphylococcus aureus* from tested bacteria species (inhibitory zone of 7.00 ± 0.57 mm). In conclusion, the prepared guava tea enhanced with cinnamon formulation is a novel natural functional product that can be used as an alternative to black tea for better health benefits.

Keywords: Ceylon cinnamon, Cinnamon bark, Cinnamon leaves, Common guava, Tea

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PCL/HAP-MMT Electrospun Scaffold with Chitosan-mediated nanosilver for Antibacterial Activity

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An electrospun biopolymer scaffold reinforced with antibacterial activity is an excellent model for tissue engineering applications as it supports local tissue regeneration while providing a barrier for microbes. In our study, we fabricated a novel Polycaprolactone/Hydroxyapatite-Montmorillonite (PCL/HAP-MMT) electrospun nanofiber (NF) system embedded with chitosan-mediated silver nanoparticles (C-AgNPs) with antibacterial activity as a potential scaffold for bone tissue engineering (BTE). Initially, C-AgNPs were synthesized using chitosan as a reducing agent. The HAP-MMT nanocomposite system was prepared using a modified wet chemical in-situ preparation method. A neat polymer blend containing 25% (w/v) PCL and the mixture of HAP-MMT 5% (w/v) was prepared by dissolving it in a solvent mixture containing chloroform and 90% (v/v) acetic acid solution. This blend was successfully electrospun to obtain unique fiber textures. The prepared scaffolds were characterized by SEM, XRD, and FT-IR. The PCL/HAP-MMT NFs showed a reduced diameter (1121 ± 48.93 nm) compared to PCL NFs (2940 ± 63.40 nm) and lowered crystallinity observed from XRD patterns suggesting an amorphous NF system. Synthesized C-AgNPs were surface coated on the neat electrospun scaffold to obtain the PCL/HAP-MMT/C-AgNP(coat) scaffold that showed antibacterial activity of (7 ± 1.26 mm) against gram-positive *S. aureus*, (11 ± 1.34 mm) against gram-negative *E. coli,* and no activity in the scaffold exclusive of nanosilver. Thus, the results of the present study will be beneficial to further BTE scaffolds with wound healing ability.

Keywords: polycaprolactone, hydroxyapatite-montmorillonite, silver nanoparticle, electrospun scaffold, antibacterial activity

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Development of batik textile colorant using Mahogany Shale (*Swietenia macrophylla*), Marigold Flowers (*Tagetes erecta*), and Onion Peel (*Allium cepa* L.)

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The rising demand for batik textiles in Sri Lanka has led to a critical issue due to the health risks posed by carcinogenic synthetic dyes used in their production. To combat this, the study focuses on developing safer, cost-effective, and eco-friendly alternatives derived from mahogany shale, marigold flowers, and onion peel. These natural colorants were extracted through various methods and applied to cotton and blue line poplin fabrics, assessing their polarity, intensity, and stability in comparison to synthetic dyes. Physical and chemical properties of the dyed textiles were analyzed, along with shelf-life testing, and a comparison was made between natural and synthetic dye-applied textiles. The study found that direct extraction using distilled water yielded superior results from mahogany shale and onion peel in terms of powder percentage, color stability, intensity, and wash cycles (up to 3 times) for overall acceptability, as compared to soxhlet extraction methods. Analysis using Ultra Violet visible spectrophotometry of 190-550 Nm and Fourier Transform Infrared Spectroscopy of 500-4000 cm^{-1} aided in determining color stability, quality, and functional groups of the natural colorants. Additionally, pH measurements gauged the acidity of the extracted natural colors. The research demonstrates the potential for replacing harmful synthetic dyes with natural alternatives derived from mahogany shale, marigold flowers, and onion peel, offering a safe solution for batik textiles without compromising on quality.

Key words: Batik textile, natural colors, plant sources, soxhlet extraction, carcinogenic

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Novel bacterial consortium for the reduction of composting odor emission and enhancing compost maturation rate in the municipal solid waste

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Composting is a crucial part of global sustainable municipal solid waste management. However, the odorous emissions during composting are considered a major social and ecological concern. Most of the available physical-chemical methods to eliminate odor emission during composting are not successful and economically not viable. Thus, the present study focuses on the control of odorous emissions in composting while accelerating the compost maturity rate using novel microbial consortia as a greener approach. For the study, Bacteria were isolated from open dump sites, five different consortia were developed and their performance against malodor reduction was evaluated. The odorous emission in terms of Volatile Organic Compounds (VOC), CH_4, NH_3, and H_2S during composting was evaluated using an electronic nose and gas analyzer. According to the results, consortium No. 5 (C5) which contained *Bacillus haynesii, Bacillus amyloliquefaciens,* and *Bacillus safensis* performed an exceptional odor reduction compared to all other treatments. The C5 consortium eliminated the odor while recording VOC, CH_4, NH_3, and H_2S concentrations between 0.5-6.0 ppm, 0.5-0.8 ppm, 0.3-0.5 ppm, and 0.5-0.6 ppm, respectively, whereas the control sample detecting, 4.5-10.2 ppm, 0.5-5.5 ppm, 0.3-5.5 ppm, and 0.5-6.4 ppm concentrations for the same odor-causing gases, respectively. Furthermore, E-nose results confirmed a significant ($p<0.05$) emission reduction of methane-aliphatic chemicals, sulfur and aromatic compounds, and alkane compounds in the C5 consortium inoculated treatment showing the potential applicability of novel prepared consortia for mitigation of composting odor.

Keywords: Bacterial consortia, composting, municipal solid waste, odor reduction

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Mapping of water and soil quality parameters in the Gampaha-Ihalagama grama niladhari division

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Water and soil are important natural resources, and the study of their distribution is of great interest. The Grama Niladhari Division, Ihalagama-East, Gampaha district, is selected as the pilot study area. These maps illustrate how the water and soil quality of a selected area is in the current state. 58 water and 58 soil samples were randomly collected, and water and soil quality parameters were investigated, followed by the construction of contour maps. Water quality parameters including pH, conductivity, phosphate content, nitrate content, and Ca^{2+} hardness were determined, alongside soil quality parameters pH, nitrate, organic matter, water-soluble Na^{+}, K^{+} ion, extractable Na^{+}, K^{+}, and water-soluble Ca^{2+} ion contents. pH of water samples ranged from 4.41-7.11, mostly acidic and some below WHO's safe drinking water range (6.5-8.5). Conductivity ranged between 52.0-277 µS/cm, well below the WHO permissible level of 1500 µS/cm. Nitrate content reached significantly high values ranging from 1.24-279.00 mg/L, with many exceeding the drinking water limit of 50 mg/L. The soil pH in all the samples falls within the acidic range, varying from 2.99-6.73. Most of the soil samples had high nitrate contents, indicating significant contamination. The percentage soil organic matter content varied between 0.60% and 13.27%. Many fertile agricultural soils contain 3-6% organic matter, with many samples exceeding standard levels. According to water and soil quality values, this area has overall acidic soil and water with critical nitrogen contents compared to standard values. Despite focusing on a single Grama Niladhari Division, the findings show significant variation, emphasizing the need for mapping to address contaminations and natural disaster impacts on these quality parameters.

Key words: Distribution, Mapping, Soil, Water, WHO

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DFT AND TDDFT calculations of linear and nonlinear optical properties of Ruthenium Alkynyls with extended π-Bridges

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Materials with large Nonlinear Optical (NLO) coefficients are great of interest in a wide range of technological applications. Amongst these NLO materials, organometallic and coordination complexes have attracted significant attention in recent years owing to their record values of NLO coefficients and greater design flexibility. The present investigation reports Density Functional Theory (DFT) and Time-Dependent (TD) DFT calculations of linear and nonlinear optical properties of a series of ruthenium complexes with different extended π-bridges: *trans*-[Ru(C≡C(B)-4-C_6H_4-1-NO_2)Cl(κ^2-dppm)$_2$, B = [–C_6H_4–]$_n$ (OPS); [–C≡CC_6H_4–]$_n$ (OPE); [–(E)-HC=CHC_6H_4–]$_n$ (OPV); [–C_4H_2S–]$_n$ (OTS); [–(E)-HC=CHC_4H_2S–]$_n$ (OTV); [–(E)-N=NC_6H_4–]$_n$ (OPA) with *n* = 1-5. For OPS, OPE, OPV and OTS, the total static first hyperpolarizability (β_{tot}) calculated with CAM-B3LYP increases considerably upon extending the bridge length up to three repeating units. After that it seems to saturate. For OPA and OTV, β_{tot} increases up to four and five units, respectively. For any *n*, β_{tot} decreases in the order of OTV > OPA > OPV > OPE > OTS > OPS. The TD- CAM-B3LYP calculations showed that for OPE, OPV and OTV, the main optical band is red-shifted until three linker units and further extending the conjugation has a minor effect on the peak position. This trend in excitation energies is consistent with the calculated HOMO-LUMO energy gaps. The β_{tot} saturation predicted at greater lengths may thus be linked to the excitation energy of the main optical band. The energy barrier to the internal rotation of phenyl units in OPS, OPE and OPV is markedly low, permitting planar and different twisted conformers to coexist under the laboratory conditions. The β_{tot} values were found to decrease significantly for twisted structures, with the communication between the electron donor and acceptor hampered by the non-planarity. The number of conformers increase with increasing the length of the bridge. Therefore, the predicted β saturation at greater bridge length may be attributed to the conformational flexibility associated with these molecules.

Keywords: Computational Chemistry, DFT, First Hyperpolarizability, Nonlinear Optics, Organometallics

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Assessment of DFT methods for calculating first hyperpolarizabilities and excitation energies of organic molecules

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Density Functional Theory (DFT) has become increasingly popular for calculating linear and nonlinear optical (NLO) properties of various molecular materials in recent decades due to its favourable accuracy-to-computational-cost ratio. A critical comparison of different DFT functionals against experimental data or accurate wavefunction-based calculations is generally required to choose the best functional for specific systems or properties. Despite a plethora of DFT studies reporting the NLO calculations, such comparisons of different DFT method for calculating optical properties are sparse. Herein, the performance of sixteen different DFT methods (BLYP, BP86, PBEPBE, SVWN, M11L, B3LYP, PBE1PBE, M06, M062X, BHandHLYP, O3LYP, CAM-B3LYP, LC-BLYP, wB97X, LC-PBEPBE and M11) in the calculations of static first hyperpolarizabilities (β_{tot}) and electronic excitations of p-nitroaniline (PNA), 4-amino-4ˈ-nitrobiphenyl (DANB), 4-amino-4ˈ-nitrodiphenylacetylene (DANA), 4-amino-4ˈ-nitrostilbene (DANS) and 4-amino-4ˈ-nitroazobenzene (DANAB) was assessed. The computed data were compared against the MP2 hyperpolarizabilities and experimental absorption maxima. For any molecule, the HF hyperpolarizability is less than the DFT data. However, the mean absolute error MAE (compared to MP2) of HF is much lower than that of pure and some hybrid methods, with pure functionals overestimating β_{tot} for relatively large molecules. Hybrid functionals showed considerable improvement over the pure functionals, particularly two methods M062X and BHandHLYP. CAM-B3LYP was found to outperform the rest of DFT methods. The magnitudes of the computed hyperpolarizability strongly rely on the amount of HF exchange in the functional than correlation effects. A similar trend can be seen in the computed excitation energies. From MAEs, the long-range corrected functionals considerably improve the excitation energies compared to their pure counterparts, especially for large molecules. Again, the lowest MAE was obtained for CAM-B3LYP. All the hybrid methods are superior to the pure ones. The long-range corrections are important for calculating NLO properties and excitation energies of large push-pull organic molecules, with the lowest MAE given by CAM-B3LYP. While pure functionals overestimate the optical data, the incorporation of a fixed amount of HF exchange in the hybrid functionals improve the pure data significantly.

Keywords: Density Functional Theory, Excitation Energy, First Hyperpolarizability, Nonlinear Optics

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Analysis of major fatty acid groups, conjugated linoleic acid and lipid quality indices in selected commercial dairy products in Sri Lanka

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Milk fat is the most complex natural fat, with over 400 different Fatty Acids (FA). Conjugated Linoleic Acids (CLA), a mixture of octadecadienoic acid isomers mainly *cis*9, *trans*11-C18:2 reportedly show numerous positive effects on human health. Lipid quality indices such as the Atherogenic Index (AI), and the Thrombogenic Index (TI) indicate the health effects of dietary FAs. This study aimed to analyze major FA groups, content of CLA, and lipid quality indices in selected dairy products available to consumers in retail sales. Ten products were selected by a consumer survey conducted in the Western province, considering products with high consumer preferences. Fat was extracted from samples (Modified Folch method) followed by the BF_3-Methanol *trans*-methylation process to prepare FA methyl esters. GC-FID was used to analyze the FA profile. The Supelco 37 FAME mix was used to identify FA peaks, including CLA. The results revealed variations in major FA groups in dairy products. For fresh cow milk, Saturated, Monounsaturated, and Polyunsaturated FAs were 68.72 ± 0.02%, 27.40 ± 0.01%, and 4.05 ± 0.01%, respectively. The CLA content in processed dairy products' fat ranged from 3.2 ± 0.12 mg/g (Milk Powder) to 6.1 ± 0.03 mg/g (Butter). Processed cheese has the highest AI (3.19 ± 0.01), followed by butter, condensed milk, ghee, and paneer. The TI was high for butter (3.68 ± 0.01) followed by processed cheese, paneer, and condensed milk. Increases in products' thrombogenic and atherogenic dietary components increase incidences of atherosclerosis and thrombosis. Conclusively, distinct FA profiles and lipid quality indices of dairy products reveal varying health effects that influence consumer health.

Keywords: Atherogenic Index, Fatty acids, Gas Chromatography, Thrombogenic Index

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Influence of land use on aquatic pollution in an urban wetland: a case study in 'Kirala kale', Matara District, Sri Lanka

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Kirala Kale is an urban wetland in southern Sri Lanka. This study examined the aquatic pollution status within the wetland in relation to the nearby land-use composition. Eight water sampling sites considering inlets and outlets, low flow rate, and easy access were selected to represent the whole wetland. Percentages of different land-use types (urban, forest, marshlands, paddy lands, sparse vegetation, and water bodies) within a 300m buffer area around each site were assessed via remote sensing and GIS. Temperature, Electrical conductivity (EC), Total Dissolved solids, Salinity, Dissolved Oxygen, pH, Nitrate (NO_3^-), Orthophosphate (PO_4^{3-}), Heavy metals (Cu, Cd, Cr, Pb) in water and macro-benthos in sediment were analyzed at two sampling occasions with three replicates from each site. There were significant positive spearman rank correlations between the proportion (%) of Urban and settlement land cover and NO_3^-($r = 0.762$, $p < 0.01$), PO_4^{3-} ($r = 0.738$, $p < 0.01$), and EC ($r = 0.833$, $p < 0.01$). Similarly, Paddy land cover and NO_3^- ($r = 0.994$, $p < 0.05$), and PO_4^{3-}($r = 0.994$, $p < 0.05$) were positively correlated. Negative correlations were observed between forest cover and NO_3^-($r = -0.708$, $p < 0.01$), and sparsely distributed vegetation and NO_3^- ($r = -0.881$, $p < 0.05$), and PO_4^{3-} ($r = -0.905$, $p < 0.05$). Cu and Cd concentrations (0.006-0.022 ppm) were below the accepted limits (0.05 ppm and 0.03 ppm, respectively) in Sri Lanka. The absence of pollution-sensitive EPT taxa and the presence of pollution-tolerant *Glycera* sp., *Pomacea* sp. *Helisoma* sp. *etc*. in sediment indicated moderate pollution at sites. Results showed urban setup has affected aquatic pollution levels in Kirala Kale wetland.

Keywords: Kirala Kale wetland, Land use Change, Water quality, Wetland pollution

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Synthesis and characterization of Chitosan-supported Ni and Cu nanoparticles

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Nanotechnology has taken an incomparable place in science and technology. In this study, the synthesis of copper (Cu) and nickel (Ni) nanoparticles (NPs) was explored using chitosan due to their low cost and readily accessible features. Nanoparticle synthesis was carried out using a convenient and inexpensive chemical reduction method using $CuSO_4.5H_2O$ and $NiCl_2.6H_2O$ as precursors. Chitosan was used as the stabilizer to modulate the size of metal NPs during synthesis and to preserve their stability by reducing the high surface charge of metal NPs. According to the UV-Vis spectroscopic analysis, Cu-NPs and Ni-NPs showed λ_{max} at 580 nm and 240 nm respectively. Cu-NPs and Ni-NPs were also characterized by FT-IR spectroscopy, which showed overlapping stretching vibrations of NH_2 and OH groups at 3302 cm^{-1} , C-H stretching at 2899 cm^{-1}, NH_2 bending at 1652 cm^{-1} , C-N stretching at 1584 cm^{-1} , and C-H bending at 1387 cm^{-1}. A blue shift was observed in copper chitosan (Cu-Ch) and nickel chitosan (Ni-Ch) NPs compared with the neat chitosan spectrum, and new absorption peaks at 614 cm^{-1} and 611 cm^{-1} confirmed the capping of Cu, Ni NPs by chitosan. It was determined that 71.4% is the ideal w/w ratio of copper/chitosan, and 1% chitosan is the optimum concentration for the synthesis of copper- chitosan NP. According to the Field Emission Scanning Electron Microscope, four major peaks of 44.21% O, 18.21% Cu, 17.34% C, and 15.87%N for Cu-Ch NP and 19.83% C, 22.42% O, and 48.7% Ni for Ni-Ch NP were observed. The mean size of both Cu and Ni NPs was calculated using X-ray diffraction data, and it is in the range of 35–75 nm, with diffraction angles of 36.50°, 42.50°, 61.50°, and 74.00° for Cu-Ch and 15.05^0 for crystalline Ni-Ch NPs.

Keywords: Chitosan, Copper-Chitosan nanoparticles, Nickel-Chitosan nanoparticles

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Fluoride removal in water using Kaolin and Eggshell powder blend adsorbents

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Fluoride contamination in water has emerged as a significant global concern due to its adverse health effects when consumed in excess. This study is focused on developing an eco-friendly, cost-effective adsorbent for fluoride removal using eggshells and kaolin. Adsorbent blends were prepared by mixing kaolin and eggshell powder in six different ratios, namely; 100:0, 80:20, 65:35, 50:50, 35:65, and 20:80. Cylindrical-shaped pellets were produced from each of the blends and subjected to the thermal treatment at 950 ^{o}C. Fluoride adsorption capacities of the pellets were investigated at different pH conditions (from pH 2 to pH 10) for a 5 ppm fluoride solution with 1 g of adsorbent dosage and 60 minutes of contact time. Pellets with a 50:50 ratio (CKE_3) were found to be the most effective adsorbent considering the adsorption capacity and stability at all the studied pH conditions. At pH 6, CKE_3 showed an adsorption capacity of 0.06 mg/g in comparison to 0.02 mg/g of kaolin-only pellets. XRD analysis indicated that $CaCO_3$ in the adsorbent has converted to CaO after the calcination. Further batch experiments were carried out with CKE_3 for adsorbent dosage, pH, contact time, and initial fluoride concentration. An adsorbent dosage of 4 g was capable of resulting a 53% removal of fluoride for a 5 ppm solution after 60 minutes of contact time. The pseudo-second-order kinetic model exhibited the best fit in the kinetic study. The isotherm data were studied for Langmuir and Freundlich models and the results were satisfactorily fitted with Langmuir isotherm.

Key words: Adsorption, Fluoride removal, Eggshell, Kaolin

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Marine algae derived ZnO NPs, Ag NPs and Ag/ZnO NCs for photocatalytic activity

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Green synthesis of nanoparticles and nanocomposites using natural sources like microbes or plant extracts as stabilizing and reducing agents offers eco-friendly and sustainable advantages. The aim of this study was to synthesize zinc oxide nanoparticles (ZnO NPs), silver nanoparticles (Ag NPs), and silver/zinc oxide nanocomposites (Ag/ZnO NCs) by employing an aqueous extract derived from *Sargassum polysistum*, a prevalent marine algae species in Sri Lanka. The synthesized nanoparticles and nanocomposites were then utilized to assess their photocatalytic activity. The photocatalytic activity of the NPs and NCs were measured by the degradation of methylene blue (MB) dye under Sunlight. The synthesized NPs and NCs were characterized using UV-Visible Spectra Analysis, FT-IR spectra analysis and Scanning Electron Microscopy analysis. The Ultraviolet-Visible spectrum exhibited a hypsochromic shifted absorption band between 360–380 nm for ZnO NPs 440-470 nm for Ag and broad band between 360-500 nm for NCs. FTIR analysis identified the specific vibrational modes associated with various functional groups. SEM analysis was carried out to determine the surface morphology of the nanoparticles resulted cross-sectional diameters of synthesized ZnO NPs, Ag NPs and Ag/ZnO NCs were 121.42±4.24 nm, 95.99±3.60 nm and 154.18±4.60 nm respectively. The photocatalytic degradation of MB reaches a maximum of 92.5% for biogenic Ag/ZnO NCs when monitoring spectrophotometrically (λ_{max} = 662.8 nm) under solar irradiation while ZnO NPs reached 82.6% and Ag NPs reached 84.7% accordingly. Therefore, marine algal mediated nanomaterials contribute to environmentally friendly and efficient photocatalyst development, with significant implications for environmental remediation and solar energy utilization.

Key words: nanocomposites, degradation, hypsochromic, irradiation, remediation

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UV-Blocking activity of *Cocosnucifera* (coconut) leaf extracts

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The polyphenols such as flavonoids are a group of phytochemicals with photoprotection properties. Flavonoids accumulate densely in leaves exposed to excess solar radiation than shade leaves. This study aimed to evaluate the sunscreen activity of extracts of *Cocosnucifera* leaves with prolonged exposure to sunlight during the day. The extracts were obtained using methanol and water separately. Phytochemical screening revealed the presence of alkaloids, phenols, flavonoids, carbohydrates, terpenoids, and tannins in both extracts while saponins were present only in the aqueous extract. The total phenolic contents were determined by the Folin–Ciocalteu method to be2079.347 ± 41.551 and 680.750 ± 21.893 mg Gallic acid equivalent (GAE)/100 mg dry weight of the leaves for methanol and aqueous extracts, respectively. The total flavonoid contents were determined by aluminum chloride colorimetric assay to be1369.571 ± 11.842 and 494.444 ± 11.403 mg Catechin equivalent (CAE)/100 g dry weight of leaves for methanol and aqueous extracts, respectively. A concentration series of 0.2, 0.3, 0.4, 0.5 mg/ml in methanol were prepared for both extracts along with a commercial lotion, Dermatone® as the reference (SPF 36). The Sun Protection Factor (SPF) was determined by Mansur method at all concentrations. A SPF of 31.288 ± 0 was obtained for methanol extract at 0.5 mg/ml. Also, 0.5 mg/ml aqueous extract has a SPF of 21.893 ± 0.038. Both extracts have exceeded the SPF of 15 at the 0.5 mg/ml concentration indicating their ability to block roughly 93% UV rays when applied thoroughly. The *Cocosnucifera* leaves with efficient UV absorbing constituents could be used in sunscreen products as a safe alternative to harmful synthetic compounds.

Key words: Sunscreen activity, *Cocosnucifera*, leaf extracts, SPF, Dermatone®

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Neutralization potential of bulk deposition in two distinct environments (Urban and Rural), Sri Lanka

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The constituents in bulk deposition influence its composition, either neutralization or acidification. This study aimed to determine the neutralization potential of acidity in bulk deposition in two distinct locations, the urbanized Crow Island-Colombo area and the pristine Kudawa-Sinharaja rainforest. A manually prepared high-density polyethylene collector was used for the weekly sampling from March to August 2023. A total of fifty samples were analyzed for pH and major ions. The analysis of major ionic species (Na^+, K^+, Ca^{2+}, Mg^{2+}, NH_4^+, Cl^-, NO_3^-, SO_4^{2-}) was performed using ion chromatography, atomic absorption spectrophotometry and ultraviolet spectrophotometer. Data analysis was performed using the Minitab 21 package. The neutralization factor (NF) was followed in order of $NF_{Ca}{}^{2+} > NF_{NH4}{}^{+} > NF_{Mg}{}^{2+}$ in Crow Island while $NF_{NH4}{}^{+} > NF_{Ca}{}^{2+} > NF_{Mg}{}^{2+}$ in Sinharaja. The relationship between Mg^{2+} and NO_3^- or Mg^{2+} and SO_4^{2-} was statistically insignificant ($p>0.05$) in both locations. The enrichment factor calculated ratios for Ca^{2+}/Na^+, Mg^{2+}/Na^+ and K^+/Na^+ were higher than the reference value, indicating a significant influence of natural and anthropogenic sources other than marine influence at both sites. This study shows a great capacity of neutralization potential of pristine areas compared to urban areas by resulting in higher NF values in Sinharaja and lower NF values in Crow Island, highlighting the impact of human influence on ion concentrations and neutralization processes in these different settings.

Keywords: Bulk deposition, enrichment factor, major ions, neutralization factor

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Zooplankton assemblages in Nilwala River and Madu River estuaries in Southern Sri Lanka as indicators of ecosystem health

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This research delved into the correlation between water quality parameters and the relative abundance and diversity of zooplankton within two specific locales: the Nilwala River (5°57′N, 80°32′E) and the Madu River estuaries (06°16′25″N, 80°02′05″E) situated in Southern Sri Lanka. Triplicate samples of zooplankton were procured from each river estuary, encompassing the lower river estuarine stretch (L1) and two other locations about 2 km (L2) and 20 km (L3) upstream from L1, during the period from March 2021 to February 2022. Standard analytical methods were employed to measure Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH, nitrate, orthophosphate, ammonium, turbidity, total dissolved solids (TDS), conductivity, and temperature. Zooplankton were collected using a plankton net (aperture size: 300 µm) filtering approx. 1000 L of water. The species diversity and richness of the zooplankton communities were estimated using Shannon Weiner's Diversity Index (H) and Pielou's evenness index (J), respectively. Twenty-two zooplankton species were identified in both locations, comprising 14 species of copepods, 5 species of rotifers, and 3 species of cladocerans, and the rest included nauplii stages and ichthyoplankton. The highest zooplankton density (53 ind./L), species diversity (1.44), and evenness (0.58) were recorded from the Madu River. The presence of species like *Brachionus* sp. and *Thermocyclops* sp. in the Madu River's lower stretch indicated eutrophic conditions, while elevated *Keratella* sp. density in the Nilwala River estuary suggested high turbidity due to suspended sediments. This is further confirmed by CCA results. CCME water quality index values confirmed that the lower stretches of the Nilwala and Madu rivers are more polluted than their middle and upper stretches.

Keywords*:* CCME water quality index, Shannon-Weiner index, species richness, Canonical analysis

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Evaluation of hydrolytic and thermal stability of plywood, bonded with urea-formaldehyde resins with tire pyrolysis char, wheat flour and coconut shell powder as novel filler systems

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The objective of this study was to evaluate the properties of the plywood, bonded with urea formaldehyde (UF) resins with added novel filler systems. 3-ply and 5-ply plywood panels were produced with rotary-peeled rubberwood veneers using UF resin as binder. Three UF resins were prepared by varying the F:U mole ratios viz., 1.0 1.2 and 1.4 (a control and two innovative high molar ratio) by a conventional alkaline-acid two-step process, with the second addition of urea. Resins were analyzed for their specifications with FTIR measurements and thermogravimetric analysis both in their liquid and cured states. Five different fillers viz., (wheat flour, coconut shell powder, commercial charcoal-N660, tire pyrolysis charcoal and treated tire pyrolysis charcoal with phenol, etc.) were selected and %wt. of filler was added to each resin varied as 10, 15 or 20. Mechanical properties and dimensional stability, i.e., water absorption and thickness swelling of the plywood varying with the % filler and the variety was investigated. The shear strengths of plywood boards of 1.4 F/U were observed as 2.50, 2.55, and 3.15 MPa when wheat flour filler was used as 10, 15, and 20 %wt. These strengths were increased to 4.64, 5.09, and 5.60 MPa respectively when the filler is changed to the coconut shell powder. Tire pyrolysis char shows better mechanical properties than wheat flour but lesser than coconut shell powder as the filler. This work showed %wt. and the variety of bio-fillers added to UF resin bonded plywood have a huge impact on their physicochemical properties.

Key words: Urea-formaldehyde resin, mechanical properties, plywood, tire pyrolysis char, bio-filler

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Production of biodiesel from waste cooking oil by using Mahogany husk ash and CaO as catalyst

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Biodiesel is an alternative fuel that is made from biological sources. Hence it is a renewable fuel. Biodiesel is generated through a process called transesterification where a variety of feedstock containing fat and oil are treated in the presence of an alcohol such as methanol. Homogeneous catalysts such as NaOH or heterogeneous catalysts such as CaO are used speedup this reaction. We generated biodiesel from used cooking oil after a pretreatment process and using a novel catalyst from Mahogany fruit husk ash and coral rubble. We proposed Mahogany carpel ash as the catalyst because it contains about 20 % CaO and a porous silicon structure. Initially, waste cooking oil was purified using activated charcoal to reduce the free fatty acid content. For comparison purposes, we prepared biodiesel from conventional catalysts NaOH and CaO, resulted 89.31% & 78.18% yield percentages separately. The catalyst was improved by incorporating CaO from the corral via wet impregnation method. A64.99% yield of biodiesel was obtained with this novel catalyst, though the yields were less than from NaOH catalyst. Density of the biodiesel produced with the new catalyst is 918 kgm^{-3}, almost same as the product obtained with NaOH catalyst. 12.26 & 0.74 (mg KOH/g oil) saponification and acid values were obtained for the novel mahogany ash catalyst indicating that less soap formation. The novel natural catalyst we produced using Mahogani fruit husk ash is successful and can be further developed as efficient catalyst to produce biodiesel from waste coconut oil.

Keywords: Mahogany fruit husk, biochar, impregnation

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Construction of low-cost s-silver chloride and carbon paste electrodes for potentiometry practicals and pH measurements

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Reference and inert electrodes are frequently used in physical chemistry practicals like potentiometric and voltammetry, but they are commercially expensive. However, these electrodes can be made at low cost within the laboratories. Therefore, the main objective of this research was to construct more affordable, low-cost silver-silver chloride and carbon paste electrodes for laboratory experiments. Also, using these electrodes we intend to construct a potentiometric device to measure the pH of a solution with reasonable accuracy. A low-cost silver-silver chloride electrode was prepared by filling a syringe with a hot agar solution, and partially immersing AgCl-coated silver wire in a saturated 3 M KCl solution. The carbon paste electrode was prepared using graphite powder and paraffin oil. These electrodes were applied for strong acid-base potentiometric titrations and endpoints were obtained using three different concentrations of NaOH (0.10 M,0.20 M, 0.30 M) and 0.10 M HCl, and these values were compared with standard pH titration and a potentiometric titration with the commercial standard electrodes. Then the pH was determined by substituting the E_{cell} values to the Nernst equation and that pH was compared with the direct pH readings. According to the titration results, the same endpoints were obtained from four different methods. Statistical analysis revealed there is no significant difference between the measured and the calculated pH of constructed electrodes. The accuracy of the calculated pH was further improved by applying mathematical modeling. The study suggests that constructed low-cost electrodes can be effectively and economically cost-effectively utilized for measuring pH in laboratories.

Keywords: Silver-silver chloride, Carbon paste, pH, Electrodes, Low-cost

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Upgraded waste tyre pyrolytic char for solid tyre tread compounds

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The objective of this study was to evaluate the treatment method of PT-char for the performance of solid tyre tread compounds. The metallic particles in the PT-char were removed by the magnetic separator and the particle sizes were reduced ≤50 µm. PT-char with reduced particle size was demineralized using two treatment methods to get the carbon black (CB) which is used for the preparation of solid tyre thread compounds. The 2M 2H sample was prepared with two washes using 2M HCl, and the 2M 2H-2M S sample was prepared with two washes of 2M HCl followed by one wash with 2M NaOH. The char: acid/base volume ratio was maintained at 1:2, and the treatment was carried out at temperatures ranging from 60 °C to 80 °C for 0.5 to 1 hour stirring. Pyrolytic char and all of the purified samples were characterized by elemental analysis, TGA, XRD, and SEM. These purified CB samples were used to prepare solid tyre tread compounds and their characteristics were evaluated. The highest purity with 91% carbon and 3.5% ash contents was observed for 2M 2H-2M S and Crude CB has 67% of carbon and 83% of carbon content in 2M 2H. The compounding test results indicated that 2M 2H-2M S sample has better performances (Tensile strength: 22.15 MPa, Tear Strength: 69.19 MPa, Hardness: 56.00 IRHD, Compression set: 5.61 %) compared to PT char and comparable to the commercial grade carbon black N330 and N660. This suggests that the current PT-char modification protocol might be a promising route to replace commercial carbon black in solid tyre industry.

Keywords Pyrolysis, Pyrolytic char, upgrading, rubber industry, tyre sector

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In vitro evaluation of coagulant activity of *Mikania micrantha* leaves extract grown in Sri Lanka and formulation of a topical herbal cream

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Mikania micrantha has a diverse array of natural phytochemicals. The objective was to screen the clotting effect of dried leaves of *M. micrantha* to develop a topical herbal cream to arrest bleeding. The phytochemical screening revealed that the extract contains phenols, flavonoids, tannins, carbohydrates, saponins, terpenoids, and steroids. The clotting activity of the 70% ethanolic extract of *M. micrantha* was evaluated according to the standard Lee and White method. A concentration series of *M. micrantha* crude extract (5, 10, 15, and 20 mg/mL in dimethyl sulfoxide) was prepared for the assay, where tranexamic acid (10 mg/mL) was the positive control and dimethyl sulfoxide was the negative control. The highest coagulant activity was observed in the 20 mg/mL crude extract. The mean clotting time of the 20 mg/mL crude extract was 5.38 seconds (SD ± 8.89) and the mean clotting time of the positive control was 18.68 seconds (SD ± 13.51). So the leaves extract of *M. micrantha* exhibited significant clotting activity as compared to the positive control (p-value 0.018). Beeswax, liquid paraffin, borax, methyl paraben, distilled water, rose water, and 0.02 g of ethanol extract of *M. micrantha* was utilized to create a homogeneous, light green herbal cream. The slab technique was used to ensure homogeneous mixing of all ingredients. The cream had a pleasant odor, and its pH gradually decreased over two weeks. This study suggests that *M. micrantha* metabolites have coagulant properties. A new formulation with notable coagulant activity for treating topical bleeding was developed, with the potential for further commercial development.

Key words: Coagulant activity, Mikania micrantha, Lee and White method, Tranexamic acid, Clotting time

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Herbal cream formulation enriched with extracts of *Pterocarpus marsupium* (Gammalu) bark

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The potential use of *Pterocarpus marsupium* in cosmetics and cosmeceutical or in sun screening products has not been investigated. This study was to formulate an herbal cream enriched with extracts of *Pterocarpus marsupium* bark and evaluate its sun screening and radical scavenging activities. Oven-dried powdered bark of *Pterocarpus marsupium* was extracted with 80% aqueous methanol. The freeze-dried extract was incorporated with a cream base in different proportions to produce F_1 (1.6%), F_2 (1.9%), F_3 (2.7%) formulations and their stability was observed for 45 days. These formulations were evaluated for radical scavenging, sun screening activities and each compared to negative and positive controls. The *in-vitro* radical scavenging activity was assessed using DPPH (2,2-Diphenyl-1-picrylhydrazyl) assay and the *in-vitro* sun screening activity was determined in terms of SPF (Sun Protective Factor) by spectrophotometric method of Mansur. Significantly higher radical scavenging activity ($p<0.05$) was present in F_1 (11.19 ± 0.47 mmol TE/100 g cream), F_2 (12.53 ± 0.59 mmol TE/100 g cream), F_3 (14.94 ± 0.51 mmol TE/100 g cream) formulations compared to mean difference of positive control (2.13 ± 0.58 mmol TE (Trolox Equivalent)/100 g cream), negative control (0.06±0.01 mmol TE/100g cream). Sun screening activity of F_1 (2.74 ± 0.17), F_2 (3.33 ± 0.21), F_3 (3.85 ± 0.21) formulations showed significant difference ($p<0.05$) compared to mean difference of positive control (SPF 40+), negative control (0.00±0.00) at 2 mg/ml concentration. F_1, F_2, and F_3 formulations had pH in the range 6.06-5.91 and were salmon pink colored in physical appearance, homogeneous with good spread-ability throughout the 45-day period. The formulations F_1, F_2, and F_3 were with appealing texture had promising radical scavenging activity and potential to act as sunscreens.

Key words: Pterocarpus marsupium, Sunscreening activity, Radical scavenging activity, Herbal cream formulation

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Sustainable synthesis of Ag-ZnO nanocomposites utilizing pumpkin agro-waste and evaluation of their antioxidant potential

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The utilization of agro-waste for synthesizing nanocomposites (NCs) offers an eco-friendly method that supports sustainability and enables diverse applications in various industries. The study focused on the biosynthesis of Ag-ZnO NCs utilizing aqueous extracts of leaves (PL), peels (PP), and seeds (PS) waste from the Suprema F1 pumpkin variety and evaluated the antioxidant activities of each waste-mediated NCs. Optimal conditions were identified for synthesizing NCs with agro-waste extracts. UV-vis spectroscopy, FTIR, SEM, TEM, and XRD were used for the characterization of NCs. The antioxidant potential of NCs was assessed through DPPH, ABTS, and FRAP assays. The formation of Ag-ZnO NCs was confirmed by characteristic surface plasmon resonance peaks ranging from 350-475 nm. The involvement of the bioactive compounds as reducing, capping/stabilizing agents for the synthesis of NCs was evident in the FTIR spectra. SEM analysis showed that Ag-ZnO NCs contained spherical-shaped AgNPs aggregating on the nanoflower-shaped surfaces of ZnO. TEM analysis indicated particle size of NCs ranged from 20-86 nm. XRD analysis confirmed that Ag-ZnO NCs displayed high crystallinity, with the hexagonal wurtzite structure representing ZnO NPs and the face-centered cubic structure representing AgNPs. Concentration-dependent antioxidant activity was exhibited by the agro-waste-mediated NCs. Among them, PL-mediated Ag-ZnO NCs demonstrated the greatest antioxidant potential, exhibiting strong scavenging potent against DPPH and ABTS radicals, with IC_{50} values of 48.87 ± 2.90 ppm and 51.70 ± 2.00 ppm, respectively, and showed high FRAP scavenging power (138 ± 0.19 mg AAE/g) with equivalent to ascorbic acid. PS-mediated NCs exhibited diminished antioxidant activity when compared to PP and PL-mediated NCs. Consequently, biogenic NCs displayed the highest antioxidant activity than corresponding plant materials. The potential of pumpkin agro-waste as a valuable source for synthesizing Ag-ZnO NCs, which could serve as promising therapeutic agents by scavenging free radicals through their antioxidant properties.

Keywords: Ag-ZnO NCs, Ago-waste, Antioxidant activity, Eco-friendly, Suprema F1

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Effects of acid treatments on the properties of pyrolytic carbon char in rubber carpet formulations

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Pyrolysis is important not only for recycling waste tyres but also for recovering valuable economically important materials such as pyrolytic oil. The generation of pyrolytic char (PT-char) as a byproduct is problematic as it has a minimum market value due to the presence of many impurities. The current study focuses on employing different acid treatments to upgrade the properties of pyrolytic char in to commercial grade carbon black. The PT-char samples were passed through a 200 micron sieve prior to acid treatments. Acid treatments were conducted in three categories mild, medium and high concentrations. The purified samples were evaluated through X-ray Diffraction (XRD), Elemental analysis, Scanning Electron Microscope (SEM), and Thermal Gravimetric Analysis (TGA) and compared with commercially available carbon black: N330. All of these samples were then used as filler in rubber carpet formulations to investigate the feasibility of refined PT-Char to be used in rubber industry. Test rheological (minimum and maximum torque, scorch time, cure rate index) and mechanical properties such as tensile strength, hardness, tear strength, compression and abrasion volume loss for the prepared rubber compounding. According to the analyses, the acid treatment improved the carbon percentage of the PT-char while improving the physic-mechanical properties of rubber compounding as well over crude PT-char. Although acid treatments reduce impurities, the ash content reduce around 12% percent to 2% - 3% percent in PT-char samples and high concentrations of acids were unaffected by the physico-mechanical properties of the rubber compounding. The mild concentration outperforms the high concentrations in terms of rubber compounding. As a result, value addition for PT- char waste can be accomplished in a cost-effective manner.

Key Words: acids, pyrolysis, pyrolytic char, purification, waste tyre

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Green synthesis of ZnO nanoparticles and study of their photocatalytic degradation of Rhodamine B

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In the current study, ZnO NPs were successfully produced using flower extracts of *Clitoria ternatea (Ct)* and leaf extract of *Azadirachta indica* (*Ai*). Zinc acetate dihydrate was used as the precursor. Phyto-components in the extract aided in NP reduction and production. The highest percentage yield, 83 wt.% of NPs was obtained for *Ct*-ZnO. Characterization techniques, including UV–Vis spectroscopy, FTIR, and PSA, were used to distinguish between ZnO NPs. *Ct*-ZnO and *Ai*-ZnO NPs indicated UV-Vis absorption at 370 and 355 nm correspondingly. PS analysis confirmed the average sizes of *Ct*-ZnO and *Ai*-ZnO as 90 (±22) and 94 (±22) nm respectively. The degradation of textile dye, Rhodamine B (RhB) in the presence of ZnO photo catalysts and also ZnO bulk particles under solar irradiation was investigated in order to study their photocatalytic efficiency. As a result, it could be established that *Ct*-ZnO presented the highest degradation efficiency, 98 while *Ai*-ZnO and ZnO BP 95 and 86 % respectively. Maximum degradation illumination period was 300 min. According to the results of investigation on the effect of catalyst amount and pH on degradation of RhB, it could be established that 0.15 g and pH 9 were optimum for 100 mL of 5 ppm RhB, respectively. It was found that degradation time reduced from 300 to 150 min under optimum conditions. Furthermore, phenol, catechol and hydroquinone, were used to study photocatalytic degradation potential of produced NPs. In conclusion, *Ct*- ZnO NPs contributed most efficiently to the degradation of industrial dye RhB, phenol and its by-products which cause water pollution.

Keywords: Clitoria ternatea, Azadirachta indica, ZnO nanoparticles, Photocatalytic degradation, Rhodamine B

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Wood apple agro-waste based zinc oxide nanoparticles and their photocatalytic activity

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Utilizing agricultural waste for synthesizing nanoparticles (NPs) has increasing importance as it is essential for promoting environmental sustainability. This study focused on biogenic synthesizing ZnO NPs from wood apple outer shell (WA) extract to examine the photocatalytic activity against a widely used industrial dye, IC orange pigment dye (PD). The optimal conditions for synthesizing ZnO NPs with higher yields were identified by varying the conditions (ion precursor concentration, ratio of plant extract to ion solution, pH, irradiation methods, and incubation time). UV-Vis spectroscopy, FTIR, SEM, TEM, EDS, and XRD analysis were used to characterize the NPs. Surface plasmon resonance peaks between 350 and 370 nm was used to preliminary confirm the formation of ZnO NPs. FTIR analysis indicated the stretching mode of the Zn-O bond in the range of 500-700 cm^{-1}. SEM analysis revealed the spherical morphology of NPs, while the particle size of 82.4 nm was observed through TEM analysis. XRD analysis confirmed the formation of the hexagonal crystalline structure of ZnO NPs, while EDS confirmed the chemical elements as Zn and O. Under the optimum operational conditions (pH, catalytic load, and dye concentration), the greenly synthesized WA-mediated ZnO NPs demonstrated exceptional photodegradation efficiency of 90.52 % at 360 mins. This exceptional performance is attributed to the wide-bandgap semiconductor capabilities of the ZnO NPs, aligning with the absorption of solar light.

Key words: Photocatalytic activity, Pigment dye, Wood apple, ZnO NPs
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Synthesis of nanocrystalline cellulose from plant and their chromatographic applications

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Researchers are exploring green synthesis methods for producing nanocrystalline cellulose (NCC) due to environmental concerns and economic constraints. In this study, NCC was synthesized in a cost-effective method using an abundant invasive plant material called Guinea grass (Panicum maximum). In this study, cellulose extraction, purification through alkaline treatment and bleaching, cost-effective acid hydrolysis using 5% sulfuric acid and 10% acetic acid, and a comparison of two drying methods (freeze-drying and oven drying) were investigated to produce NCC. The characterization of the NCC was carried out by Fourier Transfer Infrared Spectroscopy & X-Ray Diffraction. The crystallinity index was slightly higher in Oven dried Cellulose Nanocrystals (OD CNCs) (18.60 %) compared to freeze dried (FD) CNCs (18.22%). Additionally, when examining crystallite size, OD CNCs exhibited a smaller crystal size (76.08 nm) compared to FD CNCs (118.12 nm). Using FD CNCs, chromatographic paper was produced, and OD CNCs were used to make Thin Layer Chromatographic (TLC) plates. Both the paper and TLC plates exhibited comparable Rf values and were more time-efficient when compared to conventional chromatographic paper and TLC plates. This study implies a cost-effective method to synthesize CNCs using abundant plant waste. The application of CNCs in chromatography indicates their potential to replace traditional methods in the future.

Key words: Nanocrystalline cellulose, Oven dried Cellulose nanocrystals, Freeze dried Cellulose nanocrystals, Thin layer chromatography

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Synthesis of nanocrystalline cellulose from *Musa Paradisiaca* bunch stalk and peel and its' application in environmental remediation

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The heavy metals in the environment have become a serious threat to human health and the balance of ecosystems. Environmental remediation processes could be used to remove heavy metal ions from the natural environment. Nanocrystalline cellulose (NCC) is a good adsorption material that is well-available, biocompatible, and biodegradable. This study was conducted to synthesize NCC from *Musa Paradisiaca* banana bunch stalk and banana peel, a common agricultural plant waste material, and study their efficiency for heavy metal adsorption. The synthesizing process was successfully carried out with the acid hydrolysis method. From the banana bunch stalk, a 26.1555% yield of NCC was obtained, while from the banana peel, a yield of 29.15 % was obtained. According to FTIR, in the 1000 to 1200 cm^{-1} region there is a very intense peak because of C-O stretching; however, in polysaccharide compounds, an overtone of this stretching occurs in 2000 – 2500 cm^{-1} region, which is clearly visible in banana peel NCC. The XRD analysis was carried out to examine the crystallite size, and the nanocrystalline particles produced were 1.66 nm from the banana bunch stalk and 0.79 nm from the banana peel. These nanomaterials were used to find the adsorption properties of heavy metal ions of Cd^{2+}, Pb^{2+}, Cu^{2+}, and Ni^{2+}. Ni^{2+} showed a high removal percentage of 60% in the range of pH 2 to 6. Pb^{2+} showed higher removal percentages of 45% to 67% in the range of pH 1 to 5. Cd^{2+} and Cu^{2+} showed relatively low removal percentages.

Key words: Nanocrystalline cellulose, Heavy metal adsorption, Environmental remediation

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Evaluation of antimicrobial activity of essential oil of *Pogostemon heyneanus* benth (f.lamiaceae) leaves and formulation of an emulgel dosage form

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Pogostemon heyneanus Benth is an important medicinal plant belonging to family Lamiaceae.This study investigates the antimicrobial properties of the essential oil obtained from the leaves of *P. heyneanus* and formulation of an emulgel, The oil was extracted by hydro-distillation. Antimicrobial activity was evaluated against *Staphylococcus aureus, Pseudomonas aeruginosa,* and *Candida albicans* using agar disk diffusion method. Gentamicin and fluconazole served as positive controls for bacteria and fungi respectively. As negative control, 10% v/v DMSO was used. An emulgel was prepared using the above essential oil, Tween 20 (the surfactant), and Carbopol 940 (gelling agent). Agar well-diffusion method was used to test the antimicrobial activity of the emulgel. IC_{50} of the oil and the emulgel was obtained by performing the broth microdilution test. The yield of the essential oil was 1.36 % w/w. The results revealed that the essential oil exhibited significant ($p<0.001$) antimicrobial activity compared to positive control, with IC_{50} values of 8.29 mg/mL for *P. aeruginosa*, 14.92 mg/mL for *S. aureus*, and 22.11 mg/mL for *C. albicans*. However, the IC_{50} of the emulgel, was slightly higher; 61.7 mg/dL for *S. aureus*, 56.82 mg/dL for *P. aeruginosa*, and 61.29 mg/dL for *C. albicans.* The pH of the emulgel was pH 6.2. There was no any phase separation or colour change of the emulgel up to three months under room temperature. In conclusion, the efficacy of the formulated emulgel, suggesting its potential as a promising topical antimicrobial properties. Further development of emulgel as a value added product would be beneficial.

Key words: Pogostemon heyneanus, Lamiaciae, Essential oil, antimicrobial activity, Emulgel

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Computational study on the activity of serum Paraoxonase-1 (PON1) in lipid membrane with Glutamine/Arginine polymorphism at position 192

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Serum Paraoxonase-1(PON1) is a calcium dependent hydrolytic enzyme that is closely associated with high-density lipoprotein (HDL). This enzyme contains a promiscuous active site that could undergo three different types of catalytic activities such as organophosphatase activity, lactonase activity and arylesterase activity. Among these polymorphisms in serum PON1, the Glutamine/Arginine polymorphisms at position 192 are prominent and have a large impact on the rate of the catalytic activities of serum PON1. The main objectives of this study were to model the PON1 protein in a phospholipid bilayer and to investigate the possible mechanism for the change in catalytic activity of serum PON1 due to Q192R polymorphism. The lipid-bound PON1 protein was modeled using the CHARMM-GUI web server. The diazoxon ligand is a well-known organophosphate that was found to have a higher hydrolytic activity in R192 isoform than in Q192 isoform and is used as the ligand for this investigation. This ligand was docked to the serum PON1 isoforms by AutoDock Vina. Best docking poses were then subjected to molecular dynamics simulation for 200 ns using Amber 16 software. The structural analysis of output trajectories and docking results indicate that diazoxon ligand is more stable in R192 isoform than Q192 isoform which could be a reason for the greater activity of R192 isoform. Further studies will be carried out to investigate the effect of polymorphisms on the activities of PON1 protein using the developed model.

Key words: PON1, polymorphism, lipid-bound protein, organophosphatase activity, molecular docking, molecular dynamics.

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The impact of structured exercise programs on the gross motor skills development of children with Attention Deficit Hyperactivity Disorder (ADHD)

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Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental condition characterized by symptoms like inattention, impulsivity, hyperactivity, and behavioral control challenges, often associated with sensory, motor, or emotional neurological factors. This study aimed to explore the impact of structured exercise programmes on the development of gross motor skills in children diagnosed with ADHD. This study involved 28 participants (16 boys and 12 girls), aged between 5 and 10 years, who were selected purposively due to their ADHD diagnosis. Baseline assessments were conducted using the Test of Gross Motor Development-2 (TGMD-2). Over seven weeks, a structured gross motor skills training program was administered, comprising two sessions per week, each spanning 40 minutes in Chithra Lane School. The data analysis utilized a paired T-test in Minitab, revealing noteworthy improvements in gross motor skills, with a significant level of $p<0.001$ observed in the TGMD-2 gross motor quotient. In conclusion, the findings from this study underscore the effectiveness of the proposed gross motor skills training program in significantly enhancing the gross motor skills of children diagnosed with ADHD. These results emphasize the importance of addressing motor skill development as a component of ADHD management in improving the daily functioning and overall quality of life of children grappling with ADHD.

Keywords: ADHD, exercise programme, gross motor skills

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A survey on dietary and lifestyle practices among hypertensive patients: A cross-sectional study

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Hypertension, a prevalent chronic condition globally, impacts a significant population, particularly in middle-income countries. This cross-sectional study aimed to investigate the dietary and lifestyle preferences of 120 hypertensive patients. The study was conducted with ERC approval and gathered information through interviews and questionnaires at Medico Pharmacy–Battaramulla and Ayurvedic Hospitals at Borella, Navinna, Meegoda, Lunava, and Jamburaliya in the Western Province of Sri Lanka. The research focused on a diverse study population, considering gender, age distribution, occupation, race, religion, and marital status. Socioeconomic levels were categorized into low, middle, and high, while educational levels encompassed formal, primary, secondary, and tertiary education. This comprehensive approach aimed to capture a nuanced understanding of the participants, enhancing the study's depth and relevance. The inclusion of individuals from various backgrounds ensured a representative sample, contributing valuable insights to the exploration of dietary and lifestyle choices in hypertension management. Results showed prominent choices, with over 75% favoring tomatoes, carrots, garlic, and cinnamon, and over 50% preferring cardamom, ginger, and curry leaves. Additional items, including pumpkin seeds, bananas, passion fruit, drumstick leaves, cabbage, green tea, and orange, were consumed by over 25% of participants. The study delved into the pharmacodynamic properties of identified foods, analyzing their impact on hypertension management through *Rasa*, *Guna*, *Vīrya*, *Vipāka*, and chemical constituents. In conclusion, this research provides insights into the dietary and lifestyle preferences of hypertensive individuals, emphasizing potential therapeutic benefits in managing this chronic condition.

Keywords: Food and beverage preference, hypertension management, therapeutic benefits

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Soil nematodes assemblage associated with ridge-gourd fields maintained with conventional and good agricultural practices (GAP)

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Soil nematodes play a key role in the functioning of soil ecosystems. Despite their great importance, to date, only a few studies focused on nematode assemblage in Sri Lanka, especially in the southern region. In this study, soil nematode communities associated with good agricultural practices (GAP) and conventionally managed ridge-gourd fields, located in "Mirissa", Matara district, were identified and their abundance was determined in the rhizosphere and non-rhizosphere regions at three depths (0 - 5, 5 - 10, and 10 - 15cm) over three months from August to October 2022. Two fields per cultivating practice were assessed monthly by selecting five plants using systematic random sampling. Five soil cores (125g) were taken at each depth, and the nematode abundance was determined in three, 100 g sub-samples and averaged, using Baermann funnels. Randomly selected 150 nematodes were taxonomically identified up to the Genus level. Organic matter content, pH, soil moisture, and texture of the soil were measured. Altogether, 15 nematode species were found representing five feeding groups, bacterivores (2 spp.), plant feeders (6 spp.), omnivores (4 spp.), and predators (3 spp.). GAP fields contained higher (P<0.05) nematode abundance than the conventional fields. All the time, the larval abundance outnumbered the adults (P<0.05). In both practices, the rhizosphere region constituted higher nematode abundance (P<0.05) than the non-rhizosphere region, while the abundance decreased (P<0.05) with increasing depth. *Helicotylenchus* was the dominant species (72.2 ± 0.4) in GAP fields, while *Rotylenchus* was dominant (42.2 ± 0.12) in the conventional fields. GAP fields contained higher (P<0.05) organic matter content than the conventional fields. Based on the results, GAP supported higher nematode abundance and biomass compared to conventional management in vegetable fields.

Keywords: Abundance, conventional management, soil nematodes, rhizosphere

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Formulation of a potential topical antiperspirant using natural ingredients

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Hyperhidrosis is a dermatological condition characterized by excessive sweating. It significantly affects the quality of life of affected individuals, leading to various social, occupational, and dermatological problems making effective treatment options essential. This research explores the formulation of a potential topical antiperspirant using natural ingredients. Coconut oil is known for its antimicrobial properties and has been traditionally used in various applications. Natural astringents like key lime and aloe vera not only help in reducing sweat production but also exhibit antibacterial properties. Arrowroot powder acts as a natural sweat absorbent making the formulation suitable even for sensitive skin. Beeswax and shea butter contribute to the formulation's stability and provide additional antimicrobial properties. Various cream formulations (F1 to F5) were prepared by combining the above ingredients in different proportions. Among them, F3 formulation exhibited the highest stability and homogeneity after a two-week observation period. The F3 formulation was assessed for stability, color, odor, homogeneity, pH, phase separation, and antibacterial activity against *Staphylococcus aureus*, a common skin bacteria. Furthermore, an irritation test was conducted on 5 volunteers and any adverse effects were not observed after 24 hours of application. These findings suggest that the developed cream formulation holds promise to develop an antiperspirant with antibacterial activity and skin compatibility. Further research and clinical trials may be needed to explore its application as an antiperspirant.

Keywords: Antibacterial effects, antiperspirant action, excessive sweating

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Development of herbal feminine wash with *Bauhinia racemosa* (Lam.) bark-extract and *in vitro* evaluation of antibacterial and antifungal activities

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Herbal feminine products are widely embraced since their low incidence of side effects. This study aimed to develop an herbal feminine wash with potential antimicrobial activity, using the effect of abundant phenolic compounds and flavonoids found in *Bauhinia racemose* (Lam.) bark, targeting the most prevalent vaginal infections, such as vulvovaginal candidiasis and aerobic vaginitis. The crude extracts were obtained by macerating dried bark powder in 70% acetone, and distilled water separately for 24 hours in the dark. Crude extracts were tested for antibacterial activity against *Staphylococcus aureus* (ATCC 25923), and antifungal activity against a clinical isolate of *Candida albicans* using the agar well diffusion method. The crude extract of 70% acetone at the concentration of 0.8 g/ml showed 20.80 ± 0.01 mm zone of inhibition against *S. aureus* and 13.02 ± 0.37 mm zone of inhibition against *C. albicans*. Five different formulations were prepared by mixing 2%, 4%, 8% acetone extract and 5%, 10% aqueous extract. They were evaluated for antimicrobial activity against the same microbes compared to a positive control (a commercial product). Further, the stability of physico-chemical parameters of the formulations was observed over 30 days. Among all, 8% acetone extract and 10% water extract incorporated formulations showed 17.52 ± 0.54, and 20.90 ± 1.06 mm zone of inhibition against *S. aureus*, respectively. These two also exhibited 20.80 ± 0.69, and 21.27 ± 0.06 zone of inhibition against *C. albicans*, respectively. In conclusion, there are no significant alterations in the physico-chemical parameters of all formulations. Also, the 10% aqueous extract added formulation showed a markedly elevated level of antimicrobial activity against tested microorganisms.

Keywords: Antibacterial, antifungal, Bauhinia racemose, herbal feminine wash

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Immunomodulatory roles of *Edwardsiella piscicida* and *Streptococcus parauberis* derived extracellular vesicles in Zebrafish

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Extracellular vesicles (EVs) are lipid bilayer vesicles (size 20-1000 nm) released by all three domains of life namely eukaryotes, bacteria, and archaea. Bacterial extracellular vesicles (BEVs) are involved in evolutionarily conserved mechanisms for intercellular communication and activation of immune signaling pathways. In this study, we performed a comparative analysis of BEVs isolated from two fish pathogenic bacteria namely *Edwardsiella piscicida* (*Ep*-EVs) and *Streptococcus parauberis* (*Sp*-EVs), and investigated their immunomodulatory activities. *Ep*-EVs and *Sp*-EVs were isolated using respective bacterial culture supernatants by ultracentrifugation process. Analysis of BEVs size and particle concentration was conducted using the Nano-Sight NS300. After confirming the cellular internalization, qRT-PCR and immunoblot were conducted to determine immune-related genes (kidney) and protein expression (spleen) in *Ep*-EVs and *Sp*-EVs-treated zebrafish. Transmission electron microscopy (TEM) results confirmed the spherical shape of *Ep*-EVs and *Sp*-EVs. The average particle size of *Ep*-EVs and *Sp*-EVs were 85.3 ± 1.8 nm, and 168.3 ± 6.5 nm, respectively. SDS-PAGE analysis confirmed that both *Ep*-EVs and *Sp*-EVs contain differently expressed proteins with varying molecular weights. Fluorescent-labeled *Ep*-EVs and *Sp*-EVs showed cellular internalization in fathead minnow (FHM) cells. qRT-PCR and western blot analysis results revealed *Ep*-EVs and *Sp*-EVs injected zebrafish modulate the transcription of immune functional genes (toll-like receptors, interleukins, chemokines, and heat-shock proteins) and proteins suggesting their potential in therapeutic applications.

Keywords: Extracellular vesicles, Edwardsiella piscicida, immunomodulation, Streptococcus parauberis, Zebrafish

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Determination of biocompatibility of *Carmona retusa* (vahl.) Masam using brine shrimp and zebrafish assays (FET 293)

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Carmona retusa, known as 'Heen thambala' is a traditional medicinal plant in the Boraginaceae family, valued for its therapeutic properties against various ailments. Despite its traditional significance, its usage in Sri Lanka is limited. This study aimed to assess the toxicological and biocompatibility aspects of *Carmona retusa* using two bioassays. Brine shrimp lethality assay (BSLA) was conducted, exposing brine shrimp nauplii to different concentrations (100 - 500 µg/ml) of the aqueous extracts of the plant along with a control. The results revealed LC50 values of 3025 µg/ml after 24 hours (non-toxic) and 527.4 µg/ml after 48 hours (toxic), based on Meyer's toxicity index. Zebrafish assay (FET 293) was done by exposing embryos to the different concentrations (100 - 500 µg/ml) of the plant extracts. The hatch rate, survival rate, heart rate and development deformities were observed at specific time intervals (24, 48, 54, 72, 80 and 96 hpf). Hatch rates decreased with increasing extract concentrations, reaching 100% at 96 (hpf) for concentrations up to 300 µg/ml. Higher concentrations (400 and 500 µg/ml) showed 80% and 70% hatch rates respectively. Survival rates remained constant until 72 hpf, significantly decreasing at 96 hpf in the embryos exposed to 400 and 500 µg/ml. Heart rates (beats/min) slightly increased at 72 hpf and 96hpf for all concentrations but remained within the normal range. Deformity analysis identified yolk sac oedema as the primary effect with 100 µg/ml showing non-structural deformities and higher concentrations displaying yolk sac oedema. The study concludes that *C. retusa* exhibits moderate toxicity in zebrafish embryos.

Keywords: Biocompatibility, BSLA, *Carmona retusa*, toxicity

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Identification of dominant sesarmid crab species of a mangrove ecosystem in Southern Sri Lanka using DNA barcoding

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Among the herbivorous macroinvertebrates, sesarmid crabs play an important role in maintaining the stability of the mangrove ecosystems. The taxonomic identification of sesarmid crabs in Sri Lankan mangroves is important in establishing conservation priorities in ecosystem management. A few studies have dealt with the sesarmids in Sri Lanka, but no proper study has been conducted to reveal their correct taxonomic identification. Hence, this study attempts to determine the taxonomic status of the common sesarmid species from the Galle-Unawatuna mangrove forest (06°01′N, 80°14′E) using the mitochondrial DNA barcoding gene region. Three dominant sesarmid genera (*Neosarmatium, Perisesarma*, and *Episesarma*) were identified using their morphological characters. DNA was extracted from three samples of each suspected genus. The mitochondrial cytochrome *c* oxidase subunit 1 gene (~710 bp) was amplified and sequenced. The consensus sequences were compared with the NCBI database using the BLAST option. The phylogenetic tree was constructed with the support of most similar sequences downloaded from the database, and the nucleotide divergence levels were acquired using MEGA 11 software. The results confirm the morphological identification is accurate for *Neosarmatium* sp. (*p*- distance 3.0%) and *Perisesarma* sp. (*p*- distance 2.4%). The morphological identification was not congruent with the genetic analyses for three individuals of *Episesarma*. Accordingly, the results reveal the importance of DNA barcoding to confirm the identification of sesarmids in case of morphological overlapping, and further evaluate the need for their valid identification in future conservation priorities.

Keywords: Cytochrome Oxidase I, mangroves, p-distance, sesarmid crabs

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Variations of colour, total carotenoid and astaxanthin levels in fillets of Asian seabass (*Lates calcarifer*) with the post-harvest time

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Freshness and nutritive quality determine the market value of food fish. Asian seabass fetches high price both in local and export markets due to their colour, texture, taste and high nutritive value. Present study investigated seabass fillet freshness through color and nutritive quality changes measured by total carotenoid (TC) and astaxanthin content at different post-harvest times (7h, 9h, 11h, 13h, and 7-days) to develop a consumer-friendly colour chart for freshness determination. Parameters were collected in triplicates at room temperature (27 ± 1°C) from randomly caught cage-cultured fish and wild seabass fish fillets (2.0 - 2.5 kg weight, 35-50 cm total length) in Batticaloa Lagoon (n = 10 & 05, respectively). After one-week of freezing (-10ºC), same parameters were recorded. Chromometer readings; L*-lightness, a*-redness, b*-yellowness (International Commission on Illumination (CIE values)) were recorded in the fillets and these values were converted to RGB values to develop colour chart using Mathlab software. TC and astaxanthin contents of fillets were analyzed using standard procedures. Astaxanthin and TC levels were significantly reduced ($P < 0.05$) with post-harvest time except TC in wild fish fillets. Levels of astaxanthin and TC at 7-hour post-harvest time were significantly higher than those of 7-day post-harvest time ($P<0.001$). With post-harvest time, CIE values revealed no significant differences indicating limited change in fillet colour. The study's developed colour chart reflected the same confirming that the post-harvest colour changes were indistinguishable to the naked eye. This study revealed that seabass fillets maintain consistent colour for 13h of harvesting under frozen conditions, while nutritive quality of fillets has significantly reduced over time.

Keywords: Asian seabass, colour chart, fillet freshness, nutritive quality, post-harvest changes

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Significance of Wellamadama premises of the University of Ruhuna, Southern Sri Lanka for the conservation of avifauna in Matara district

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Birds, with their diversity and functions in ecosystems, are valuable indicators of overall ecosystem health and biodiversity. This study was conducted weekly from July to October 2023 as a comparative analysis in two distinct habitats in southern Sri Lanka, *i.e., the* University of Ruhuna (UOR) premises and the adjoining Matara town area (MTA). A line transect method integrated with point counts with unlimited distance (Variable Circular Plot Method - VCPM) was used to count birds. Transects were selected according to the local road network, with randomly selected starting points. Peak counting hours were between 0600 h–0900 h and 1500 h–1800 h. Binoculars (10 × 40) and standard field guides were used to identify diurnal birds and calls of birds were used to recognize nocturnal birds. The Shannon Diversity Index (H) and Shannon Evenness Index (EH) were calculated to compare the avifaunal diversity and their evenness in UOR and MTA. A total of 2,776 (MTA-1,622, UOR-1,154) individuals that belong to 73 species (MTA-26, UOR-73) were identified during this study period. Of them, 47 species including five endemic species were noted only from the UOR, highlighting the significance of the UOR premises for the conservation of those species. Diversity indices also showed that the diversity and evenness of birds are higher in the UOR premises (H = 3.3713; EH = 0.7858) than in the MTA (H = 1.8901; EH = 0.5801). Two migratory bird species (*i.e.*, Blue-tailed Bee-Eater (*Merops philippinus*) and Indian Pitta (*Pitta brachyura*)) were also detected only from UOR. The most common species found in the UOR were the Indian Swiftlet (*Aerodramus unicolor*) (12.9%) and Yellow-billed Babbler (*Turdoides affinis*) (11.5%), while House Crow (*Corvus splendens*) (29%) and Common Myna (*Acridotheres tristis*) (26.6%) were the most common species in MTA. The results of this study suggest that UOR premises provide more diverse habitats for both residential and migratory birds than the MTA, which is rich with urbanized characteristics and coastal landscapes.

Keywords: Avifaunal Diversity, bird conservation, urban Biodiversity, urban greenspaces

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SELEX for identifying albumin binding DNA aptamers in a local setting – a preliminary study

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Aptamers are synthetic single-stranded DNA or RNA molecules which are capable of folding into defined 3-dimensional architectures and complex shapes thereby allowing for predictable and specific molecular interactions and complex formation with protein and small-molecule targets. This specific binding of aptamers with high affinity allows them to serve as antibody analogues paving the way for them to be used in a wide range of diagnostic and therapeutic domains. Systematic evolution of ligands by exponential enrichment (SELEX), the process of identifying aptamers is both time-consuming and a labor-intensive process. The current study aims to conduct SELEX in a local setting using a cost-effective approach to identify albumin-binding DNA aptamers. Eight SELEX cycles were conducted on a microtiter plate-based selection platform. Real-time amplification curve, melt curve and high-resolution melt curve were used as monitoring tools and the product of the final SELEX cycle was subjected to next-generation sequencing (NGS) analysis. Across the eight SELEX cycles, real-time PCR-based amplification curve analysis showed a gradual increase of bound fraction, while melt curve and high-resolution melt curve analysis showed a gradual reduction of aptamer pool diversity reflecting successful enrichment. The aptamer sequence with the highest frequency in the final SELEX pool was selected based on NGS results. The binding assay of this selected aptamer sequence with albumin revealed comparable binding affinities as compared to the control. Thus, the authors report successful attempts in the establishment of SELEX platform in the local setting with the potential to use this molecule in diagnostic platforms for the detection of albumin in future.

Keywords: Aptamer, SELEX, ssDNA, Monitoring, Real-time PCR

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Investigating the impact of socio-demographic factors on reservoir conservation interest

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Reservoirs provide a wide array of benefits to rural communities through ecosystem services. Conservation of reservoirs is a vital factor to ensure sustainable use of these ecosystem services. In the current context of reservoir project evaluations, the conservation interests of the neighboring community and their socio-demographic factors have not been considered. Therefore, the present study was formulated to address the gap in the current evaluation process in Sri Lanka. Deduru Oya reservoir was selected as the study site and the target respondents were the direct beneficiaries neighboring to Deduru oya reservoir. This study investigates the willingness of local communities for both 'monetary' conservation efforts and 'non-monetary' conservation efforts by means of 'time and labor'. A socio-economic survey was conducted through a structured questionnaire across 68 households for three months from January to April 2023. The questionnaire comprises both closed and open-ended questions. The findings of this study derive the relationship between conservational interests and socio-demographic factors thus demonstrating the lack of applicability of typical conservational approaches which has been used in major reservoir projects in Sri Lanka. In conclusion, the rural communities' willingness for reservoir conservation by non-monetary means of spending their time and labor has a higher significant impact (R^2 = 20.8 %) than monetary conservational interests (R^2 = 18.8 %).

Keywords: Conservation, ecosystem services, reservoir, socio-demographic

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Acute toxicity of cylindrospermopsin on zebrafish (*Danio rerio*) embryonic development

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Eutrophic conditions in freshwater bodies cause the formation of cyanobacterial blooms. Cylindrospermopsin (CYN) is a tricyclic alkaloid cytotoxin produced by cyanobacteria as a secondary metabolite. Exposure to elevated concentrations of CYN could cause liver and kidney damage in fish. The present study focused on the acute toxicity effects of CYN on zebrafish embryonic development. Zebrafish embryos were exposed to a concentration series of 0.1 μgL^{-1}, 1.0 μgL^{-1}, 2.5 μgL^{-1}, 5.0 μgL^{-1} and 7.5 μgL^{-1} prepared using CYN standard solution and control (distilled water). After 1 hour of post-fertilization (hpf), 30 eggs per concentration were exposed and triplicated with three different batches. Hatching rate, hatching time, mortality rate and heart rate were recorded at every 24 hrs up to 96 hpf. The highest mortality rate was recorded as 13.3 % at 7.5 μgL^{-1} concentration, whereas the lowest was 3.3 % at 0.1 μgL^{-1}. Hatching time increased from 55.2 ± 2.04 hpf to 76.3 ± 2.21 hpf with increasing concentrations. In contrast, the control showed the lowest hatching time at 53.7 ± 2.16 hpf with 0 % mortality. Heart rate decreased from 124.7 ± 2.45 bpm to 95.5 ± 2.79 bpm in high concentrations compared to the control of 145.7 ± 2.26 bpm. Statistical analysis showed that CYN concentration and embryo survival have a negative correlation while hatching time has a positive correlation ($p < 0.05$). Findings suggest that the impact of CYN on the embryonic development is influenced by the dosage as higher doses lead to greater vulnerability. This could potentially lead to a reduction in the zebrafish population especially when water bodies are hypereutrophic.

Keywords: Cyanotoxin, Cylindrospermopsin, Embryonic development, Zebrafish
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An optimization model for integrated vehicle routing problem and vehicle sequencing problem with Cross-docking System

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The efficiency of a supply chain (SC) is crucial for survival in the globalized industrial environment. Industries adopt the innovative logistic strategy known as “Cross-docking” in their SC to satisfy the requirements of customers in terms of time, quality, and cost. A cross-docking system (CDS) operates as a transshipment center between suppliers and customers. As per the recommendations made in the literature on SC, this study integrates the vehicle routing problem and vehicle sequencing problem with some internal operations such as loading/unloading products at the doors of CDS and moving shipments inside the CDS. Therefore, the objective of this study is to obtain the optimal solution to the integrated problem of “routing vehicles from CDS to suppliers and from CDS to customers” and “sequencing inbound vehicles to single in-door and outbound vehicles to single out-door at CDS” which is referred here as VRSQ-CDS. Sequencing the inbound vehicles to in-door is based on the arrival time to CDS and the outbound vehicles are sequenced based on the product ready time at CDS. The results of the small-size instances extracted from a benchmark problem are compared with the enumeration method to ensure accuracy. Furthermore, the compatibility of the developed mixed integer quadratic programming model for VRSQ-CDS is also confirmed in it. Therefore, it is recommended to employ this model in small-size instances. Since the run time to obtain the exact solutions gradually increases with the problem size when using the Branch and Bound algorithm, it can be recommended to apply an appropriate meta-heuristic approach to reach a near-optimal solution to large-size instances of VRSQ-CDS.

Keywords: Cross-docking, Moving shipments, Optimization, Routing problem, Sequencing Problem

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A hybrid CNN-SVM model for Tamil handwritten character recognition

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Recognizing offline Tamil handwriting is a very challenging task because of the complex linguistic structures used by writers, and similarities in the appearance of Tamil characters and individual differences observed in the handwriting of the same person. In this paper, we propose a hybrid system that combines Support Vector Machines and Convolutional Neural Networks for multi-class classification to recognize offline handwritten Tamil vowel characters. The proposed hybrid CNN-SVM model is developed by replacing the final output layer of the CNN model with an SVM classifier. The classifier is a fully connected layer with trained softmax which uses an end-to-end approach. In this model, the support vector machine is piled on top by deleting the final fully connected softmax layer. A dataset consisting of 12 handwritten Tamil vowel characters with 580 samples per vowel is considered for the experiment. SVMs using the RBF kernel give an accuracy of 97.13%, the CNN model 98.00%, and the hybrid CNN-SVM model 98.54%. Based on this experiment, it can be concluded that the proposed hybrid CNN-SVM model achieves better results compared to the SVMs and the CNN model.

Keywords: CNN, CNN-SVM, HOG, OCR

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A multivariate measurement error model for method comparison data under skewed and heavy-tailed distributions

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Agreement evaluation among multiple measurement methods is vital in healthcare and related disciplines. The main objective is to evaluate the extent of agreement based on a parametric approach through multiple comparisons of method pairs. In literature, existing approaches often depend on the normality assumption and typically employ mixed-effects models. However, in reality, the assumptions are breached depending on skewness and heavy-tailedness. Also, the presence of inherent measurement errors denies the usage of mixed-effect models. To overcome these challenges, this article introduces a novel multivariate measurement error model (MEM) that assumes scale mixtures of skew-normal distributions, including skew-t, skew generalized-t, and skew-normal for true unobserved covariates and scale mixtures of normal distributions for errors. A key feature of this model is that it can accommodate different degrees of freedom for the true covariate and errors. Further, the normally distributed replicated MEM is considered for comparative analysis. The maximum likelihood estimates are derived through the expectation conditional maximum algorithm. To assess the performance of these estimates, we conducted a simulation study, considering metrics such as bias and root mean square error. The tumour dataset is utilized to illustrate the practical application of the proposed model effectively, and using the probability of agreement metric, we have assessed agreement among the possible method pairs. The results reveal that our proposed model is well-suited for modelling method comparison data between multiple methods across small, modest, and large samples, particularly when data exhibit skewness and heavy tails.

Keywords: Agreement evaluation, Expectation conditional maximization, Skewed and heavy-tailed distributions, Probability of agreement, Multivariate measurement error model.

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CFD simulation for miscible and immiscible viscous fingering formation for distinct injective fluids

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P. Saffman and G.I. Taylor investigated the Saffman-Taylor instability, also known as viscous fingering, which is the creation of patterns in a morphologically unstable interface between two fluids in a porous medium, mathematically for the first time in 1958. The most frequent occurrence of this circumstance occurs during enhanced oil recovery and drainage processes via porous or soil mediums. When a more viscous fluid is displaced by a less viscous fluid and injected at a relative speed through a porous medium, the interface becomes unstable and forms protuberances resembling fingers. Using COMSOL Multiphysics, we were able to visualize the formation of miscible and immiscible viscous fingers in a homogeneous porous medium by injecting various fluids, including water, carbonated water, and nano-brines (aluminum oxide, silicon dioxide, and magnesium oxide) during the enhanced oil recovery process. Nanopowders and carbon dioxide are miscible in both water and oil. It tends to reduce viscosity, improving mobility. This allows oil to flow more freely towards the production well. This study was done in a 2D Darcian frame for various injection log-mobility ratios. We captured the spatio-temporal evolution at certain times and discussed the results for each injective fluid. As a result, we can conclude that with nano-brines, we can recover more oil than with other methods and less oil when using water injection, according to the findings of the existing literature. Among nano-brines, aluminum oxide comes first, followed by silicon dioxide and magnesium oxide, respectively.

Keywords: COMSOL Multiphysics, Darcy law, Enhanced oil recovery, Log-mobility ratio, Miscible and immiscible viscous fingering

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Exploring monthly births in Sri Lanka

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Monthly births are important to a country as they directly influence its population and demographic structure, economy, and healthcare system. As Sri Lanka is a developing country, analyzing monthly births can be introduced as a major aspect of resource management. The number of monthly births during 2012 (January) – 2021 (December) was obtained from the Registrar General's Department of Sri Lanka. There has been no attempt to access the forecasting monthly birth count so far. The main objective of the study was to fit a suitable model and forecast future monthly births. We observed that there is a trend and seasonality. By the ADF test (p-value<0.01), the first difference of the series is stationary. We fitted seasonal Autoregressive Integrated Moving Average (SARIMA) and Holt-Winters methods and did a comparison based on the residuals to find the best model. According to the results, the best-fitted model was selected based on Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percentage Error (MAPE), and the Mean Absolute Scaled Error (MASE). By the comparison of accuracy measures in SARIMA and Holt-Winters methods, SARIMA is given the best accuracy. By ACF and QQ plots, forecasting errors are uncorrelated, normally distributed, and independent by the Ljung-Box test (p-value = 0.709). Then we conclude that SARIMA (4,1,1) (2,0,0) [12] was the best model for forecasting monthly births in Sri Lanka.

Keywords: Monthly Births, SARIMA, Holt-Winter's, prediction, forecasting

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Parameter estimation in eurvival distribution by using Expectation Maximization (EM) algorithm

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For ages, actuaries, medical officers, and governments have used survival analysis to estimate life expectancies, medical treatment effectiveness, insurance premiums, and annuities. Censored data, the motivating factor for survival analysis, can be thought of as a special case of a more general statistical topic, missing data. Let $X_1, X_2, \ldots, X_n$ be the failure data from some absolutely continuous distribution function $F(t, \theta)$; where t is the time, and let $Y_1, Y_2, \ldots, Y_n$ be the censored data from some distribution function $G(t)$. We further assume that two samples are mutually independent. In this study, we consider the right censoring data $(Z_1, \delta_1), (Z_2, \delta_2), \ldots, (Z_n, \delta_n)$, where $Z_i = min(X_i, Y_i)$ and $\delta_i = I(X_i < Y_i)$ and $I(.)$ is the indicator function, and explain how to estimate the unknown parameter θ of relevant distribution, and hence obtained the parametric estimator for the survival distribution. In this study, we used the EM algorithm to estimate the unknown parameter θ because the EM algorithm is efficient for handling missing data. We conducted all simulation studies by using R software. In the simulations study, survival data are generated by using a one-parameter Exponential distribution and then a two-parameter Weibull distribution. In both cases, we compared the obtained parametric survival distributions with the nonparametric version, the Kaplan-Meier estimator. The results obtained by the three methods: Maximum likelihood method, Expectation Maximization algorithm, and Kaplan-Meier estimator, were the same. So, we can conclude that both estimation methods are suitable for parameter estimation in survival analysis.

Keywords: Censored data, Expectation Maximization, Kaplan-Meier, Survival Analysis

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Multi-objective programming approach to find the best set of software components in component-based software engineering

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Component-based software engineering (CBSE) is a process that focuses on the design, selection, assembly, and development of computer-based systems with the use of reusable software components. With the increasing popularity of this approach and the expanding pool of commercially accessible software components, choosing a suitable set of components to meet specific requirements while keeping costs minimal has become a challenging task. Essentially, our task involves choosing a group of components from a given set that can meet specific requirements while keeping the overall cost of these selected components to a minimum. This problem involves three objective functions; Maximize Bestseller Ratings, Download Ratings, and Review Ratings. Since Conventional methods are insufficient to solve such complex systems, we considered a multi-objective programming model to identify a cost-effective solution that simultaneously maximizes three objectives. In this analysis, we addressed the model individually for each objective, solving it three times and obtaining solutions of 15, 48, and 16 for each objective. Subsequently, we applied the proposed model, aiming to minimize the maximum deviation from the previously determined values. The resulting model provided an optimal solution that not only met all the specified maximum objective function values with a 0 % deviation but also highlighted the most significant set of software components. Certainly, using Excel Solver, we obtained a budget-friendly solution by identifying the optimal set of components that satisfy three user requirements. For future directions, the Multi-Objective Fuzzy approach can be extended by incorporating additional objectives and addressing more user requirements.

Keywords: Multi-objective Optimization, Component Selection, Component-Based Software Engineering

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An improved mathematical model for making certain procurement-related decisions in sri lankan industry

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Reducing unnecessary costs is a decisive factor in any industry for making maximum profits. The use of sophisticated machinery in the industry to enhance and strengthen operational efficiency has increased. However, the market prices of such machines have been continuously increasing due to the current economic crisis. Even if an organization needs to procure a machine, it is hardly affordable because they have a limited budget. This type of case can be observed mainly in the construction and IT fields. Such industries may choose the option of renting or leasing the machine for the required time. The objective of the present work is to support decision-makers or top management in the industry in choosing the best possible option among buying, leasing, and renting, thus reducing expenses drastically. The model was developed using concepts in actuarial mathematics, and the present value of the annuity was used in theory. A series of monthly payments were considered with the depreciation of the currency value, which is changed with the current inflation rate of the country, and the total costs were calculated separately for the three alternatives. Hence, the lowest price to be incurred for buying, leasing, or renting was recognized as the ideal decision for the business organization. An improved user interface based on the Java programming language has been developed to enter the inputs directly into the system and to display the output in a comprehensive way. The user has been further assisted by adding a HELP menu for vocabulary in business finance.

Keywords: Actuarial Mathematics; Buying; Renting; Leasing; Java programming language.

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Modeling and forecasting dengue incidence in matara district using kernel smoothing with boxcar kernel function

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Dengue is one of the main health diseases that we have to face in day-to-day life, therefore this research aim is to model the monthly number of dengue cases in Matara district and forecast the dengue incidence. Of note, there has been a rapid increase in dengue cases in the Matara district in the year 2021. To model Dengue incidents, kernel smoothing is used in this study. Kernel smoothing is a nonparametric method. Besides the classical parametric methods, any predefined functions of a finite number of parameters are not required. Kernel smoothing methods have been developed on the monthly data collected from October 2014 to October 2022 from the Epidemiology Unit at the Ministry of Health in Sri Lanka. The kernel smoothing method with Boxcar kernel is used and gets the neighborhood length as 1.1 with the lowest cross-validation error. Finally, we can conclude that the kernel smoothing method gives a very accurate fitted model for this data set as the Mean Absolute Percentage Error (MAPE) of the model is 17%. However, climate changes, uncontrolled urbanization, and commercial trade are the main external factors that can affect dengue cases as well as the accuracy of our model. We can conclude that our model is suitable and will be useful for government and health staff to make decisions for the future. Predicted Dengue cases for November and December 2022 and January 2023 are 86.2323, 98.4320, and 138.5731 respectively.

Keywords*:* Dengue, forecasting, kernel smoothing, cross-validation, MAPE
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A mathematical model for diabetes presence with two control strategies - an optimal control approach

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Diabetes has emerged as a global health concern that occurs when there are problems with insulin production or effectiveness. Long-term uncontrolled diabetes can cause some complications, such as heart disease, kidney disease, nerve damage, and vision issues, that may need to be amputated. However, with effective management of diabetes, individuals with diabetes can lead healthy and fulfilling lives. In this study, we developed a mathematical model of optimal control by utilizing two strategies for controlling the growth of the diabetic population. Our control strategies were an awareness program by raising awareness of the importance of following a diet plan along with maintaining good health care and regular testing, and an awareness program for diabetes without complications. We derive the optimality system using Pontryagin's maximum principle, and then we solve the system numerically using the fourth-order Runge-Kutta method. According to our model results, an optimal control can reduce the overall burden of diabetes by limiting the number of pre-diabetics and diabetics with and without complications. By applying these two controls number of pre-diabetics, diabetes without complications, and diabetes with complications decreased by 44%, 78%, and 76% respectively in 50 years.

Keywords: Diabetes, Mathematical Model, Optimal Control, Runge-Kutta method, Pontryagin's maximum principle

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Meta-analysis on the effects of Romosozumab on bone mineral density in Osteoporosis; comparison of Fixed effects and Random effects models

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Osteoporosis is a bone illness characterized by a reduction of bone mineral density (BMD), bone mass as well as structural and quality deterioration of the bone tissue. This has a potential to result in weakening in the strength of bones which can increase fracture issues. Romosozumab is a monoclonal antibody, which is approved for treating osteoporosis and high fracture risk in postmenopausal women. This meta-analysis aimed to compare the random-effect model (REM) and the fixed-effect model (FEM) to estimate the effect of romosozumab on BMD in postmenopausal women suffering from osteoporosis. Conducting two systematic searches in accordance with PRISMA guidelines in PubMed, Clinicaltrials.gov, and Ovid, and then appropriate studies were selected. Mean percentage changes in BMD at the total hip (TH), lumbar spine (LS), and femoral neck (FN) after 12 months were extracted for every study. The outcome of the study was determined by taking the mean differences in BMDs between the two study groups. Four out of the 11 potentially eligible articles were incorporated into the meta-analysis for romosozumab. The results of the higher mean BMD changes in REM than the FEM show that REM is more applicable than the FEM, considering heterogeneity among studies. After 12 months, romosozumab treatment demonstrated a notable enhancement in mean percentage changes in BMD at the TH, LS, and FN. In conclusion, the REM is more appropriate than the FEM and, romosozumab considerably increases BMD at FN, TH, and LS after 12 months in postmenopausal women suffering from osteoporosis.

Keywords*:* Bone mineral density, fixed-effect model, meta-analysis, random-effect model, romosozumab

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A fuzzy multi objective programming techniques applied to a case study on an apparel Industry

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The textile and apparel industries have been using linear programming (LP) techniques to optimize profit and costs of production. While LP techniques are useful for decision-making, it has limitations when dealing with trade-offs between multiple objectives. Fuzzy multi-objective linear programming (FMOLP) addresses this issue by modeling uncertain parameters. In FMOLP, the developed LP models were solved separately. The objective function values were determined for each optimal solution, and a pay-off matrix was constructed using solutions of the objective functions. Finally, linear membership functions were defined for each objective to achieve the results. A case study is sourced from a study by R. Chanda, V. Pabalkar, and S. Gupta and that study is to optimize the profit and cost of an apparel company's product mix using an Excel-based LP model. According to that study, all raw materials of stocks have been used for production considering only maximizing the profit while satisfying the demand. In this study, the FMOLP model has been developed for maximizing profit while minimizing labor and material costs in the apparel industry and solving the formulated model using Excel solver to get profitable values than the above study's results with the same data. Comparison has been made as follows; the profit was reduced by 27 % but material and labor costs were reduced by 27 % and 22 %, respectively using the FMOLP model and minimizing the extra pieces manufactured according to the result given in the reference paper.

Key Words: Fuzzy Multi-Objective Linear Programming, Profit Maximization, Cost Minimization, Apparel Industry, Excel Solver

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Exploring the future direction of cancer incidents in Sri Lanka

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Cancer is a non-infectious disease that develops in any part of the human body, as a result of developing abnormal cells that can be spread to other parts of the body as well. In the past two decades, the number of cancer incidents had increased precipitously with the increment of the population in Sri Lanka. This study analyzes the historical trajectory of cancer incidents in Sri Lanka from 2000 to 2020, focusing on trends, variations, and predictive patterns. This aims to put insight into its past by emphasizing the changes and significant shifts in cancer prevalence in the considered period of years. The Cancer Incidents' data was obtained through the "Cancer Incidence and Mortality Books" published by the National Cancer Control Program in Sri Lanka. Graphical representations such as pie charts, line plots, bar charts, and box plots were used to analyze provincial and district-wise cancer data of the above-mentioned period. The One-Way ANOVA was used to test the hypothesis between the mean distributions of prevalent cancer types in Sri Lanka, such as Breast, Thyroid and Lip, tongue & mouth etc. Tukey's HSD test was executed to identify disparities between the provincial cancer incidents and could conclude that the distribution of cancer incidents among most of the provinces was different from the others. Exponential regression methodology was applied to investigate the growth dynamics of cancer incidents in Sri Lanka. As the primary objective, identified the most appropriate predictive pattern was Exponential Regression with the minimum Mean Absolute Percentage Error value of 6.33%.

Keywords: Cancer, Sri Lanka, ANOVA, Exponential Regression, Holt-Winters.

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Analysis of road accident patterns in Sri Lanka using k-means clustering

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Road accidents are one of the most highly discussed topics in the world, as their severity is the loss of thousands of lives and considerable property damage. The trends in road accidents are intended to analyze and investigate the root causes of such occurrences and may be useful in mitigating the risk. Hence, this study aims to identify the road accident patterns in different locations across Sri Lanka using the K-means clustering technique with principal component Analysis (PCA). Euclidean distance is used to calculate dissimilarity between data points and the quality measure for the clustering algorithm is compared along with the Dunn index (DI), and average silhouette coefficient(S). The dataset covers the 24 hours for a particular year from January 2018 to December 2022 occurring in 40 police divisions in Sri Lanka. The optimal number of clusters is obtained as three based on the Elbow method and the analysis of clustering indicated that the high-risk areas for road accidents are in Colombo, Nugegoda, Gampaha, Mount Lavinia, Kelaniya, Kandy, Kurunagala, and Rathnapura at nightfall. Finally, the accuracy of the model was evaluated utilizing the correlation coefficient and Root Mean Squared Error (RMSE). The model demonstrated acceptable accuracy with a correlation coefficient closer to one and 0.9240 RMSE. These findings are useful in elaborating to strengthen road safety in high-risk areas at nightfall. Further, this study has the potential to identify the various factors behind road accidents that occur at observed times and durations as future work.

Keywords: Dunn index, Elbow Method, K-means Clustering, Road accidents, Silhouette coefficient

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Forecasting paddy production in matara district of Sri Lanka using time series analysis

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Paddy production in the Matara district of Sri Lanka holds significant agricultural importance within the region. The main objective of this study is to model the paddy production of the Matara district of Sri Lanka and forecast paddy production. In this study, the secondary data on total paddy production in the Yala and Maha seasons in the Matara district during the period from the year 1979 to 2021 are taken from the Department of Census and Statistics of Sri Lanka. These data are analyzed to fit an appropriate time series model for forecasting paddy production in the Matara district. According to the Augmented Dickey-Fuller test, the time series is stationary at 5% significance level. Further, the results of the Kruskal-Wallis test conclude the existence of seasonality. Therefore, the data set is fitted with the Seasonal Autoregressive Integrated Moving Average (SARIMA) model. SARIMA (0, 0, 0) (1, 0, 1)[2] is selected as the best model as it has the lowest values of both the Akaike Information Criterion and Bayesian Information Criterion. According to the residual analysis done for the SARIMA (0, 0, 0) (1, 0, 1)[2] model normal Q-Q plot and the Ljung-Box test indicate the residuals are normally distributed and independent respectively. Forecasted values for the Maha and Yala seasons of the years 2022 and 2023 are 37.000, 35.093, 37.011, 35.218, 37.02, 35.336 (‘000 Metric Tons), respectively. Under the statistical methods to validate the developed models Mean Absolute Percentage Error is considered. Researchers and policy makers can use this model to forecast the paddy production in the Matara district of Sri Lanka.

Keywords: Forecast, Paddy production, SARIMA, Time series

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Development of an automatic external ventilation system for automobile

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This project proposes an external ventilation system for parked vehicles to mitigate the adverse effects of high heat, particularly when the vehicle is exposed to sunlight during the daytime. Prolonged exposure to solar heat can result in the deterioration of interior materials such as plastic and leather. In addition, there is an adverse effect on health of passengers due to the possible evaporations of Volatile Organic Compounds used in interior materials. A new approach to vehicle ventilation system is designed to create a comfortable environment within an automobile when it is exposed to sun light for long hours. The system is designed to be used when the vehicle's engine is completely turned off. The novel design facilitates ventilation of vehicle by drawing of external air into vehicle compartment after cooling it down through two heat sinks followed by a supply of harmonious flow of fresh air. Both heat sinks are integrated with four TEC1-12706 Peltier devices to generate the cooling effect, and an installed fan facilitates the smooth transfer of cooled air within the compartment. A DHT11 temperature sensor is installed inside the vehicle to measure real time temperature and humidity. Once the temperature reaches a predetermined threshold value, for example 35 °C, the microcontroller (Arduino Uno/ NodeMcu) switches on the 12 V DC power supply to deliver the cooled air into the vehicle. The power supply is switched off when temperature drops below the threshold temperature. It was proven by the laboratory experiments that the efficiency of the proposed system is 4.3 %.

Keywords: Ventilation, Arduino, Automobile, Peltier

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Sound transmission characteristics of loosely packed wood dust And wood chips for noise attenuation: A preliminary study

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This study investigates the sound transmission coefficient (STC) of loosely packed wood dust and wood chips as potential organic materials for sound insulation. The STC was determined by measuring the transmission loss (TL) through cubical-shaped boxes filled with the test material. The packing uniformity was ensured by using two meshed cubes (60×60 cm^2 on each side, 5 cm thick) to secure the material. A B&K type 4292 omnidirectional speaker and a type 2734 amplifier were, placed at the cube's center. Sound pressure level (SPL) measurements were conducted using a B&K type 2250 class 1 sound level meter inside and outside the cube, with average values taken from measurements on four sides. The study employed pink noise (12.5 Hz – 20,000 Hz) in one-third of octave bands for the investigation. TL and STC were calculated independently for wood dust and chips. Results indicate a significant dependence of TL on particle size and sound frequency. Minimal attenuation was found for frequency below 400Hz for wood chips and below 80 Hz for wood dust. Sound with higher frequencies experienced substantial attenuation for both materials. The STC of loosely packed material was found to be highly dependent on particle size, with smaller particles promoting higher absorption and higher TL, resulting in lower STC. The STC for loosely packed wood dust is less than 0.05, while the same for wood chips vary between 0.3 and 0.4 across a wider frequency range. In comparison, commercially available solid wood panels have an average STC of 0.04 in this frequency range, indicating compatibility with our results for wood dust but with higher reflection. The study suggests that using loosely packed, durable organic materials can offer a sustainable and aesthetically pleasing alternative in the acoustic insulation industry, potentially positively impacting human health and well-being.

Keywords: Sound insulation, Wood chips & dust, Loose packing, Sound Transmission Coefficient.

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Enhancing digital intelligence: A comprehensive approach to detailed recognition of Hand-Drawn circuit diagrams

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Circuit diagrams are graphical representations of electrical or electronic circuits. Hand-drawn circuit diagrams remain crucial for brainstorming and innovation, yet engineers need to redraw them in simulation software for simulations and analysis. Recognizing details in these diagrams bridges this gap and leads to reconstructing circuits, creating better netlists and performing accurate simulations by saving resources. This study presents a comprehensive approach to recognize all the details in hand-drawn circuit diagrams using object detection and optical character recognition (OCR) techniques with raw data of a dataset by applying data converting techniques. Faster R-CNN with a ResNet101 backbone network was trained for circuit components and text bounding box detection was carried out using 1766 hand-drawn circuit diagrams with approximately 148,652 objects related to 58 object classes, including nodes and terminals. MobileNet was trained to recognize textual contents using 31,116 words extracted from the hand-drawn circuit diagrams including unit symbols like omega and micro. An improved approach based on checking overlapping between object bounding boxes was used for correctly assigning words to their nearest objects. An object detection technique was introduced to detect nodes and terminals in circuits. 50 hand-drawn circuit diagrams (including simple and complex) were tested, and we achieved 90% overall accuracy, 94.67% accuracy for components and text box detection, 89.82% accuracy for text recognition, and over 96% accuracy for text box assignment. Printed circuit diagrams were also tested and were more accurate than the hand-drawn ones. This study is the first to recognize all details in hand-drawn circuit diagrams, surpassing prior efforts focused solely on component recognition.

Key words: Hand-Drawn, Circuit Diagrams, Detailed Recognition, ResNet101, MobileNet.

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Sentiment analysis on ChatGPT based on Twitter data: A comparison between different algorithms

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Advanced generative Artificial Intelligence (AI) models have been built as a result of the rapid growth of AI and natural language processing. ChatGPT, developed by OpenAI, is one of them. It is designed for generating human-like text responses and engaging in natural language discussions. Analyzing sentiment about ChatGPT is important for improving ChatGPT interactions, addressing real-world applications across industries, advancing natural language understanding, strengthening system robustness, and addressing ethical concerns. Therefore, the main objective of this research is to apply sentiment analysis on ChatGPT using twitter data. Today, Twitter is the main place to share sentiment publically. A Twitter dataset with 217,622 records was collected for the proposed approach. After data pre-processing, different feature vector generations such as TF-IDF, Word2Vec, Doc2Vec, and GloVe were applied to extract features. Then algorithms such as Support Vector Machine (SVM), Artificial Neural Network (ANN) and Long Short Term Memory (LSTM) were applied to classify twitter data with 84% training and 16% testing data set. Throughout our research, we examined algorithm performance using key measures such as accuracy, precision, recall, F-measure, and error values. These measures allowed us to evaluate the algorithm's efficacy in classifying sentiment as positive, negative and neutral. According to the results, the LSTM algorithm with the TF-IDF feature extraction method was the most effective solution for sentiment analysis, with 77.7% accuracy, higher recall, precision, f-measure values, and lowest error values than other algorithms. This research advances practical applications and contributes valuable insights specially on the AI-powered language model ChatGPT.

Key words: ChatGPT, Deep Learning, Sentiment Analysis, Twitter

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Ensemble approach for predicting bug priority level using deep learning algorithms

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A bug is an unexpected fault or flaw in software systems or devices, frequently brought on by bad programming. The priority of the bug is a crucial factor to consider when addressing the bug and this bug priority prediction is done manually. However, it was a difficult task and the wrong decision might be a reason for huge software failures. The main objective of this study is to propose an ensemble approach to predict the bug priority level of bug reports. 25,000 bug reports from Bugzilla dataset which include the bug descriptions and priority levels are used. After pre-processing the data by tokenization, stemming, stop-words, and lower-casting, study uses feature extracting techniques namely Glove, Word2Vec, Tf-idf, and Doc2Vec. We use a model that primarily uses eight architectures of Convolutional Neural Network (CNN) : AlexNet, LeNet, VGGNet, 1DCNN, ResNet, LZ Net, DenseNet and Siamese. Then the five architectures :ResNet, DenseNet, LZNet, AlexNet, and 1DCNN that had the best accuracy are used in an ensemble method and the final results were taken by the majority values. The performance of the ensemble approach showed 79.18% accuracy. Other individual architectures show accuracies of AlexNet 77.1 %, LZ Net 75.08 %, VGG Net 60.06%, 1DCNN 75.44 %, ResNet 77.34 %, Siamese 39.98 %, DenseNet 77.32 % and LeNet 48.58 %. It was discovered that the proposed ensemble model performed better than the individual algorithms. Finally, when a new bug is identified it can be added to this proposed model, and the model will then determine the bug's priority level.

Key words: Ensemble Approach, CNN Architectures, Priority prediction, Bug report

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Elementary model for bird species identification using convolutional neural network: Case study in Sri Lanka

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Bird species identification has gained significant attention in the field of computer vision and deep learning due to its ecological and conservation implications. Identifying birds that are exclusive to a specific geographical area holds significant importance. While numerous deep learning models have been suggested for this purpose in various countries, none has been specifically proposed for the Sri Lankan context. This paper presents a comprehensive analysis of bird identification using deep learning techniques focusing on the avian diversity found in Sri Lanka. The main research question focus of this study was how to transfer experts' knowledge of bird identification to the general public. Initially, the images of five bird species found in Sri Lanka were collected through various sources. The bird species used for this study were Pavo cristatus, Acridotheres tristis, Oriolus xanthornus, Ardea intermedia, and Halcyon smyrnensis. Subsequently, the images with noise and duplicates were removed manually. Later, the resulting images were resized to ensure consistency and compatibility for the convolutional neural network. Image augmentation was used to increase the dataset. The model was composed of six convolutional layers paired with three max-pooling layers followed by two feedforward layers. The trained model achieved accuracies of 0.9944 and 0.8987 for the training and testing phases, respectively.

Keywords: Birds Identification, Convolutional Neural Network, Deep Learning,

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Effect of artificial light supplementation and split application of Albert's fertilizer solution on growth and yield of Bell Pepper in protected conditions

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Enhancing plant productivity through split fertilizer applications and providing supplementary artificial light has not been adequately addressed in Sri Lanka's protected agriculture sector. Therefore, this study aimed to investigate the impact of artificial light supplementation (ALS) and split application of Albert's solution (SAAS) on the growth and yield of bell pepper (variety-Polaris) grown under a controlled environment using coir dust media. A grid of 60 W LED lights, controlled by an automated system, was utilized to sustain a minimum of 3000 lux between 6.00 a.m. to 6.00 p.m. Meanwhile, a separate house was maintained under natural light conditions. As determined by previous experiments the optimal level for Albert's solution, 1.5 g/plant/day, was administered as a split application: in twice and thrice per day applications. The experimental design was two-factor factorial CRD with four treatments and five replicates. At two-week intervals and harvesting, respectively, growth and yield parameters were assessed. The results indicated that ALS and SAAS were individually significant for the growth and yield of bell peppers. Therefore, significantly highest values for plant height (152.9 cm), number of leaves/plant (47.8), number of flowers/plant (16.5), number of fruits/plant (7.5), fresh weight of fruit (177.8 g) and diameter of fruit (7.1 cm) were obtained by ALS. On the other hand, significantly highest values for number of flowers/plant (15.2), number of fruits/plant (6.7), fresh weight of fruit (170.7 g), and diameter of fruit (6.5 cm) were observed thrice a day SAAS. The study suggests that artificial light supplementation and split application of Albert's solution individually enhance bell pepper growth and yield under protected house conditions.

Keywords: Albert's solution, Artificial light supplementation, Bell pepper, Growth, Yield

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In vitro evaluation of Dicloran 75 % WP as a new fungicide against Onion Bulb Rot Caused by *Sclerotium rolfsii*

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Big onion (*Allium cepa* L. var. cepa) is considered as one of the important cash crops cultivated mainly in dry zone in Sri Lanka. The crop is highly susceptible to pests and diseases due to its succulent nature. Among the diseases, fungal bulb rot caused by *Sclerotium rolfsii* is a prevalent disease that spread extensively during *Maha* season. Long term survival of *Sclerotium* in the soil has increased the threat of this highly devastating disease in Sri Lanka. There are recommended fungicides against the disease. However, the introduction of new, safer fungicides and revisiting the available fungicide is important for effective management of the disease. Therefore, this research was conducted to evaluate the efficacy of Dicloran 75% WP as an alternative fungicide to those that are already recommended. Each fungicide was tested at the concentrations of 100 ppm, 500 ppm, 1000 ppm, 1500 ppm, 2000 ppm (a.i.). *on the radial growth of Sclerotium rolfsii on Potato dextrose agar (PDA) medium by Petri plate assay.* In conclusion, laboratory tests revealed that Thiophanate-methyl 50% + Thiram 30% WP inhibited *Sclerotium rolfsii* growth in a concentration-dependent manner, while Thiophanate methyl 70% showed no significant effect. Dicloran 75% WP stood out with a remarkable 76.54% inhibition at 2000 ppm, suggesting it as an effective fungicide for mitigating *Sclerotium rolfsii* impact in Sri Lankan onion cultivation. However, the study emphasizes the need for field trials to validate its real-world efficacy. While Dicloran 75% WP appears promising, additional research is crucial for practical feasibility and informed decision-making in sustainable onion disease management.

Keywords: Allium cepa, Bulb rot, Chemical Control, Sclerotium *rolfsii*

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Management of root-knot, *Meloidogyne incognita* in tomatoes using medicinal plant-based compost

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Sedentary vascular endoparasite Root-knot nematode, *Meloidogyne incognita*, is the major pest of tomato (*Lycopersicon esculentum L.).* As *M. incognita* is a polyphagous pest, it is very difficult to manage unless proper monitoring from the planting. Therefore, this research was aimed at managing root-knot nematode with different medicinal plant composts to reduce hazards of chemical application. Leaves of lantana (*Lantana camara),* cotton seed (*Gossypium hirsutum),* castor seed (*Ricinus communis),* neem oil cake (*Azadirachta indica),* marigold flower (*Tagetes erecta),* tamarind leaf (*Tamarindus indica),* avaram flower (*Alexandrian senna)* were mixed with fresh cow dung in 1:1 ratio separately and allowed to decompose for one month. Derived compost was tested for its nutritional quality (N-Kjeldhal method, P-Spectophotometer method, K- flame photometer method). All the experiments for eight treatments including the control treatment were carried out under a Complete Randomized Design (CRD) with three replicates. Data were subjected to ANOVA using SAS *statistical software*. In the NPK analysis of each compost, the highest significant nitrogen value (4.81%) was recorded in neem cake and the highest phosphorus content (2.6%) was recorded in cotton-based compost. The highest potassium value (7.9%) was recorded in tamarind-based compost. All the plant-based compost showed the lowest gall formation in varying degrees compared to the control. Although, the number of root galls was significantly low in castor compost (6.00 ± 0.2). The results confirmed that the castor, marigold, neem cake, and cotton plant-based compost stimulated the plant height, and reduced the nematode infestation. Lantana has a significant effect on plant growth parameters however the number of galls was high (20.6 ± 0.3) in Lantana. Nematicidal properties of castor, marigold, neem cake, and cotton-based compost need to be investigated in future studies.

Keywords: Medicinal Plants, Root-knot nematode, Root gall, Tomato

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Comparative assessment of different drying techniques on physicochemical, proximate, antioxidant and sensory properties of Bilimbi Fruit (*Averrhoa Bilimbi* L.)

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Bilimbi (*Averrhoa bilimbi* L.) is one of the underutilized fruits found in tropical countries. Given its high perishability, drying is one of the best preservation methods for extending its shelf-life, with a focus on its large export market potential. However, compared to fresh, drying may significantly affect organoleptic and nutritional qualities of foods. Therefore, the present study aimed to evaluate and compare the physicochemical, proximate, antioxidant and sensory properties of bilimbi fruit prepared from different drying techniques. Fresh bilimbi slices (2 mm in thickness) were pre-treated with 1% salt solution w/v for 5 min and dried using different drying techniques such as sun drying (direct sunlight, 3 hrs), dehydrator drying (55 °C, 1 hr), electric oven drying (100 °C, 40 min) and microwave oven drying (low heat, 35 min). Standard methods were used to analyze the physicochemical, nutritional, and antioxidant properties of dried fruits while 30 semi-trained panelists were used to conduct the sensory analysis with a 7-point hedonic scale. Results showed that dehydrated sample had the highest sensory attributes, rehydration ratio (3.97 ± 0.02), whiteness index (435.87 ± 56.5), yellowness index (57.32 ± 4.52), crude protein (5.50 ± 0.15%), crude fat (3.64 ± 0.01 %), crude fiber (8.939 ± 1.26 %) and the lowest water activity (0.48 ± 0.002). Microwave oven-dried samples exhibited the highest amount of ash (17.1 ± 3.14%) and total polyphenol (71.96 ± 1.27 mg GAE/g) with the least moisture content (5.17±0.08%). However, the highest DPPH radical scavenging activity (10.04 ± 0.003 µg TE /g) was reported in sun-dried bilimbi sample. Overall, it can be concluded that dehydrator drying was the best drying method to preserve the sensory and nutritional qualities of bilimbi fruits.

Keywords: Antioxidant properties, Bilimbi fruit, Dehydration, Physicochemical properties, Proximate composition

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Evaluation of nutritional, physicochemical and cooking quality of defatted Soy Flour (*Glycine max* L. Merr.) enriched pasta

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Pasta is traditionally manufactured from durum wheat, which gives its desired texture and quality. Despite its high protein content (11-15% w/w), it lacks essential amino acids including lysine and threonine, common to most cereal products. Therefore, there is a growing demand for the development of pasta with non-traditional flour to improve nutritional quality. The present study aimed to develop a defatted soy flour (DSF) enriched pasta, and evaluate its sensory attributes, cooking quality, and physicochemical properties. The pasta samples were developed with durum wheat flour (DWF) and defatted soy flour (DSF). The DSF was included at varying ratios (5%, 10%, 20%, and 30% w/w), with the control sample containing 100% durum wheat flour. Standard protocols were used to evaluate the cooking quality, physicochemical, and antioxidant properties of pasta and 13 trained panelists evaluated the sensory properties using a 9-point hedonic scale. According to the sensory evaluation, the 20% (w/w) DSF added sample had the highest sensorial properties and showed similar cooking quality and textural properties compared to the control. The values were as follows: 12.33 ± 0.57 min cooking time, 2.20 ± 0.10 swelling index, 8.66 ± 0.28% cooking loss, 214.33 ± 1.52% volume increase, 215.00 ± 5.00% water absorption ratio, 2630 ± 337g hardness and 13.76 ± 1.07mJ chewiness. The 20% (w/w) DSF sample had significantly higher protein (23 ± 0.50%), ash (9.71 ± 1.00%), fat (2.27 ± 0.25%), fiber (0.90 ± 0.14) and lower moisture content (7.50 ± 0.50 %) than the control sample. Moreover, it exhibited a high DPPH radical scavenging activity (32.10 ± 0.25 %). Overall, it can be concluded that pasta containing 20% defatted soy flour resulted in nutritious pasta with better textural, sensorial, and functional qualities.

Keywords: Cooking quality, Defatted soy flour. Pasta, Physicochemical properties, Protein supplementation

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Formulation and quality assessment of "Peanut-based" spread incorporated with Flax, Chia, and Sesame seeds

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Peanut butter is one of the most popular spreads in the world. There are many alternative plant seeds with greater nutritional and therapeutic potential that can be used to produce plant seeds-based butter. Therefore, the present study aimed to develop a Peanut-based spread enriched with Flax (FS), Chia (CS), and Sesame Seeds (SS) and evaluate its physicochemical, sensory, and functional properties. The spread was prepared using the various ratios of the above seeds while the control was 100% peanut seed. The physicochemical, DPPH radical scavenging and phenolic activities were determined using standard protocols. Sensory evaluation was conducted by 15 trained panelists on a 9-point hedonic scale. The sensory evaluation data demonstrated that 70% Peanut, 15% FS, 10% CS and 5% SS is the best ratio to develop a plant-based spread (OVA). In addition, the OVA sample showed significantly high ($P < 0.05$) crude fiber (63.63 ± 0.14%) and protein (24.20 ± 0. 10%) while fat (26.34 ± 0.10%) and ash (1.32 ± 0.04%) was lower than the control. The addition of FS, CS, and SS had significantly increased the alpha-linolenic acid content, total phenolic and antioxidant activities, and values were 5.16 ± 0. 06%, 2.66 ± 0.09 GAE mg/g, and 37.37 ± 0.78%, respectively. There was no change in the cohesiveness (0.11 ± 0.02), adhesiveness (1.1 ± 0.17 mJ), and chewiness (0.67 ± 0.11 mJ) of the OVA compared to control. Additionally, no microbial counts were detected in the 4-month refrigerated storage study. Therefore, this study demonstrated the feasibility of developing a peanut-based spread enriched with flax, chia, and sesame seeds, achieving desired sensory and textural quality, and enhancing its therapeutic potential.

Keywords: Alpha-Linolenic Acid content, Antioxidant activity, Functional foods Peanut based spread, Phenolic content

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A preliminary study of some of the physicochemical, nutritional, and functional properties of rice bran in white and brown rice (Bg 300 and At 362) in Sri Lanka

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Rice bran, a by-product of rice milling, has garnered increasing attention for its potential as a valuable resource with versatile applications across various industries. This study extensively compares the physicochemical, functional, and nutritional properties of two distinct rice varieties (Bg 300 white rice bran and At 362 brown rice bran), that are highly consumed in Sri Lanka. Although, higher bulk density (0.40 ± 0.01mg/mL), oil absorption capacity (192.33 ± 9.82%), water holding capacity (2.91 ± 0.03g/g), foaming capacity (13.95 ± 2.12%), and foaming stability (64.8 ± 13.1%) were given by Bg 300, higher values of water absorption (261.1 ± 15.9%), swelling power (3.8 ± 0.08 g/g), and water solubility index (3.7 ± 0.05 g/g) were shown by the variety At 362. The variety Bg 300 exhibits higher levels of fat, (20.43 ± 0.32%), protein (11.09 ± 0.22%), and fiber content (5.6 ± 0.19%). Comparatively, higher levels of potassium (4554.05 ± 1.5 mg/kg) and sodium (72.70 ± 2.12 mg/kg) were also found in Bg 300. Total flavonoid content (552.14 ± 7.66 mg quercetin equivalents (QE)/100 g) and total phenolic content (312.93 mg gallic acid equivalents (GAE)/100 g) of At 362 were significantly higher than that of Bg 300. Similarly, according to TEAC assay, the antioxidant capacity of At 362 (27.12 ± 0.80 mmol Trolox/g) was higher than that of Bg 300. In comparison, Bg 300 is more dominant in physical properties like bulk density, oil absorption, hydration properties, and nutritional properties like fat, protein and fiber, whereas At 362 shows significantly higher levels of antioxidant activity and higher flavonoids, phenolics contents.

Keywords: Antioxidant, Functional properties, Nutritional composition, Physical properties, Rice bran

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Evaluating yoghurt quality attributes with banana (*Musa acuminata*) peel integration

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Banana peels, often discarded, are rich in bioactive compounds such as pectin. Integrating them into yogurt enhances its quality. This research assesses the impact of "Kolikuttu" banana (*Musa acuminata*) peel on yogurt quality. Ripe banana (Stage 6) was locally sourced, and their peels obtained after wash with 200 ppm chlorinated water. A portion of peels was dried, then powdered, 0.1 %, 0.5 % ,1 % & while another remained fresh and pulped 1%, 5%, 10% were separately incorporated into yogurts at 42°C. Starter culture "ABY10" containing *Streptococcus thermophilus, Lactobacillus bulgaricus, Bifidobacterium animalis subsp*. lactis 1:1:1 ratio was added at 0.01% (w/v). After incubate at 42°C for 4 hours and refrigerated at 4°C. Then the shelf life, pH and syneresis were analyzed. Statistical analysis (ANOVA) was done with Tukey test ($P < 0.05$) to compared groups, and sensory evaluation by 30 panelists with 7-point scale to gauged consumer acceptance. Shelf life of the dried peel powder (DPP) incorporated yoghurts was limited to 7 days but shelf-life fresh peel pulp (FPP) incorporated yoghurts up to 28 days in 1 % and 5 % incorporation & 21 days in 10 % incorporation yoghurts. The data also reveals that end of the shelf-life, 10% FPP yoghurts exhibit pH-4.46 ± 0.04 which was significantly ($P < 0.05$) lower than the control (pH - 4.53 ± 0.01). Microbial break down pectin presence in peel (6.8 % w/w) leading to the to this phenomenon. 10% and 5% FPP demonstrate significantly ($P<0.05$) lower syneresis respectively 0.28±0% and 0.12 ± 0.01% compared to the control as pectin reduces whey exudation. 10% FPP incorporation also exhibited a similar sensory attribute when compared to the control. The study demonstrated that incorporation of 10% FPP is the best level to enhance the quality attributes of the yoghurts.

Keywords: Banana, Peels, Pectin, Syneresis

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Evaluating the effect of king coconut husk ash, biochar, together with inorganic fertilizer application to improve soil fertility in coconut lands

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This research evaluates the combined effects of king coconut husk ash (KCHA), biochar, and fertilizer to enhance soil fertility in coconut lands while substituting Muriate of Potash (MOP). The study followed an randomized complete block design (RCBD) with two blocks with 24 palms. Ash had substantially greater total and available potassium and pH values (16.01%, 2.10%, and 11.31) than biochar, according to the analysis of the two materials. The study tested six treatments on coconut palms by applying king coconut husk ash (A), biochar (B), and inorganic fertilizer (F). Control, F, FA, FB, FAB, and $FA^{1/2}B$ are 6 treatments respectively. Soil samples were taken for four months with one-month intervals after treatment application. The availability of macronutrients (NPK) and Electrical Conductivity (EC) of soil showed significant differences over 16 weeks, with NPK with higher values in treatments involving KCHA application, especially in T3 with Inorganic Fertilizer, 100% Ash, No Biochar, respectively 0.947% and 5.61 ppm and 0.059%. Also, higher values of K were observed in treatments involving KCHA combined with biochar and inorganic fertilizer in T5 (0.077%) and T6 (0.083%). A decreased trend was observed in biochar-applied treatments due to its slow-release behavior. However, no significant effects were observed in soil moisture content, microbial activity, pH and available Calcium and Magnesium. T6, which used half the recommended KCH ash dosage, biochar, and fertilizer, had the greatest positive impact on soil characteristics during the study period. KCHA offers a cost-effective potassium solution for coconut lands, a natural alternative to conventional fertilizers (MOP). However, the study's findings also indicate the potential for longer-term impacts that warrant further investigation.

Keywords: Biochar, Coconut lands, King coconut husk ash, Nutrient availability, Soil fertility

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The potential antimicrobial activity of two common *Zingiber officinale* cultivars grown in Sri Lanka.

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Ginger (*Zingiber officinale*) is a popular therapeutic agent in traditional medicine. In Sri Lanka, many cultivars of ginger are often used as a spice in cuisine and for Ayurvedic medicine. This study tested two widely grown cultivars of *Z. officinale* in Sri Lanka, Sri Lankan and Chinese, for their antimicrobial properties. Ethanol and aqueous extracts were obtained from their dried rhizomes. The antimicrobial activity of the extracts was tested using the agar-well diffusion method against three pathogenic bacterial strains: *Staphylococcus aureus* ATCC 25923, *Salmonella typhi* DSM 17058, and *Escherichia coli* ATCC 25922. The antimicrobial efficiency was assessed by measuring the clear zone diameter and controls (positive-chloramphenicol and negative-ethanol [95%]/distilled water). The Chinese cultivar showed the highest inhibition on *S. typhi* with both extracts (33.7 ± 1.53 mm-ethanol, 33.3 ±0.58 mm-aqueous). However, the effect of ethanol extract of Sri Lankan ginger against *S. typhi* (7.7 ± 1.15 mm) was comparatively less effective. The effect of ethanol extracts from both cultivars on *S. aureus* was moderate, showing inhibition zones of 16.3 ±0.58mm-Chinese cultivars and 12.0 ± 1.00 mm- Sri Lankan cultivars, respectively. The aqueous extracts of both cultivars were less effective against the target organisms, except for the Chinese cultivar against *S. typhi*. None of the extracts were effective against *E. coli*. In conclusion, both *Z. officinale* cultivars exhibited varying degrees of antimicrobial potential, with ethanol extracts showing stronger activity than the aqueous. The antimicrobial activity of the Chinese cultivar outperforms the Sri Lankan cultivar against target organisms, *S. typhi* and *S. aureus*.

Keywords: Antimicrobial activity, Ginger (*Zingiber officinale*), Sri Lankan and Chinese cultivars

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A study on the performance of four underutilized vegetable crops in Northern Province with different trellises

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Underutilized vegetables have several agronomic traits that are beneficial for farmers and consumers. Crops, which were used in the current study, are traditionally cultivated in the North Central Province and rarely in the Northern Province. Considering the importance of promoting their cultivation, this study was carried out to study the performance of four underutilized vegetables, Sikkim cucumber (*Cucumis sativus* var. *sikkimensis*), clove bean (*Ipomoea muricata*), hyacinth bean (*Lablab purpureus*), and sponge gourd (*Luffa cylindrica*), with different trellis at the Faculty of Agriculture, University of Jaffna, from April to July 2023. The trellises were selected based on their growth habits and the information collected from Anuradhapura district farmers. Sikkim cucumber was supported with horizontal and inverted "V", clove and hyacinth beans were supported with vertical and inverted "V" and sponge gourd was supported with vertical, horizontal and inverted "V" trellis and their performance was compared with control. The experiment was conducted in a randomized complete block design with three replicates. Growth parameters; vine length, leave number, branch number and yield parameters; numbers of flower buds, fruits, pods, pod weight and total yield were recorded. All parameters were subjected to analysis of variance. The provision of the trellis significantly ($p<0.05$) improved the yield and quality. Highest performance was observed in Sikkim cucumber with horizontal (17.8 t/ha); hyacinth and clove beans with vertical (3.01 t/ha), (4.19 t/ha) and sponge gourd with inverted "V" (11.7 t/ha) trellises. Inclusion of these crops will enthuse a nutrient-rich, climate-resilient, and sustainable agriculture in the Northern Province.

Keywords: Northern province, Parameters, Trellis, Underutilized crops

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Formulation of fiber-rich drink powder mix from Ridge Gourd (*Luffa acutangula*) and evaluation of its quality parameters

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Constipation is often a result of insufficient fiber and inadequate fluid intake of individuals. Ridge gourd is a natural remedy for constipation due to its fiber-rich nature. However, traditional curry of ridge gourd is less preferred and modern community demand for convenient and more attractive products. Therefore, this study aimed to develop a pineapple-flavored, fiber-rich drink powder mix using ridge gourd. Ridge gourd powder (RGP) and pineapple powder (PD) were produced using heat pump dehydration techniques (moisture content 5-8%). The powder was formulated with varying ratios of RGP and PD. A powder containing 85% mucilage polysaccharide (Fybogel) served as a control. The sensory evaluation conducted by an 8-trained panelists using a 7-point hedonic test, determined the optimal powder ratios. The resulting product underwent testing for Total soluble solids (TSS), color, pH, solubility, viscosity, crude fiber, and ash content through standard methods. Microbiological testing was carried out to determine the product's shelf life. The formulation containing 4% (w/w) luffa powder and 6% (w/w) pineapple powder exhibited the best sensory properties. The product demonstrated TSS (4.76 ± 0.05°Brix), color (L* 20.5 ± 0.02), pH (4.79 ± 0.07), and viscosity (50.54 ± 0.63 cP) values similar to that of the control. Additionally, it showed higher solubility (61.77 ± 0.69% w/v), fiber (36.46 ± 0.21), and ash (8.85 ± 0.07) contents compared to the control. Shelf-life testing revealed a one-month shelf life under refrigerated conditions. Therefore, this study demonstrated the potential application of ridge gourd and pineapple powder in developing a drink powder rich in fiber, exhibiting favorable physicochemical and sensory characteristics.

Keywords: Constipation, Dehydrated powder Fiber-rich drink, Pineapple powder, Ridge gourd

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Development and characterization of kithul flour (*Caryota urens*) based alternative tissue culture media for agar

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Plant tissue culture uses an artificial culture medium containing macronutrients, micronutrients, organic supplements, growth regulators, and solidifying agents to grow the explants. Agar is the common gelling agent used for solidification of the growth media, which contributes 70% of the cost of culture media preparation. This study explores a cost-effective alternative to agar-based plant tissue culture media. Kithul flour, characterized by its favorable gelling properties and nutrient content, was investigated. The study evaluated kithul flour's composition, moisture content (11.14%), pH (6.15), ash content (6.32%), amylose (18.84%), crude fat (6.21%), swelling power (9.02%), and solubility (4.89%). Alternative growth media were prepared by blending kithul flour with MS media powder, macronutrients, micronutrients, sucrose, and myo-inositol. Varying agar-to-kithul flour ratios were tested. (Agar: Kithul flour = 5:0, 4:1, 3:2, 2:3, 1:4, 0:5). Observations revealed that kithul flour excelled in gelling capacity, particularly at a 3:2 ratio. Preliminary findings suggest that a 3:2 kithul flour-to-agar ratio offers a cost-effective alternative to 100% agar-based culture media. In the context of micropropagation of *Brassica spp.*, the kithul flour-gelled medium consistently provided a stable gel surface throughout the culture period. This resulted in enhanced plantlet growth, with increased shoot numbers, shoot length, and leaf count. The six treatments included an agar-to-kithul flour ratio (T0 = 5:0, T1 = 4:1, T2 = 3:2, T3 = 2:3, T4 = 1:4, and T5 = 0:5). Statistical analysis was done using Minitab software and found significant differences ($P < 0.30$) in shoot regeneration based on the gelling agents used in combination with agar. The study introduces a promising alternative to costly agar-based culture media, with kithul flour demonstrating excellent gelling properties and supporting optimal plantlet growth in *Brassica spp. micropropagation.*

Key words: Agar; Alternative, Kithul flour, Low cost, Tissue culture

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Development of composite flour incorporated with banana pseudo-stem flour and application in waffle cones

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In Sri Lanka, the *Embul* banana (*Musa acuminate* L.), is a widely grown and frequently consumed fruit. Pseudo-stem is its main by-product, after harvesting a bunch of bananas. This study aimed to develop gluten-free composite flour using banana pseudo-stem flour (BPSF) as a wheat flour substitute for usage in waffle cones. BPSF was made by treating pseudo-stem pieces with 0.2% citric acid and 0.3% sodium metabisulphite, drying at 60°C for 24 hours, and then grinding. The waffle cone was prepared by blending BPSF, rice flour, manioc flour, and chickpea flour in different ratios (5:25:15:5, 10:20:17:5, 15:20:19:5) with other ingredients. The sensory evaluation for three treatments was done by thirty semi-trained panelists on a 7-point hedonic scale to select the best recipe evaluating their appearance, color, texture, taste, smell, and overall acceptance. The accepted sample with 10% (w/w) BPSF, was selected for proximate analysis (AOAC, 2000) and the shelf-life assessment, which included measuring the total plate count (TPC), yeast and mould count (YMC), moisture content, and water activity. During storage, water activity and moisture content of flour were changed to 0.46-0.53 and 7.05%-7.07%, respectively. The developed cone was analyzed for proximate composition; carbohydrates (69.23 ± 0.14%), crude fiber (2.34 ± 0.10%), crude protein (12.92 ± 0.18%), crude fat (13.43 ± 0.25%), and ash (1.63 ± 0.12%). The water activity, TPC, and YMC of the cone were not significantly ($P > 0.05$) changed at room temperature until 4th week. Banana pseudo-stem flour incorporated composite flour, with its elevated fiber content, offers a viable alternative to wheat flour in waffle cones.

Keywords: Banana pseudo-stem, Gluten-free flour, Waffle cone, Wheat substitution

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A Comparison of the phytochemicals and *In Vitro* antioxidant activity of different parts of *Syzygium cumini* in Jaffna District, Sri Lanka for the preparation of nutraceuticals

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Syzygium cumini (L.) Skeels (Myrtaceae) is also known as Java plum commonly available in the Jaffna District, Sri Lanka has been widely used in traditional medicine to treat diabetes and various diseases as allergies, inflammation, and gastric ulcers due to the presence of bioactive compounds. In this study, the aim was to compare the phytochemicals and antioxidant activity of the different parts of *S. cumini*. Three parts, including leaves, seed coat, and bark, were collected in November from the Jaffna District and their ethanol, methanol and aqueous extractions were subjected to the evaluation of qualitative and quantitative analysis of phytochemicals and antioxidant activity using standard laboratory procedures. Antioxidant capacity was measured using spectrophotometer following standard procedures with DPPH and ABTS assays in which trolox was used as the standard. Three replicates were maintained for each sample in every analysis. The Statistical analysis of results was carried out using ANOVA using mini tab 17 software and Turkey's multiple comparisons at probability value ($p \leq 0.05$). Phytochemical analysis revealed that all extracts of all parts contained alkaloids, flavonoids, tannins, phenol, triterpenoid, quinone, and saponins. The highest phenolic (10.43 ± 0.64), tannin (844.05 ± 5.36) and alkaloid (66.62 ± 0.82) contents were present in the methanolic extract of the seed coat. Also, the methanolic extract of the seed coat of *S. cumini* showed the highest DPPH and ABTS antioxidant activities due to the lowest IC_{50} values (125.57 ± 0.25 and 140.67 ± 0.32), respectively. Based on these findings, the methanolic extract of the seat coat of *S. cumini* showed the existence of medicinally significant phytochemicals and antioxidant potential compared to other parts and it can be used as a nutraceutical in future.

Key words: Antioxidant activity, ABTS, DPPH, Phytochemicals, *Syzygium cumini*

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Effect of actigen prebiotic on growth performance of broiler chicken

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Actigen is one of the prebiotics used to enhance body weight and increase the feed intake in broiler chicken. This study investigated the effect of prebiotic actigen on broiler performance in a tropical environment. The experiment was conducted in a completely randomized design with two treatments in six replicates. The experiment was designed using T1 (feed with Actigen) and T2 (only feed) groups. The study was conducted on 120 day-old chicks over a period of 34 days. The corn and soybean meal-based base diet is formulated to meet the recommendation of the Lohman Indian River birds. The T1 group was fed with the base diet and supplemented with the actigen (0.05%) for the pre-starter, starter, and finisher phases. For the statistical analysis, the growth performance of body weight, feed intake, and feed conversion ratio was analyzed by One-way ANOVA by using a statistical analytical tool (SPSS) with a significant difference ($P < 0.05$). The initial average body weight of both treatment groups was 45.83g, and the body weight showed a positively rising trend with significant differences over the study period. In the 5th week, the body weight of chicks in T1 and T2 were 1876.70 ± 18.61g and 1613.30 ± 39.32g, respectively. Feed intake of both groups significantly differed and had a gradual increase up to the 4th week and remained unchanged (T1: 852 ± 33 g and T2: 842 ± 89.12 g). The feed conversion ratio of the actigen-supplemented group in the 5th week was 1.55 ± 0.04 and it was significantly different from that of T2 (1.74 ± 0.07). This study showed that the supplementation of prebiotics Actigen increases broiler growth performance.

Keywords: Actigen, Broiler, Feed conversion ratio, Prebiotics

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Effect of different time periods of pinching on growth and flowering of an ornamental plant, *Platycodon grandifloras* Jacq. var. 2009B

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Platycodon (*Platycodon grandifloras* Jacq.) is an ornamental species that requires controlled growth to meet quality standards of potted flowers. The timely practice of pinching, involving the removal of the apical bud at the appropriate time, has been explored as a crucial cultural technique to enhance both plant growth and flowering quality. This study was aimed to investigate the effects of pinching at various time periods on the plant growth and flowering of the *P. grandiflorus* Jacq. 2009B variety under greenhouse conditions. The experiment was laid out in Completely Randomized Design (CRD) with six treatments and ten replications. Different time periods of pinching treatments including pinching after 6 (T1), 7 (T2), 8 (T3), 9 (T4), and 10 weeks (T5) of sowing and control treatment without pinching (T_0) were studied to evaluate the impact of pinching time. Plant growth and flowering parameters were analysed using SAS statistical software at 5% significance level. The maximum number of leaves (56.2) and branches (6.4) were recorded in the T_5 followed by T_3 and T_4, whereas the highest stem diameter (3.13mm) and plant height (17.2cm) were recorded in T_0 control treatment. When pinching time was delayed (10 weeks after sowing) flower bud formation also was delayed (111.9 days in T_5) compared to the treatment without pinching (90.3 days in T_0). However, the highest number of flowers were observed in the T_3 (16.8) while T_4 recorded the lowest (11.8). Also flower diameter was significantly higher in T_0 (11.6cm) and the lowest was recorded in T_1 (8.8cm). Hence, based on the results obtained from the present study, it can be concluded that pinching after 8 weeks of sowing (T3) was found to be effective in promoting early-stage branching and enhancing flower yield of *P. grandiflorus* Jacq. 2009B.

Keywords: Flower production, *Platycodon grandifloras*, Pinching, Vegetative growth

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Development of Beverage Powder from Vacuum Dehydrated Lavulu (*Pouteria campechiana (*Kunth) Baehni) and Lime (*Citrus aurantiifolia (*Christm.) Swingle) fruits

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This research explores the utilization of Canistel, locally known as "Lavulu" (*Pouteria campechiana (*Kunth) Baehni), an underutilized fruit crop in Sri Lanka. Lavulu is a cheap source of macro and micronutrients. While Lavulu is traditionally hindered by its high moisture content and short shelf-life, the study's primary aim is to enhance its utilization among consumers. To achieve this, the research focuses on developing a beverage powder derived from Lavulu fruit through vacuum dehydration, creating a value-added product from this underutilized fruit. Four distinct drink mix powders were formulated, combining vacuum dehydrated Lavulu with vacuum dehydrated Lime (*Citrus aurantiifolia (*Christm.) Swingle) fruit powder in varying ratios: T1: 100% Lavulu powder, T2: 75% Lavulu with 25% Lime fruit powder, T3: 50% Lavulu with 50% Lime fruit powder, and T4: 25% Lavulu with 75% Lime fruit powder. Sensory evaluation identified the 100% vacuum dehydrated Lavulu powder mixture as the most acceptable, featuring a °Brix value of 9.43% and a titratable acidity of 0.416%. Proximate analysis of this selected powder mixture revealed 2.7 g of moisture, 94.2 g of carbohydrates, 0.8 g of protein, 0.6 g of fat, 0.2 g of crude fiber, and 1.5 g of ash content per 100 g of dried powder, providing 385 kcal of energy. By introducing Lavulu fruit into the beverage industry, this study demonstrates a novel value-added product for consumers offering a promising solution for the enhanced utilization of Lavulu fruit in Sri Lanka.

Keywords: Beverage powder, Canistel, Lime, Vacuum dehydrated

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Antibacterial activity of acetone fractions of the root of *Vateria copallifera* against *Staphylococcus aureus* and *Escherichia coli*

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Vateria copallifera is an endemic plant to Sri Lanka, and it is used traditionally for the treatment of wound healing. Therefore, this study focused on the antibacterial activity of fractionations obtained from the acetone extract of roots of *V.copallifera.* The root was collected and authenticated by the national herbarium. The powdered root was macerated with acetone and the solvent was removed using a rotatory evaporator under reduced pressure. The dried crude extract was analysed in the thin layer chromatography, followed by silica flash column chromatography, and obtained as five distinct fractions (F1, F2, F3, F4, F5). The antimicrobial activity of fractions was tested against *Staphylococcus aureus* (ATCC 25923) and *Escherichia coli* (ATCC 25922) using the agar well diffusion method and co-amoxiclav as positive control and acetone as negative control. A preliminary phytochemical screening was carried out for antimicrobial active fraction F5. The diameter of the zone of inhibition(mm) was expressed as Mean ± Standard Deviation of the mean and the antimicrobial activity of extracts was analyzed with one-way ANOVA. F3, F4 and F5 showed antibacterial activity against both organisms, however F1 and F2 showed antibacterial activity against only for *S. aureus.* Among the five fractions, F5 demonstrated better activity compared to the others for *S. aureus* (17.67 ± 0.57 mm) and *E. coli* (16.00±0.00 mm) while the zone of inhibition for co-amoxiclav was 24.13 ± 0.74 mm and 34.46±0.63 mm respectively. Phytochemical analysis indicated that the F5 showed positive results for polyphenol. One-way ANOVAs revealed that the antimicrobial inhibitory effects showed by standard and fractions differed significantly ($P < 0.05$). This study revealed that fractionation F5 showed better antibacterial activity against the *S. aureus* and *E. coli* than other fractions and possibly phenolic compound was responsible for its antibacterial activity.

Keywords: Acetone fraction, Antibacterial activity, Phytochemical analysis, Root, Vateria copallifera

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Evaluation of antibacterial potential of *Pandanus kaida* inflorescence crude extracts and formulation of a transparent antibacterial soap

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Pandanus kaida, also known as "Wetakeiya" in Sinhala, is a coastal plant native to Sri Lanka and India, yet the antibacterial properties of inflorescence remain unexplored. This study aims to introduce a transparent antibacterial soap incorporating different solvent extracts obtained from *Pandanus kaida* male inflorescence to combat bacterial skin infections. The extraction process yielded 262 mg, 195 mg and 520 mg of hexane (HE), dichloromethane (DE), and ethyl acetate (EE) extracts, respectively from 1.3 kg of ground male inflorescence. These crude extracts (100mg/mL in DMSO) were tested against *Staphylococcus aureus* (SA), methicillin resistant *Staphylococcus aureus* (MRSA), *Escherichia coli* (EC), *Pseudomonas aeruginosa* (PA), and *Proteus* sp. using an agar well diffusion assay. Transparent soap formulations were formulated with 2%, 5%, and 10% of crude extract mixtures (HE:DE:EE 1:1:1). Crude extracts demonstrated inhibitory effects against SA, MRSA and PA with a zone of inhibition ranging from 7-13 mm while the ciprofloxacin, the positive control exhibited a zone of inhibition more than 33 mm against all the tested pathogens and DMSO, the negative control showed no inhibition. Soap formulations (500 mg/mL) with crude extracts exhibited antibacterial properties against SA, MRSA and PA and inhibition zone diameters were ranging from 13-18 mm while commercial antibacterial soap and the soap base (500 mg/mL) showed 7-8 mm of inhibition zone. Tests for pH (8-9), fatty acid content (50-55%), and water content (31-38%) of the developed soap formulation were aligned with the SNI06-3532-1994 reference standards. In conclusion, this study successfully formulated an antibacterial transparent herbal soap infused with *Pandanus kaida* flower extract, demonstrating promising antibacterial effects to the tested bacterial species.

Keywords: Antibacterial, Herbal soap, Male inflorescence, Pandanus kaida

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Enhancement of antibacterial efficacy of Norfloxacin through biotransformation by *Saccharomyces cerevisiae*

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Fluoroquinolones, a class of synthetic antibiotics for bacterial infections, target DNA replication via topoisomerase IV and DNA gyrase. The emergence of fluoroquinolones marks a notable progress in the field of antibiotic treatment. Despite efficacy of fluoroquinolones, resistance and adverse reactions drive the need for novel antibiotics. This study aims to investigate norfloxacin biotransformation using *Saccharomyces cerevisiae*. Biotransformation experiments involved fermenting fluoroquinolones (4mg/mL), ciprofloxacin, moxifloxacin, levofloxacin, and norfloxacin with *S. cerevisiae* in a medium (50 mL) containing 10% W/V glucose as the source of energy for dry *S. cerevisiae* (3g). Control experiments (fluoroquinolones treated with glucose and fluoroquinolones treated with sterile distilled water) were conducted to eliminate the potential influence of glucose or water exposure on fluoroquinolones. Solutions lacking an antibiotic component served as the negative control which was used to exclude any antibacterial effect of metabolites of *S. cerevisiae*. Freshly prepared fluoroquinolones (4mg/mL in distilled water) served as the positive controls of antibacterial assay. The antibacterial activity was assessed using the agar disk diffusion method. Antibacterial assays against *Staphylococcus aureus* demonstrated larger inhibition zones (24.7 mm ± 1.15) for fermented norfloxacin (5 µL per disc) when compared with the inhibition zone diameters (15-16 mm) of positive control and other control experiments of norfloxacin. However, the antibacterial efficacy against *S. aureus* remained unchanged with other tested fluoroquinolones upon fermentation. The negative control demonstrated no inhibition of *S. aureus*. This study concluded the role of *S. cerevisiae* in possible biotransformation of norfloxacin. The observed changes in norfloxacin's potency require further investigations through techniques like NMR spectroscopy, and future research should be extended for antibacterial activity assessments against diverse bacterial strains.

Keywords: Biotransformation, Fluoroquinolones, Norfloxacin, Saccharomyces cerevisiae, Staphylococcus aureus

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Plant mediated synthesis of ZnO/CuO nanocomposite using juice extracts of *Citrus limon* and the evaluation of its antioxidant activity

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The green synthesis of nanoparticles and nanocomposites has received a great deal of interest due to its low cost, easy scalability, non-toxicity, and environmental friendliness. In contrast to chemical synthesis, green synthesis of nanoparticles and nanocomposites necessitates the employment of fungus, yeast, actinomycetes, bacteria, and plants. This research focuses on the green synthesis and characterization of a 10% ZnO/CuO nanocomposite (ZnO:CuO ratio; 90:10) utilizing *Citrus limon*, a plant that is rich in citric acid, which functions as a good capping and stabilizing agent. This study evaluates the antioxidant activity of the synthesized nanocomposite in comparison to ascorbic acid (standard). The produced nanocomposite was characterized using a variety of methods, such as UV-Visible spectroscopy to confirm the formation of the ZnO/CuO nanocomposite, FTIR (Fourier Transform Infrared) spectroscopy for the identification of functional groups present, and scanning electron microscope (SEM) analysis for the investigation of the surface morphology. Antioxidant experiments using DPPH (2,2-diphenyl-1-picrylhydrazyl) assay validated the nanocomposite's function as an antioxidant. Upon evaluation of the IC_{50} values, it was found that the test sample, ZnO/CuO nanocomposite, has an IC_{50} value of 934.4 mg/L, while the standard has an IC_{50} value of 335.6 mg/L. Hence, it can be concluded that the ZnO/CuO nanocomposites show promising antioxidant activity and can be used as free radical scavengers. As a result, for the first time, this work reveals the green synthesis of ZnO/CuO nanocomposite using *Citrus limon* and its role as an antioxidant.

Keywords: Antioxidants, Green synthesis, Nanocomposite

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Eco-friendly photocatalyst derived from egg-shell waste for methylene blue dye degradation

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The growing concern over environmental pollution (water) and the need for sustainable greener solutions has prompted extensive research into novel materials for pollutant remediation. The present study reports a novel approach to synthesize an eco-friendly photocatalyst by impregnating egg-shell waste with bentonite for the degradation of methylene blue dye, a common and persistent water pollutant. The synthesis of the catalyst was achieved by mixing the egg-shell waste powder with bentonite powder by optimizing the blending ratios (0:100; 20:80; 40:60; 50:50; 60:40; 70:30). Cylindrical-shaped calcined (at 900 ℃) composite pellets of 2 mm in height were evaluated for their photocatalytic activity in the degradation of Methylene Blue dye (λ_{max} = 664 nm) under the sunlight. The effect of various studies like kinetic, adsorption and pH are systematically investigated to determine the dye degradation behaviour of the photocatalytic material using Tungsten filament bulb (100 W) as the light source. Comparisons are made with other conventional photocatalysts: bentonite only in sunlight, composite in the dark, and zero adsorbent conditions in sunlight, to highlight the efficiency and sustainability of the proposed composite material kept in sunlight. Catalyst material follows the first order kinetics (R^2 = 0.9709) with the multilayer adsorption mechanism (R^2 = 0.9768 for Freundlich isotherm) and confirms the highest efficiency at basic pH values (11.98). The findings of this study demonstrate the promising potential of the bentonite-impregnated egg-shell waste composite as an effective green photocatalyst for the degradation of methylene blue dye. This research bridges the gap between waste utilization and environmental remediation, paving the way for future advancement in the field of photocatalysis and green materials.

Keywords: photocatalyst, egg-shell, bentonite, methylene blue dye

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Traits of Ferruginous gravel and Laterite deposit and stratigraphic correlation with red earth in northern Sri Lanka

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Iron-cemented clastic sedimentary deposits cover most parts of Northern Sri Lanka, correlating with laterite and red earth deposits. The detailed study of the formation processes of ferruginous gravel and laterite deposits and the stratigraphic correlation of ferruginous gravel, laterite, and quaternary red earth deposits remains unexplored in the northern part of Sri Lanka. The study addresses the formation processes and stratigraphic sequences among ferruginous gravel, laterite, and red earth deposits by studying two detailed profiles in the Mullaitivu District of Sri Lanka. Field observations of the study area and the collected samples were subjected to profile analysis and petrographic studies. The stratigraphy of the iron-cemented nodules laid down in the middle of laterite and red earth deposits, dark brown to reddish brown colored angular gravels, provide two depositional ages of ferruginous gravel and red earth deposits. Ferruginous boulders were formed by the chemical precipitation of the iron-rich gravels during post-deposition. Petrographic studies and field observations have unveiled the transport mechanisms and diagenetic transformations undergone by the ferruginous gravel. Further, the characteristics of ferruginous gravels and laterites, along with the processes involved in the formation of nodules by the accumulation of post-iron fluid in the pre-deposited sediments and the leaching process effected by the formation of laterite by groundwater fluctuations in arid to humid conditions.

Keywords: Ferruginous Gravel, Laterite, Red Earth, Stratigraphic Correlation, Iron-Cemented

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Investigation of antioxidant activity in leaf extract of *Argyreia pomacea* (Manpanchan)

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Oxidative stress is a fundamental process underlying various human diseases. Antioxidants are substances that significantly delay or inhibit the oxidation of substrates. Plants and plant products are natural sources of antioxidants. *Argyreia pomacea* is a climber plant mostly found in Batticaloa, Sri Lanka. The leaves of the plant are used to treat diabetes, ulcers, and internal wounds. Hence, this study aimed at investigation of antioxidant activity of the *A.pomacea* plant. Initially, leaves of the *A.pomacea* were collected from Batticaloa. Then, cleaned, dried and powdered leaf sample of the plant was extracted separately in methanol and ethyl acetate solvents at room temperature and under hot condition (66 ℃ and 77 ℃ for extraction in methanol and ethyl acetate respectively). Subsequently, the antioxidant activity of the above leaf crude extracts was evaluated by DPPH and phosphomolybdenum assays using ascorbic acid as the standard. The DPPH assay revealed the highest antioxidant activity for the leaf sample extracted in methanol under ambient condition (IC_{50} value = 35.51) and the lowest activity was observed for the leaves extracted in ethyl acetate under hot condition (IC_{50} value = 103.56) compared to the standard ascorbic acid (IC_{50} value = 13.47). The Phosphomolybdenum assay demonstrated the highest activity for leaves extracted in ethyl acetate under hot condition. This study has revealed that the leaf of *A.pomacea* is a potential source of natural antioxidants. Further studies are required to idetify the active phytochemicals which are responsible for this antioxidant activity.

Keywords: Argyreia pomacea, Leaf, Antioxidant activity, DPPH assay, Phosphomolybdenum assay

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Study of synergistic bioactivities of *Coffea arabica* leaf extract with copper oxide nanoparticles

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This study explores the concept of synergistic bioactivities, where combined substance action exceeds individual effects, producing enhanced biological reactions. *Coffea arabica* leaves are subjected to maceration using hexane and methanol, producing extracts for detailed analysis. The methanol extract, rich in Phenols and Flavonoids, underwent thorough investigation. Simultaneously, copper oxide nanoparticles (CuO NPs) were synthesized via chemical synthesis using Copper(II)acetate as the starting material, NaOH; the reducing agent and Glacial Acetic Acid. Characterization of the nanoparticles was done by UV-visible spectroscopy and FTIR analysis. Anti-inflammatory effects were evaluated using the Albumin denaturation inhibitory assay, while the anti-bacterial properties were assessed through the Agar Well-diffusion method against *E. coli and S. aureus* bacteria, representing gram-negative and gram-positive strains, respectively. Combining the *Coffea arabica* methanol extract with CuO NPs exhibited significant bioactivity across each category. The combination produced the lowest IC_{50} value (75.19 ± 0.05 µg/mL), surpassing individual activities of coffee leaves (138.854 ± 0.12 µg/mL) and CuO NPs (1508.38 ± 0.09 µg/mL), indicating remarkable anti-inflammatory activity of the combination. Meanwhile, maintaining the plant extraction at 5 mg/mL while varying nanoparticle concentration from 0.5 mg/mL to 8 mg/mL against bacteria revealed enhanced anti-bacterial properties with increasing nanoparticle concentration in the combined form. Individual activities were inferior to the combination confirming nanoparticles boost Coffee leaves' antibacterial properties. These findings propose pharmaceutical and nutraceutical applications for inflammation and bacterial infection treatment by combining CuO NPs with *Coffea arabica* leaf extract. Further research is essential for understanding mechanisms and thoroughly evaluating the safety and toxicity profiles of this synergistic blend.

Keywords: Coffea arabica, Copper oxide nanoparticles, Synergistic, Anti-inflammatory, Anti-bacterial

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Nanoscale zero-valent iron biochar composites for heavy metal removal: Thermodynamics, material regeneration, and application to simulated wastewater

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Heavy metals such as lead and cadmium are a major source of water contaminants. Nanoscale zero-valent iron (nZVI) has gained significant interest as a remediation agent, due to its low reduction potential and adsorption capabilities. However, pristine nZVI has inherent issues of agglomeration and passivation which can be mitigated by using an inexpensive support material such as biochar (BC). The carbothermal reduction of iron on BC creates a surface-deposited composite (Lig-sG@nZVI) while simultaneous pyrolysis and reduction of a mixture of iron and carbonaceous material forms an nZVI-embedded BC composite (Lig-eG@nZVI). SEM/EDX results show that Lig-sG@nZVI has a high surface iron loading than Lig-eG@nZVI. In addition, the observed XRD peak patterns confirmed that the loaded iron was present in the zero valent state. Enhanced uptake of Cd(II) and Pb(II) was observed at pH 6 and pH 5, respectively. The experimental data for both heavy metals was best fitted to the Sips isotherm model. For Cd(II), maximum Sips capacities were ×1.45 and ×1.21 higher for Lig-eG@nZVI and Lig-sG@nZVI compared to Lig-BC while for Pb(II) removal, maximum Sips capacities were ×1.44 and ×2.11 greater for Lig-eG@nZVI and Lig-sG@nZVI compared to the control material. Fast remediation kinetics were observed for Cd(II) whereas maximum adsorption was reached at 45 mins for Pb(II). According to thermodynamic studies conducted, the overall adsorption processes were confirmed to be spontaneous and endothermic in nature. Furthermore, the application of synthesized nanocomposites to simulated wastewater showed comparatively increased adsorption capacities.

Key words: Nanoscale zero valent iron, Biochar, Lignin, Heavy metal remediation

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Rice husk derived silica gel as a desiccant and TLC stationary phase

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Silica gel is a highly porous substance and is formed as a granular form of silicon dioxide. It is a popular desiccant used in many commercial applications. Moreover, silica-gel is used as stationary phase material in thin layer chromatography (TLC) and column chromatography. Extraction of silica-gel from granular form is expensive, therefore in this research we investigated a low-cost method to extract silica gel from rice husks and determined their properties. Silica-gel was produced primarily under three steps; (1) obtaining rice husk ash through burning or pyrolyzing, (2) treating with NaOH to obtain sodium silicate in microwave oven or water bath, and (3) precipitating silicic acid using HCl. The first two steps are highly energy-consuming. Therefore, instead of a more energy-consuming muffle furnace, we used open burned ash. Also, we used microwave heating instead of water-bath heating to obtain soluble silicate. Accordingly, average yields obtained for the open burn-water bath method, open burn-microwave method, muffle furnace-water bath method, and muffle furnace-microwave method were 51.9%, 88.27%, 66.75%, 82.29% respectively. The highest yield of silica-gel and the best water adsorption ability were obtained with open burning and microwave approach which is low cost compared to other approaches. Furthermore, successfully developed a silica-gel material for thin-layer chromatography (TLC) plates utilizing rice husk-derived silica and ran a sample test using benzoic acid as the analyte. Resulted Rf value revealed a close agreement with the standard values. However, further investigations needs to be conducted for several other analytes and solvents to validate these results.

Key words: Low cost, Rice husk ash, Silica gel, Water adsorption, TLC plate

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TLC-based Metabolite Profiling for *Amurthashtaka kwatha*: An Ayurvedic Polyherbal Formulation Used for Fever Associated Inflammation

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Amurthashtaka kwatha (AK) is a polyherbal Ayurvedic formulation of eight raw plant materials; Azadirachta indica (Neem), Cyperus rotundus (Nut grass), Holarrhena antidysenterica (Coneru), Picrorhiza scrophulariiflora (Katuka), Santalum album (Sandalwood), Tinospora cordifolia (Guduchi), Trichosanthes cucumerina (Snake gourd) and Zingiber officinale (Ginger). This study has focused on thin layer chromatography profiling of metabolites of AK and its plant materials under standardization process. The plants were collected from five locations in Sri Lanka (one location contains all eight plant materials) and they were named as sample 1,2,3,4 and 5. Methanolic extracts of individual plants and AK were prepared using decoction method. Ethylacetate: n-hexane=5:5v/v, chloroform: methanol: acetic acid = 8.5: 1.5: 0.2v/v, toluene: ethylacetate: formic acid: methanol=3:3:0.3:0.2v/v, chloroform: methanol: formic acid=7:2:1v/v, toluene: ethylacetate=8.5:1.5 v/v, chloroform: methanol=8.5:1.5v/v, n-hexane: ethylacetate = 9:1v/v and n-hexane: ethylacetate=6:4v/v were used as mobile phases for A. indica, C. rotundus, H. antidysenterica, P. scrophulariiflora, S. album, T. cordifolia, T. cucumerina and Z. officinale respectively. Purchased nimbolide, berberine and picroside were used as standards. Spots were visualized under UV light at 254nm and 366nm. Only one kwatha sample exhibited similar spots with nimbolide at 254nm while four kwatha samples were given spots at 366nm (R_f 0.35). P. scrophulariflora sample 2,5 and kwatha sample 1,2 were given similar spots with picroside at 254nm (R_f 0.55). T. cordifolia sample 1 and four kwatha samples were given similar spots with Berberine at 254nm while three T. cordifolia and all kwatha samples gave spots at 366nm (R_f 0.14). The present study qualitatively determined the presence of: nimbolide, picroside and berberine in AK; picroside in P.scrophulariiflora; and berberine in T.cordifolia.

Key words: Amurthashtaka kwatha, methanolic extracts, mobile phases, phytochemicals and Thin Layer Chromatography
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Synthesis and characterization of desferrioxamine entrapped PEO/ethyl cellulose nano-hybrids

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Repetitive transfusion of blood as a treatment for thalassemia poses serious health problems in patients by raising the blood iron concentration to abnormal levels, which is called iron overload disease (IO). In order to minimize the IO condition, the drug desferrioxamine (DFO) is administrated slowly via a subcutaneous injection. However, the unavailability of the oral form of the medication and the need for subcutaneous infusion for long hours have markedly limited its use. Therefore, it is imperative to move towards orally administered management model for IO. The main objective of the current study is to synthesize and characterize polyethylene oxide-ethyl cellulose nanoparticles (PEO-EC) for the purpose of loading DFO. PEO-EC nanoparticles were synthesized using desolvation method in the presence of PEO, Tween 80 (0.2% − 0.4%)/aqueous system and EC/ethyl acetate organic phase. Synthesized particles were characterized using scanning electron microscope (SEM), particle size analyzer and Fourier transform infrared spectrometer (FTIR). The appearance of the prominent sharp stretching band of N-H amine in the region 3294 cm^{-1} − 3390 cm^{-1} confirms the entrapment of DFO in PEO-EC nanoparticles. The SEM micrographs of the synthesized particles confirm the presence of spherical shape morphology. PSA data reveals the formation of average 106 nm (PDI: 0.795) particles (Tween 80: 0.4%, PEO: 0.1 g). UV-Vis spectroscopic analysis data at 410 nm revealed DFO entrapment efficiency of 5.5 − 6 % with 27.3 − 30 mg/g loading capacity. Hence, these results show a promising approach for the use of PEO-EC nanoparticles for the development of orally administered model for IO.

Key words: desferrioxamine, drug loading, polyethylene oxide, ethyl cellulose

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Comparative phytochemical screening and thin layer chromatography development for soxhlet and ultrasound-assisted extracts of *Piper longum* (*Thippili*) and *Piper sarmentosum* (*Gas thippili*) grown in Sri Lanka

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Piper longum (PL) holds significant importance in Sri Lankan traditional medicine, while *Piper sarmentosum* (PS) is considered a potential substitute for PL. Despite the recognized medicinal demand, few studies have compared the phytochemistry of these two species in Sri Lanka. The primary objective of this study is to identify a better extraction method for further phytochemical studies regarding PL and PS and to compare the phytochemical composition of different parts of both species. Fruits, stems, roots, and leaves of both species were extracted with methanol using Soxhlet extraction (SOXE) and ultrasonic-assisted extraction (UAE). Each extract underwent phytochemical screening and Thin Layer Chromatography (TLC) development using a hexane: ethyl acetate: methanol (60:40:1) solvent system. Results indicate that UAE extracts exhibited better outcomes, showing more intense bands in TLC and higher extractability of Flavonoids and Piperine/Pipeamides compared to SOXE. Furthermore, based on the phytochemical screening of different plant parts from UAE, Phenolics/Tannins, Flavonoids, Alkaloids, and Terpenoids were detected in all plant parts of both species. However, Saponins were only detected in fruits and leaves of both species. Regarding TLC, some spots with respective R_f values appeared in both species, while some spots only appeared in either PL or PS, visualized under different UV levels and with the anisaldehyde sulphuric acid reagent. In conclusion, the UAE method is more efficient for extracting phytochemicals from PL and PS. The study reveals both similarities and differences in the phytochemical profiles of different parts of PL and PS, providing valuable insights for future research.

Key words: *Piper longum*, *Piper sarmentosum*, phytochemicals, UAE, TLC

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Rerecord of *Asymmetricata impressa* (Lampyridae) after 112 years from Central Province, Sri Lanka

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Asymmetricata impressa Olivier is one of the Luciolinae fireflies in Sri Lanka. The original description of this species as *Luciola impressa* was based on male and female specimens collected from Peradeniya, Kandy, Central Province of Sri Lanka in 1910. There were no subsequent records of *A. impressa* following its original description, and hence, its taxonomic status in Sri Lanka remained uncertain. However, the recent visual encounter survey of fireflies carried out in 2022 recorded male *A. impressa* from `Rikillagaskada` in Nuwalaeliya district, Central-Intermediate Zone of Sri Lanka, almost 112 years after its first record. The specimens were captured using an insect hand net for close examination, and photographs were taken. The present specimens were confirmed after a detailed assessment of their morphology with images of type specimens and consideration of expert reviews. Taxonomic description of *A. impressa* include: male: 11-12 mm long, 5-6 mm wide; Pronotum is 2-3 mm long, yellowish orange with a distinct pair of dark spots, black broad anterior margin; Head is black and antenna are black and filiform; Elytra are 8-9 mm long, yellowish–orange, dark base and pale apex, distinct regular punctures and interstitial lines on the elytron. Thorax is yellowish orange; abdominal ventrites: II-V black, light organ in ventrite VI entire and VII bipartite, last segment (tergite 8) asymmetric and inclined to right. The rerecord of *A. impressa* from the region, which was previously recorded in Sri Lanka helps fill the knowledge gap in firefly taxonomy and diversity in the country.

Keywords: Asymmetricata impressa, Central-Intermediate zone, Taxonomic description

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Physical and microbial stability of three extemporaneously compounded medicines in selected pharmacies in Uva and Southern Provinces

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In-house preparation of medications called extemporaneous compounds meets specific patient needs when no commercial alternative is available. This study aimed to determine the stability of Calamine lotion BP (CLBP), 2% cetrimide shampoo BP (2% CS), and 10% urea in aqueous cream BP (10% UA) within a month until their expiration. CLBP, 2% CS (100ml each), and 10% UA (100 g) were collected from two pharmacies where these formulations were available. Visual appearance, pH, and viscosity were assessed to determine physical stability utilizing a pH meter and viscometer. Spreadability was determined for UA via the parallel plate method. Foam ability, foam stability, and solid content of CS were measured. Microbial stability of CS and UA was evaluated using colony-forming unit (CFU) values, through the streak plate method. All tests were performed according to the British Pharmacopeia on the day of preparation, after 15 days, and after 30 days at the Department of Pharmacy, University of Ruhuna. Changes in colour and odour along with clear phase separation were observed in CLBP. CS showed changes in odour, and clarity, reduced solid content, 9.7% to 1.7%, and increased foam ability, 18 ml to 22 ml, and foam stability, 15 ml to 16 ml. UA remained visually unchanged with variations in spreadability around 3000 mm^2 - 6000 mm^2 range. Viscosity of all samples decreased, and pH values showed minimal changes around 7 - 9.8 range. CFU revealed an increase in colonies, 4 to 27 in UA, and a decrease in colonies, 1876 to 709 in CS. Based on these results, it is concluded that there are certain issues related to the stability of the tested products, suggesting the need for further studies.

Keywords: Calamine lotion, cetrimide shampoo, extemporaneous medications, urea aqueous cream

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Evaluation of quality and stability of spironolactone tablets stored in different household conditions

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The quality and stability of a pharmaceutical product is important for its therapeutic effectiveness. Packaging material and storage conditions may affect the stability of a medication. Spironolactone is a diuretic medication used to treat cardiovascular diseases. This study aimed to assess the quality and stability of spironolactone tablets stored in simulated household conditions. Seven samples of Spironolactone 25 mg tablets (n=107 each) with the same lot number were obtained. One sample was subjected to visual inspection of appearance, weight variation, chemical assay, dissolution, disintegration, friability, and hardness tests according to British Pharmacopoeia at the baseline. Other six samples were stored for 30 days; two samples in the original packaging (OPS), and four as repacked samples (RPS). OPS were stored under standard storage conditions (below 30ºC, protect from moisture, heat, and sunlight) and on a table. The RPS were stored at standard conditions, on a table without a container, in a closed cupboard, and within a used metal container. After 30 days, the same tests were performed. The RPS kept on a table failed assay (78.16 ± 0.56) and dissolution tests (79.39 ± 24.83) and showed discoloration of tablets. All RPS in household conditions failed the hardness (36.09 ± 1.73, 25.75 ± 5.24, 32.61 ± 4.44) test and had significantly different results with the OPS sample for weight variation test (p values: 0.022, 0.012, 0.006). The stability of repackaged spironolactone 25 mg tablets stored in typical household conditions cannot be guaranteed after 30 days. However, the stability can be maintained for 30 days in their original packaging. Hence, it is important to advise the patient on suitable household storage conditions.

Keywords: Chemical assay, diuretic medication, repacked samples, stability

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In vivo immunomodulatory properties of *Edwardsiella piscicida* challenged olive-flounder plasma exosomes

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Edwardsiella piscicida (Gram-negative bacteria), the major causative agent of Edwardsiellosis frequently affects aquatic animals including olive flounder (*Paralichthys olivaceus*) resulting in huge economic losses to the industry. Extracellular vesicles (EVs) including exosomes play an important role in transferring genetic information to cells from healthy or diseased states, and their potential roles in clinical diagnosis and therapeutics have been identified. Exosomes (30-150 nm) that originate from cell endocytosis secrete from both pathogens and host cells and contain pathogen-related molecules and host factors (RNAs, miRNAs, proteins, lipids, etc.) of different cellular origins. Exosomes can be utilized by both pathogens and host, hence could regulate the infection to either increase or suppress. In this study, immunomodulatory properties of the exosomes from *E. piscicida*-infected flounder plasma were investigated to search for their anti-infective role. Fish were challenged with *E. piscicida*, and exosomes (Ep-Exo) from plasma were isolated (at 72 hours post-challenge) by ultracentrifugation. Ep-Exo was characterized and its immunomodulatory effect on zebrafish and flounder was compared with non-infected exosomes (PBS-Exo). The higher number of Ep-Exo than PBS-Exo indicates that upon infection, exosome content varies due to host cellular alterations, but cup-shaped membrane-bound morphology has remained. The upregulated genes in zebrafish (*tlr2, tlr4b*, *il1β, tnfα, il6*, *cat)* and flounder (*TLR2*, *TLR5a*, *TLR5b*, *TNFα*, *IL2*) kidneys upon Ep-exo treatment demonstrated its immunostimulatory activity. It was further confirmed by upregulated zebrafish TNFα, IL10, IFNγ, and TGFβ protein expression. In conclusion, Ep-Exo could be utilized as a novel target for developing an immunostimulant/ modulatory agent for enhancing the immune protection of the fish.

Keywords: Edwardsiella piscicida; extracellular vesicles; exosomes; immunomodulation; Paralichthys olivaceus

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Addressing the early dropout of Quantity Surveying Courses among university students in Sri Lanka

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This research develops into the critical issue of early dropout rates among university students pursuing Quantity Surveying courses in Sri Lanka. Despite the significance of Quantity Surveyors in the construction industry, a substantial number of students fail to complete their programs. To understand and mitigate this problem, a comprehensive study was conducted by considering tertiary and vocational sectors, private institutes that offer quantity surveying courses as well as students, lecturers, and professionals who are engaging with the Quantity surveying profession. Moreover, in this study, it was selected the stratified sampling method and Quantitative research approach for data collection. Thus, the structured questionnaires were sent to the respondents of this study. With that, the following challenges were identified as contributing to early attrition such as financial constraints, exacerbated by economic challenges and the COVID-19 pandemic. On the other hand, there are internal challenges in the institution and industry that encourage dropouts as the mismatch between the curriculum and industry demands, lack of training, language, gender barriers, education costs, and career prospects. To find solutions to these challenges, it was created the Likert scale questions and the following solutions were proposed. It includes curriculum updates aligned with industry needs, financial aid, awareness programs about career opportunities, language proficiency enhancement, and increasing practical exposure. Collaborations between academia and industry, as well as government support, are integral to the success of these interventions. With the above findings, this research highlights the urgency of addressing early dropout rates in Quantity Surveying courses. Implementing the proposed solutions can foster a conducive learning environment and empower students. This study creates future paths on fostering female professionals while contributing to the growth of Sri Lankan construction industry.

Keywords: Quantity Surveying, early dropout, student retention, Education challenges, construction industry

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Modelling breast cancer incidences in Sri Lanka using time series analysis

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In Sri Lankan women, Breast cancer is the most prevalent type of cancer. Sri Lanka has relatively low breast cancer survival rates when compared to more developed countries. Over 3,000 new cases of breast cancer are diagnosed each year, according to the analysis of the Sri Lanka National Cancer Registry. The breast cancer incidence data published in the National Cancer Registry, Sri Lanka during 2005 – 2020 was obtained. Sri Lanka has primarily a public health care system. Therefore, by understanding and predicting breast cancer rates, healthcare systems and organizations can be better equipped to prevent, detect, and treat this disease effectively. The main objective of the study was to predict a suitable model and forecast future breast cancer incidences. In this study, we predicted the Quadratic trend model, Exponential trend model, and Holt-Winters methods and did a comparison based on the residuals to find the best model. According to the results, the best prediction model was determined based on accuracy measures of Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD), and Mean Standard Deviation (MSD). By comparing these accuracy measures, the Quadratic trend model is selected as the best-fitted model for breast cancer incidences during these 15 years. The forecasted values for the years 2021, 2022, and 2023 are 5267, 5602, and 5950 respectively.

Keywords: Breast Cancer, Quadratic, Holt-Winter's, Sri Lanka, forecasting

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Application of Dijkstra's algorithm to find the shortest paths between selected travel destinations in Colombo

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This study was a case study that was done as a project under a course unit in the BSc degree program. In this case study, Dijkstra's algorithm was used to determine the shortest distances and shortest paths between selected places around Moratuwa, Dehiwala-Mount Lavinia, Boralesgamuwa, and Sri Jayewardenepura Kotte regions. The places have been chosen considering their significance as travel destinations. Therefore, the main purpose of this study was to provide some support for people who search for the shortest path between these selected places and the places near those places. As the main method of this study, Dijkstra's algorithm has been used with some assumptions on selecting roads and creating the graph. To apply the algorithm, a directed weighted graph was created using the data on the distances and locations of the places according to Google Maps. The edge weights represent the distances between places, while the vertices represent places. Using "Online Dijkstra's Solver in Javascript," this study has found the shortest distances and the shortest paths between selected thirty places within the above-mentioned regions, considering one place as a source vertex at a time.

Keywords: Graph theory, Dijkstra's algorithm, Mixed graph, Directed weighted graph, Google map

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Investigating the influence functions of Cumulative Hazard and Kaplan-Meier estimators for survival data

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In this study, we considered the right-censored data $\{(Z_1, \delta_1), (Z_2, \delta_2), \ldots, (Z_n, \delta_n)\}$, where $Z_i = min(X_i, Y_i)$ and $\delta_i = I(Z_i = X_i)$. Let $X_1, X_2, \ldots, X_n$ be a random sample from an absolutely parametric continuous distribution $\{F(t, \theta), \theta \in \Theta\}$, and these are the actual failure times of the objects being observed. Additionally, let $Y_1, Y_2, \ldots, Y_n$ be a random sample from an absolutely continuous distribution $\{G(t)\}$. It is assumed that X_i and Y_i are independent. Here we considered the nonparametric maximum likelihood estimator, the Kaplan-Meier estimator, of the survival distribution $\bar{F}(t, \theta) = 1 - F(t, \theta)$. The influence curve is an effort to offer empirical understanding of the "influence". The problem we are interested in here is to derive the influence functions of the cumulative hazard function and survival function of the failure data. We obtained above two influence functions by considering the sub-survival functions of Z_is. In simulation study, we considered two distributions, Exponential distribution and Weibull distribution. All simulation studies were carried out in R software. Influence functions for the cumulative hazard function and survival function were obtained for both distributions, and their application was extended to a discrete data case.

Keywords: Cumulative hazard, Influence function, Kaplan-Meier, Right-censored

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A goal programming model for land allocation for crops in udawalawa irrigation scheme in Sri Lanka

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Crops are not only produced for human consumption but also to get a profit in the economic aspects. Therefore, a proper cultivation plan is needed. In this study, a goal programming model is developed to determine a cultivation plan for selected crops in the Udawalawe Irrigation scheme. Udawalawe, Chandrika-Lake, Habaralu-Wewa, Kiriibban-Wewa, and Andara-Wewa are the reservoirs that are being selected for this research. Six regions between the above-mentioned reservoirs are being selected and aimed to study paddy, banana, sugarcane, and other crops cultivated in these areas. A weighted single objective is suggested for the model by considering all objectives. The primary objective of the model is to maximize the profit from the crops. Utilization of total available land for cultivation and minimizing positive deviation from the average monthly inflow to Udawalawe reservoir are the other objectives that we considered. The total area of available lands, availability of water, crop water requirement, reservoir storage limits, water storage continuity equations, and crop production targets are the constraints considered in the model. The model is implemented in MATLAB. According to the results, we can use all the area of available land in each region and the monthly inflow of water to the Udawalawe reservoir can be used less than or equal to its average value. Data was collected from regional agrarian officers. Under the given parameters, the proposed model can be applied to obtain a cultivation plan for the selected crops for each region that will maximize the profit while satisfying the other constraints.

Keywords: Profit maximization, Goal programming, Average, Udawalawe

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Kauffman bracket polynomial of the $(3, q)$ torus knot

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Knot polynomials are polynomials associated with knot projections, capturing essential knot properties that remain unchanged through ambient isotopy. In simple terms, if a knot K possesses an invariant α, this invariant, it remains consistent across all its projections. In this research, we delve into the concept of knot polynomials and elucidate the methods for determining them for a given knot projection. Our focus primarily centers on torus knots, which are knots resting on an unknotted torus without crossing over or under themselves. Extensive research in this field concentrates on establishing various polynomial representations, including the Kauffman Bracket polynomial and the Bracket polynomial for $(2, q)$-torus knots, well-known representations like the Alexander polynomial, Conway polynomial, and Jones polynomial for (p, q)-torus knots. The primary emphasis lies in the computation of the Kauffman bracket polynomial for $(3, q)$-torus knots and the formulation of a general expression for the Kauffman bracket polynomial for $(3, q)$-torus knots. Furthermore, this research work explores an innovative approach for resolving specific crossings within $(3, q)$-torus knots and obtains the formula for the Kauffman bracket polynomial of $(3, q)$-torus knots, $K\big(T(3, q)\big)$ given by $K\big(T(3, q)\big) = (-1)^{q+1}A^{5(q-1)} + (-1)^{q+1}A^{5(q-3)+2} + (-1)^{q}A^{(q-9)}$where 3 and q are coprime with $q \geq 4$.

Keywords: Torus Knots, Knot Polynomial, Projections, Crossings, Isotopy, Kauffman Bracket-Polynomial, Recursive formula

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A discrete dynamical model for natural resistance against HIV

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Human Immunodeficiency Virus (HIV) is a complex and deadly virus that attacks the human immune system. HIV/AIDS remains one of the most pressing global health challenges, affecting millions of individuals and communities worldwide. The CCR5 (Chemokine Receptor type 5) is a crucial key player in HIV infection due to its major involvement in the infection process. Natural resistance, which has come since ancient times, is being built in humankind against some diseases such as Malaria, Galactosemia, etc. This natural resistance is built by changing genetics and ~~it~~ continues to ~~the~~ future generations, providing very suitable examples of Charles Davin's evolution theory. In the recent investigation on HIV, it was found that individuals carrying the CCR5-Δ32 (a-nucleotide deletion in the exon of the CCR5 gene) live a normal life and are warranted a natural barrier to HIV infection. There are many research papers proposing continuous dynamical models for HIV. In this paper, we propose a discrete dynamical model taking into account the evaluation of a gene type, which shows how rapidly the concentration of the CCR5-Δ32 allele converges to its maximum equilibrium level. Graphical methods, including web analysis and analytical methods, were used to find the stable equilibrium value E. $\frac{d(n)-E}{d(n-1)-E}$ were computed for moderately large values of n, where $d(n)$ is the proportion of the CCR5-Δ32 allele in the generation n. We determined the rate at which the frequency of the CCR5-Δ32 approaches its stable equilibrium, and used this rate to estimate what percentage by which the frequency gets closer to equilibrium in one generation compared to the previous generation. There is no surprise that the present and future generations of the human population shall acquire resistance to HIV than in the past.

Keywords: CCR5, Natural resistance, Dynamical system

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Modeling Temperature Variation in Trincomalee District, Sri Lanka: Time Series Approach

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Sri Lanka has a warm and tropical climate throughout the year, with temperature variations depending on the region and the influence of monsoon winds. It is important to note that specific temperature patterns and changes can vary across different areas of Sri Lanka. The area selected for this study is Trincomalee district of Sri Lanka which is the hottest temperature measured from 1949 to 2018 and the annual and monthly average air temperature from 2013 to 2018 was collected from the Department of Census and Statistics. The main objective of this research was to develop a suitable model and forecast average temperature of the Trincomalee district. In this study, the *p*-value (8.292e-09) in Kruskal-Walli's test identified the existence of seasonality. The *p*-value (0.01) in Augmented Dickey-Fuller (ADF) test and the *p*-value (0.1) in Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test realized that the series was difference stationary. According to the results, Seasonal Autoregressive Integrated Moving Average (SARIMA) model was fitted to find the best model by using R programming and identified SARIMA (1,0,0) (2,1,1) [12] as the best fitted model, out of the 14 tentative models considering minimum AIC, AICc and BIC values. The *p*-value (=0.6559) of the Portmanteau test reveals that the residual time series are different from zero. Autocorrelation plot of residuals suggested that residuals have no correlation. Finally, the accuracy of the model was evaluated using Mean Absolute Percentage Error (MAPE) value. MAPE value of less than 10% reveals that our model is excellent.

Keywords: forecasting; SARIMA, Temperature, time series

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Numerical study of age-structured two-sex population dynamics model for transmission of Thalassemia disease

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Thalassemia is an inherited blood disorder that is characterized by the absence or reduced synthesis of globin chains of hemoglobin. It is an autosomal recessive disorder, which means both the parents must be affected with or carriers for the disease to transfer it to the next generation. The high prevalence of thalassemia makes it one of the major health problems and a priority genetic disease. Very recently, authors formulated an age-structured two-sex continuous-type population dynamics model that describes the genotype composition of the population resulting from the thalassemia trait. Further, the existence of a non-negative continuous solution to the proposed model was established. The purpose of this study is to numerically solve the mathematical model by applying the Crank-Nicolson form of the finite difference method of characteristics, combined with the trapezoidal rule. To verify the model and test the numerical scheme, a numerical simulation was run to predict the growth of the population of Sri Lanka structured by the thalassemia trait over the decade between 2011 and 2021. We underestimated both the total male and female population not having the thalassemia trait by merely 3.8% and 1.1%, respectively. In addition, the error estimations of individuals with thalassemia minor and major have never been greater than 10%. The estimated errors of those two thalassemia classes are quite significant due to the law accuracy of data. In conclusion, these findings show the overall validity of the age-structured two-sex population model for thalassemia transmission as well as the usefulness of our approximation algorithm.

Keywords: Age-structured, Crank-Nicolson method, Numerical study, Thalassemia, Two-sex

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Impact of environmental, social, and governance (ESG) reporting in the corporate performance of the companies listed in the Colombo Stock Exchange in the year 2020

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Integrating environmental, social, and governance (ESG) factors into investment decisions has gained high momentum. This has primarily led large-scale companies to disclose their ESG and sustainability activities. However, there are skeptics regarding the necessity of ESG reporting. Hence, this study aims to assess the correlation between ESG reporting and corporate performance in 2020 (incorporating 128 listed companies under the Colombo Stock Exchange in Sri Lanka that use ESG reporting). Data was sourced from their annual reports and quantified using the Refinitiv ESG methodology. An assumption that all themes are equally weighted is considered in ESG quantification since the weightings are not available/ calculated for Sri Lanka. Return on equity (ROE) is taken as the dependent variable to measure corporate performance. Statistical analyses, including scatter plot, regression and residual analysis, were conducted to measure the relationship using SPSS and excel software. However, the findings revealed that there is no substantial link by only having a R square value of 0.001, between ESG reporting and corporate performance in 2020. This may imply that ESG reporting is not as important for enhancing company performance. However, this study cannot be considered perpetually applicable due to the unprecedented global pandemic situation in 2020 (since the corporate performance varied greatly during the year causing ROE to reach negative values to high positive values). Additionally, factors such as the high influence of the greenwashing activities of the companies, the unsuitability of ESG quantification methodology for Sri Lanka, and the non-availability of the ESG score quantified data in Sri Lanka may have affected the results. Therefore, the study could be extended over more years, using control variables to reduce the higher variability, for perpetual usage. The ESG scoring for companies can be an immense contribution to future research.

Keywords: Corporate performance. ESG, Sri Lanka, Sustainability, ESG reporting

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Numerical analysis on size dependency of spherical silver nanoparticles in response to an electric field

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Noble metal nanoparticles such as Silver, Gold, and Platinum nanoparticles are used in a broad range of optical applications due to their unique absorption, reflection, and transmittance properties. Such applications include biosensing, improving performances of electronic devices, and nano-optics. In this study, an ambient electric field enhancement around spherical silver nanoparticles in the range of 1 nm to 100 nm diameters was numerically analyzed using COMSOL Multiphysics software. Nanometer scale geometry was designed, and material properties were appropriately set. Using the electromagnetic wave module, a transverse electric input port of 1 W was created, and the output port was set to be parallel to the input port. The study was conducted by simulating an incident electromagnetic wave with 500 nm wavelength in the geometry built. Results showed that electric field enhancement in the vicinity of the nanoparticles (~10 nm) was over 2000-fold relative to the background electric field. The electric field enhancement showed a positive relationship related to nanoparticle size, with a maximum electric field enhancement at 100 nm for the considered diameter range. The simulations illustrated that the spherical nanoparticles enhance the electric field in the vicinity, which consequently enhance the optical properties in the ambient environment, and it is dependent on the diameter of the nanoparticle. The findings emphasize the importance of a thorough understanding of size-dependent phenomena in nanoparticles, and its need of precision in nanoparticle design and manipulation for tailored functionalities and applications.

Keywords: Nanoparticle, Numerical Analysis, Electric fields

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Use of end area rule for the volume estimation in two dimensionally varying sections

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Volume estimation is a crucial aspect of the design phase as well as in post-construction stage in engineering projects, particularly in road construction. End area rule is the most widely used technique which is used in this regard, especially to calculate the volume between two cross sections. This study was conducted to examine the validity of the end area rule for two dimensionally varying section where two cross sections stand parallel to each other. The study was conducted using a numerical model developed using basic integration and a digital model developed using Blender 3.3 software. At first, it was concluded mathematically that the sectional area of the model does not vary linearly between the two ends resulting the end area rule is not valid since the rule depends on two basic assumptions where the two sections being parallel and the area varying linearly between the sections. The volumes of 10 objects with selected dimensions were calculated using conventional end area rule, numerical model and digital model. The results showed that the volumes given by later two methods as similar which can be considered as actual and a different result for the end area rule. This confirmed that the volume calculated by end area rule is deviating from the actual value making the end area rule is not valid. But a correction factor can be introduced such that end area rule is still valid and giving a closer result to the actual volume.

Keywords: End area rule, volume estimation, two dimensionally varying sections

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Investigation of electrical properties of composite dipped films developed with Electrically Conductive Carbon nanotube (CNT)-Natural Rubber Latex (NRL)

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Electrically conductive NRL dipped films are important in applications such as electrically conductive gloves, sensing applications and in electromagnetic interference shielding (EMIS) due to their light weight, low thickness, and cost effectiveness. This study focused on developing electrically conductive thin NRL dipped films by aligning CNTs in the latex medium by the application of an Electric field. Angled multiple dipped article preparation was carried out with (a)compounded latex (CL), (b) CL with dispersed CNTs and (c) CL with dispersed CNTs under the effect of an electric field induced using an external power supply. The dipped films were characterized by Raman, FTIR, TGA and Tensile strength analyses. The comparison of ID/IG ratio obtained from the Raman study revealed the presence of a higher proportion of graphitic carbons in composite films compared to the multi-walled CNT (MWCNT) sample due to the elimination of the non-graphitic constituents of MWCNT during solubilizing. By observing the TGA, we can confirm the presence of MWCNT. A slight decrease of tensile strength was observed in the dipped composite films compared to the plain latex films, indicating the CNT's role as a non-reinforcing filler. The electrical conductivity and the EMIS effectivity of the films were investigated using a four-probe conductivity meter and a portable oscilloscope, respectively. An electrical conductivity within the range of 0.0002-0.002 Sm^{-1} was determined and an initial reduction in intensity of attenuated EMR was observed only in the (c) films, suggesting the presence of an effectively aligned mesh structure of MWCNTs within the CL matrix.

Keywords: Natural rubber latex, Carbon nanotube, Dipped film, Electrical conductivity, Electromagnetic interference shielding

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Investigation of mechanical properties of grit blasting waste incorporated concrete

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A large amount of blasting grit waste is generated from rust and coating removal during ship-repairing industries worldwide. Due to lack of proper waste management mechanisms, it has become an immense environmental issue affecting soil and groundwater. This research targeted to examine the feasibility of incorporating grit waste into concrete partially replacing it with fine aggregates. Different grit waste (unpurified) percentages (5%, 10%, 20%, 30%, 40%) were added to M25 concrete replacing sand and variations in compressive strength and workability were investigated. According to the results, the average maximum compressive strength of 35.40 MPa and 41.93MPa was attained after 7 and 28 days by the sample with 10% grit waste content. Compared to the control sample (with 0% grit waste), it showed an 18% increment and 0.94 % decrement in compressive strength after 7 and 28 days, respectively. Even after adding 40% waste grit, 31. 66 MPa and 39.90 MPa of average compressive strength were achieved after 7 and 28 days respectively, which were higher than the characteristic strength. Moreover, maximum workability was recorded in the sample with 10% grit waste content. Although there were variations in the values, all results are above the standard range. Therefore, it can be concluded that even though there are reductions in compressive strength compared to the control sample, up to 40% reduction of sand can be achieved, as the proposed mixtures had a higher strength than the characteristic strength. Further, it reduces the environmental impact, and cost, and ensures environmental sustainability.

Keywords: Grit blasting waste, compressive strength, construction materials, environmental sustainability

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HTTP-based real-time HD to SD adaptive video streamer for mobile devices

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Real-time video streaming in mobile devices such as smartphones and tablets is used in a wide variety of applications, and it has become very popular in the present era. Because of their smaller screen resolutions and sizes, mobile devices are usually expected to stream video in Standard Definition (SD). However, there is an increased need for streaming real-time High-Definition (HD) video on them. Difficulties associated with streaming HD video on regular mobile devices can be due to limitations of HD video decoding hardware, unavailability of HD video software on specific devices, and unreliability of mobile internet speeds. To resolve these problems, an HTTP-based HD to SD adaptive video streamer has been proposed, developed, and tested. In the proposed method real-time HD video is played on a server, video & audio are captured, converted in real-time into SD resolutions, and adaptively streamed using HTTP Live Streaming (HLS) protocol with HTML5 to multiple mobile devices. The server software needed for these implementations was developed using the open-source FFmpeg libraries. When HD videos were attempted to be streamed directly on the tested regular mobile devices, special streaming software had to be installed. Yet, the videos were unwatchable in real-time due to limitations of the device hardware and buffering of the videos, especially when the connected 4G mobile network was congested. In contrast, when the newly developed streamer was used, HD videos were properly streamed in real-time SD without buffering on the tested mobile devices in their standard web browsers, even when the mobile network was congested.

Keywords: Adaptive, HLS, Real-time Capture, FFmpeg

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Project management Failure and Impact on the Investor's Budget in Sri Lankan Construction Industry

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The construction sector in Sri Lanka has been a crucial driver of economic expansion and growth. This industry is not immune to challenges, with project management failures which are becoming increasingly common. This paper aims to investigate the fundamental factors contributing to project management failures in the Sri Lankan construction industry and their significant impact on investors' budgets. It sheds light on the consequences of these errors, offering insights into the economic, immediate, and social penalties that construction companies face. Identifying these issues enables stakeholders to develop solutions to reduce project management failures and safeguard investor budgets, ultimately contributing to the long-term success of construction companies. The Standard condition of contracts is frequently used in Sri Lankan building sector to create precise requirements for buildings. The study is anticipated that these approaches will vary significantly among different construction companies involved by using the random stratified sampling for selected 50 construction companies while issuing the questionnaires. However, only 30 construction companies completed the questionnaire. The data collection is outlining the basic results of this research and what they mean for the Sri Lankan construction industry. It stresses the severe effect of project management failures on investor finances and stresses the importance of resolving these challenges. The research revealed the results of avoiding project management failures as strong planning for projects, personal growth, compliance with laws and regulations, and good risk management. Finally, the conclusion provides suggestions for future study as well as practical methods that may be used to improve the success of projects and safeguard investor budgets in the Sri Lankan construction industry.

Keywords: Project, Management, investor, Budget, Construction Failure, Sri Lankan

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Comparative analysis of condition of contracts in Sri Lankan construction industry, study of ICTAD AND FIDIC

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Standard condition of contracts is frequently used in Sri-Lankan building sector to create precise requirements for buildings. The world-famous Federation des Ingenious Councils (FIDIC) and the regional Institute for Construction Training Development (ICTAD) are two of the well-known contractual structures used. With a focus on the ICTAD and FIDIC conditions frameworks, this research comprises of a detailed comparative evaluation of standards used in contract terms in Sri-Lankan projects. This study was reviewed the importance of standard condition of contracts (ICTAD or FIDIC) in the Sri Lankan projects, also discussed the essential function of these contracts for controlling construction activities and reducing problems. It is also reviewed the contents of condition of contracts, clauses with usages and limitations of the FIDIC and ICTAD documents. This study incorporates case studies like construction variations, claims, bonds issues and guaranties to show how choosing between ICTAD and FIDIC conditions papers may affect building projects in Sri Lanka. In this study used the quantitative methodology especially use the questionnaire, and questionnaire sent to the random sampling size 50 people from construction industry. However, only 35 people fully response to the questionnaire. This research study examines the flexibility of FIDIC and ICTAD conditions such as market conditions, ecology requires and industry development. This study expert comparison analysis offers useful information from those who involved in the construction Sri Lanka, also these analyses revealed the answers are ICTAD suitable for priority documents, contract agreement, investor's benefit and most suitable cost formula in Sri Lankan construction industry. On the other hand, FIDIC suitable for right to access site, performance guarantee and safety arrangement in the site. Providing through the analysis of benefits with drawback of ICTAD and FIDIC documents, the research makes choosing an in contract easily. This research helps to providing approaches and improvements of handling projects. Also this study creates the future hope to analyse the worldwide other various condition of contracts and suitability in the Sri Lankan building projects.

Keywords: FIDIC, ICTAD, Contract, Condition, Sri-Lankan

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Analyzing the factors effect on wear of brushes and optimizing the brush life of AC universal motors

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Among many types of motors available, the single-phase AC or universal motor stands out for its compact size, lightweight design, high-speed performance, and strong starting power. However, a significant challenge lies beneath their seemingly flawless operation: the limited lifespan of the brushes and commutators within these motors. The research focuses on minimizing brush wear, a critical issue affecting motor efficiency.

By investigating brush wear intensity concerning applied force, the research establishes a mathematical model linking brush wear to brush pressure. Laboratory experiments on a BSM 550E universal motor reveal a direct correlation between force on brushes and sparking energy, with brush wear dependent on applied force. The optimal spring pressure for brushes is determined to be around 3 N, resulting in minimal wear intensity (0.0186 mm/hour). The study concludes that maintaining constant brush pressure is crucial for increasing motor lifespan. To address this, a mechanism is developed to automatically reduce brush force by shortening the brush length proportional to wear, offering a practical solution to enhance motor longevity.

Keywords: Universal motor, Commutation, Spark energy, Brush wear, Spring pressure

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Improving the accuracy using ensemble based predictive model for predicting healthy lifestyle based on lifestyle, habits, and behaviors

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A healthy lifestyle is important more than past in these days because we are living very busy lifestyles to accomplish life goals. Sometimes we forget our health, social connections, etc. because of this infinite life journey. Every individual's lifestyle is unique, and it directly affects their happiness. It is important to identify the lifestyle status early to overcome some health issues. Therefore, the primary aim of this research is to forecast the lifestyle by examining current habits and behaviors. Here, whether the lifestyle is okay or not is decided based on the work life balance score of the dataset obtained from 'Kaggle' and expert advice. After data pre-processing by identifying and handling the missing values, removing unnecessary values, and ranking attributes, the data set was reduced to 15,489 with 22 features. These features belong to five categories namely, mental well-being, health and wellness, life vision, personal growth, and social connection. The Artificial neural network (ANN) and Long Short-Term Memory (LSTM) algorithms were selected to train and test the model based on the suggestions of literature review. After tuning the parameters, an ensemble approach is used with the weighted average method to combine the ANN and LSTM two algorithms to increase the accuracy. The ensemble model achieved the highest accuracy at 99.05% compared to the individual algorithms ANN 98.81% and LSTM 96.5%. Also, high precision, recall, and f-measure results and lower error values were achieved by the proposed ensemble method. Using the proposed approach, predictions can be generated based on the individual's specific lifestyle.

Key words: Healthy Lifestyle, Deep learning, Ensemble approach, Weighted average, Prediction

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Uncovering the multifaceted nature of fake news: Latent dirichlet allocation topic modelling approach

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Disseminating fake news is a critical challenge in the digital information world. Misleading or fabricated information, masquerading as reliable news, has impacted public opinion and information integrity. Fake news is subjective to its context. This research aims to uncover diverse thematic structures within spanning topics of fake news through Latent Dirichlet Allocation (LDA) and visualizers. The well-established fake news labeled dataset was taken and then we followed the preprocessing techniques such as text normalization, punctuation, stop words, and custom word removal. We extracted features through CountVectorizer and moved for the topic modeling. The LDA model was employed to find ten topics. As a result, topics encompass keywords which are diverse themes, from everyday discourse to electoral dynamics, governance, and global affairs. Some topics underscore the role of news outlets in propagating misinformation, emphasizing the need for source scrutiny. Continued iterations made this more accurate in approach. Additionally, this research delves into political scenarios, gender issues, investigations, law enforcement, and political campaigns, revealing the multifaceted nature of fake news challenges as topics analyzed through the LDA visualizer. Visualizer helps to differentiate the nuanced dimensions of fake news between each topic. Each topic was analyzed through its semantic value in the fake news. The results emphasize the commonly used words in the fake news corpus. That pinpointed the triggering words in fake news, distinguishing them from reliable news through topic modeling and analysis. This methodology can be extended to user profiling based on the extracted keywords, into characteristics of individuals interacting with online content.

Key words: Fake News, Latent Dirichlet Allocation (LDA), Topic Modelling, LDAvisualizer

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Deep learning approach for breast cancer prediction with Biglycan as a potential biomarker

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Breast cancer is the most common cancer among women in Sri Lanka, with significant mortality rates. Over the years, there has been a significant focus on developing more efficient, convenient screening methods and identifying diagnostically sensitive, non-invasive and minimally invasive biomarkers. DNA and microRNAs are some of the most promising biomarkers currently being implemented, with Biglycan emerging as a potential biomarker. Biglycan is a small leucine-rich extracellular proteoglycan identified to be associated with the aggressiveness of cancers. This study presents a novel approach combining Convolutional Neural Networks and the exploration of Biglycan as a potential biomarker for breast cancer prediction using the Biglycan breast cancer dataset. The dataset consists of histological images of cancerous (n = 203) and non-cancerous (n = 133) breast tissue, with the expression of the Biglycan biomarker. The class imbalance of the dataset was handled using several data augmentation techniques. The study utilized a CNN model architecture with two fully connected layers to reduce the risk of overfitting of the model due to the relatively small dataset size. The model training process employed a 70:30 train:validation split and RMSprop optimizer with 40 epochs and achieved a training and validation accuracy of 61% and 60%, respectively. The cancerous and non-cancerous images were classified with a precision of 0.70 and 0.65 and a recall of 0.80 and 0.70, respectively. Hence, additional model fine-tuning techniques and further validation using data representing diverse populations are required to assess the potential of using Biglycan as a biomarker for breast cancer prediction.

Key words: Breast cancer, diagnosis, Biglycan, machine learning, biomarker

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