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"Multidisciplinary Approaches Leading to Disruptive Innovations for Development"

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"Multidisciplinary Approaches Leading to Disruptive Innovation for Development"

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Faculty of Graduate Studies
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MESSAGE FROM THE VICE-CHANCELLOR

It is my immense pleasure to provide a message for the 9th International Conference on Multidisciplinary Approaches (iCMA) - 2022, one of the flagship research events of the Faculty of Graduate Studies of the University of Sri Jayewardenepura.

I firmly believe that the theme selected for this year's conference, "Multidisciplinary Approaches Leading to Disruptive Innovation for Development", is timely and highly significant. Furthermore, the conference is conducted along with an Industrial forum to involve industrial people in the research conference to make pathways to the development of the country by creating a link from disruptive research innovations to commercialized properties. The prevailing conditions due to the economic crisis in the country have affected the whole nation critically. This research conference and the industrial forum will be an enormous opportunity to improve the current situation via disruptive innovations. By conducting the conference physically, I hope that this will be an excellent opportunity to blend the research findings into commercially valuable properties.

The University of Sri Jayewardenepura, guided by its motto, 'Vijja Uthpata than Setta' (Among all that arise, knowledge is the greatest) as quoted from the Dhammapada, which was written 2,500 years ago, has long set its path to facilitate those who seek knowledge. The University's contribution to this country's education can be traced back to its 146-year-old history when it was established as Vidyodaya Pirivena by Venerable Rev. Hikkaduwe Sri Sumangala Thero.

In the University, research is being conducted in highly demanding and necessary areas along with disruptive innovations such as Nano Technology, Herbal Products, Food technology, Health care, Management, etc. The University has collaborated with acclaimed local and foreign companies such as the British Council, Moody's Analytics, Deloitte, Siddalepa, etc.
As a University, we play a key role in ensuring quality leaders are available with adequate knowledge of multidisciplinary approaches which can drive innovation in the country. In this context, the iCMA 2022 will be a challenging but exciting experience.

The Faculty of Graduate Studies has made a great effort to organize this conference for the ninth consecutive time, and is an important responsibility in uplifting this nation's research culture and output. Thus, my sincere appreciation goes to the organizing committee of the iCMA 2022 for their tireless effort in ensuring the success of this event. I wish that the iCMA 2022 be a ground-breaking event which will benefit all participants and the country.

Snr. Prof. Sudantha Liyanage
BSc (Hons) (USJ), PhD (Cardiff), C Chem, FRSC, FIChem C, FPRISL
Vice-Chancellor
University of Sri Jayewardenepura
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MESSAGE FROM THE CONFERENCE CHAIR

As the Dean of the Faculty of Graduate Studies of the University of Sri Jayewardenepura and the Chair of the Organizing Committee of the 9th International Conference on Multidisciplinary Approaches (*i*CMA) - 2022, it is my immense pleasure to issue this message. The Faculty of Graduate Studies (FGS) of the University of Sri Jayewardenepura, since its establishment in 1996, has come a long way during a comparatively short period and is on the track of achieving its mission: 'to produce high caliber professionals with knowledge and skills by designing and providing innovative courses, achieving excellence in teaching, research and scholarship through local and global partnerships for the wellbeing of the larger community'. The faculty of Graduate Studies (FGS) of the University of Sri Jayewardenepura is the official coordinating body for postgraduate academic and research activities. The study programs of FGS stem from the strategic disposition of our University, which is thriving towards greater heights in an ultra-modern technological environment but has a solid religious, cultural, and traditional knowledge base. The rich natural resources in the country provide opportunities for both local and international students to get hands-on experience with nature and learn how to manage them for long-term sustainability.

The FGS engineered *i*CMA conference as it is linked with nine Board of Studies covering all academics and research areas of the University (i.e., Board of Studies in Humanities, Social Sciences, Management Studies & Commerce, Physical Sciences, Life Sciences, Medical Sciences, Engineering, Industrial Technology, and Multidisciplinary). Thus, with its purview, FGS organizes International Conference on Multidisciplinary Approaches (*i*CMA) to provide a forum for academics and industry professionals engaged in multidisciplinary research and development. Accordingly, a platform is created for them to share knowledge and experiences towards national and global development. I am happy to note that this time *i*CMA - 2022, the ninth consecutive international conference, is held with the theme of 'Multidisciplinary Approaches Leading to Disruptive Innovation for Development.' I believe this is a highly contemporary theme for 2022 that encapsulates the main areas of high international and national significance.

Let me extend my heartfelt appreciation to the Chief Guest of the conference, Snr. Prof. Sampath Amaratunge, Chairman, University Grant Commission. My profound gratitude goes out to the guest of honour of the conference Snr. Prof. Sudantha Liyanage, the vice chancellor of the University, for providing the facilities and infrastructure that enabled us to arrange this conference successfully. I convey my sincere appreciation to the keynote speaker Prof. Rohan Samarajiva, Board Chair & Founder of LIRNEasia. Furthermore, I would like to thank Prof. Naushard Cader, Mr. Stefano De Panfilis, Mr. Sarath Kularatne, Mr. Arjuna Nanayakkara, Eng. Asela Eranda to accept our invitations as the guest speakers of the University-Industry Forum.

Considering the country's prevailing economic crisis, the conference aims to upgrade the country's situation by introducing disruptive innovations to industries. We received more than 150 abstracts for this conference, and 113 were accepted for oral presentations in six distinct themes. Accordingly, I earnestly request you to

participate physically, share your experiences, thoughts, and understandings, and enhance your and our knowledge. Overall, I firmly believe and wish that this conference will have a significant impact on making this world a better place by overcoming the Challenges posed due to the economic crisis. Thank you immensely for all the commitment and effort to make *i*CMA - 2022 a success!

Snr. Prof. M. M. Pathmalal
Conference Chair – *i*CMA 2022 & Dean,
Faculty of Graduate Studies
University of Sri Jayewardenepura
Sri Lanka

MESSAGE FROM THE KEYNOTE SPEAKER

I am happy to contribute to the success of the conference on Multidisciplinary approaches leading to disruptive innovations for development organized by the Faculty of Graduate Studies at the University of Sri Jayewardenepura. My post-graduate education began at a Faculty of Interdisciplinary Studies (though it changed its name subsequently), so it was difficult to say no. The debates on interdisciplinarity versus multidisciplinarity may be bracketed for now, and we can simply focus on the need to transcend disciplinary boundaries if we are to solve real-world problems.

The world has many problems that need to be addressed urgently. Amid the unprecedented crisis Sri Lanka finds itself mired in, the urgency is even greater. The problems and even some of the new tools that we have for addressing these challenges, such as machine learning, do not come in forms that mesh with disciplinary templates. If we are to respond to the demands of our times, there are few alternatives to multidisciplinary approaches.

Disruptive innovation is here being used in sense broader than its original conceptualization which was focused on what established firms could do to respond to competition and what challengers could do to displace the market leaders. Firms are about making money. Development is not their prime objective. Development occurs or is hindered by many actions including, but not limited to, what firms do. But these kinds of metaphorical extensions are not uncommon and may even be described as a manifestation of the cross-fertilization that occurs when disciplinary boundaries are transcended.

In 2008, Nokia, then a leading global telecom equipment supplier, came to LIRNEasia with a question they wanted answered: How was it that countries in South Asia, not known for the highest standards of policy and regulation, were offering the lowest prices for mobile communication to their customers? Conventional wisdom was that a stable policy environment with an independent and efficient regulatory agency was essential for good performance.

Nokia provided us with comparative price data which we looked at in the context of the findings of the extensive "Teleuse at the Bottom of the Pyramid" surveys and qualitative studies we had conducted and the Telecom Policy and Regulatory Environment studies we were running in countries in South and Southeast Asia at that time. Our conclusion was that a mobile service provider in each of the markets had adopted what we named the "Budget Telecom Network Business Model" on BTNM, and that others had quickly emulated them, bringing down the price levels and average revenues per user below what anyone in developed country markets could imagine.

Coming from academia, I was not used to analysis sans theory, so in parallel, we started looking for relevant theoretical frameworks when we came across Christensen. I do not think he envisaged all the suppliers quickly converging on the same innovation when he wrote the book, but that did not stop us from fruitfully using his insights to inform and frame our work.

The BTNM, so named to evoke the more familiar Budget Airline Business Model, allowed millions of poor people to use the affordances of mobile connectivity in all sorts of innovative ways. We used to talk about "giving missed calls" whuch befuddled our European and US audiences. The ubiquity made possible by the BTNM allowed innovations by development practitioners as well.

In addition to talking about the development impacts of the BTNM, I intend to talk about a current innovation using machine learning (usually described as artificial intelligence) that has transformed flood warnings in the Ganges Plain and which, if all goes well, will be deployed in Sri Lanka as well. LIRNEasia has been active in disaster risk reduction ever since our work in the aftermath of the 2004 Indian Ocean Tsunami. My own engagement goes back to my time at the Arthur C. Clarke Centre in 1985-86. Disaster risk reduction is exemplary of a problem that demands a multidisciplinary approach.

The link to the Christensen concept becomes even more tenuous in this innovation story. Google is the protagonist and does not have a profit motive associated with this particular innovation. But it is disruptive because it has the potential to generate precise and location-specific flood warning that will not only save lives, but also hopefully allow those in the flood plain to minimize property losses and destruction of livelihoods.

Hopefully, my keynote address covering the above content will reinforce multidisciplinary work and perhaps even support disruptive innovation at the University. I wish this enterprise the very best.

Professor Rohan Samarajiva
Board Chair & Founder,
LIRNEasia

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THE ENHANCEMENT OF THERMOELECTRIC PROPERTIES OF ZINC OXIDE THROUGH DOPING

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Abstract

Due to the increase in global energy consumption, the world is turning to an eco-friendly renewable energy source. Thermoelectric materials (TEM)s have attracted significant interest in this regard, due to their ability to convert waste heat into usable electrical energy. An efficient TEM should have a high Seebeck coefficient, a high electrical conductivity and a low thermal conductivity. A thermoelectric generator (TEG) is an interesting device used to generate thermoelectricity which contains an array of junctions with p-type and n-type two dissimilar TEMs. The extensively used TEMs, such as bismuth and antimony chalcogenide-based materials were toxic, expensive and rare. Zinc oxide (ZnO) is an n-type semiconductor with a wide operating temperature range and a direct band gap. ZnO is a non-toxic, low-cost and naturally abundant material. In this project, the thermoelectric properties of bulk ZnO were investigated and thermoelectric properties were enhanced by doping ZnO with aluminium (Al). Electrical conductivity, Seebeck coefficient and thermal conductivity were measured, and the figure of merit (ZT) and generated power were calculated for commercial ZnO and chemically synthesised 0 %, 1 %, 3 % and 5 % Al doped ZnO (Al-ZnO) pellets. Al doping increased the electrical conductivity and Seebeck coefficient of ZnO and decreased the thermal conductivity of ZnO, making Al-ZnO a promising candidate as a TEM. The Seebeck coefficients of commercial ZnO, chemically synthesised 0 %, 1 %, 3 % and 5 % Al-ZnO pellets at 373 K were -280.41, -286.07, -299.88, -322.14 and -371.78 $\mu V K^{-1}$ respectively and generated powers at 373 K were 14.12, 15.12, 17.81, 20.20 and 30.74 nW respectively. The n-type semiconductor behaviour of ZnO and Al-ZnO was verified by the observed negative Seebeck coefficient values.

Keywords: Thermoelectricity, Zinc Oxide (ZnO), seebeck effect, generated power, figure of merit.

EXTRACTION OF EXPANDED GRAPHITE FROM NATURAL GRAPHITE USING DIFFERENT SULFATE SALTS AND INVESTIGATION OF THE YIELDS

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Abstract

Graphite is the most stable allotrope of carbon and is naturally produced. It has the SP^2 hybridization and forms a 2D hexagonal crystalline lattice of C atoms. Graphite can be used to synthesize graphene, and both graphite and graphene have various practical applications. Sri Lanka is famous for high-purity vein graphite. In this study, natural graphite obtained from Kahatagaha mines was exfoliated using electrochemical exfoliation, which is a low-cost and non-toxic method. Three sulfate salts; $CuSO_4$, Na_2SO_4, and K_2SO_4 were used as electrolytes, and six combinations of electrochemical cells were prepared by varying the electrodes. Here, the most suitable sulfate salt from the above three electrolytes, which gives the highest yield of exfoliated graphite, was investigated. Further, the performance of platinum (Pt) vs. graphite was investigated as the cathode material in the electrochemical cells. The yields obtained for the $CuSO_4$, Na_2SO_4, and K_2SO electrolytes along with two graphite electrodes were 0.998, 0.280, 0.206 g, respectively. However, when a graphite electrode was replaced with a Pt electrode, the yields improved to 1.345, 0.494, 0.312 g, respectively. From the above three electrolytes, the highest yield was obtained for K_2SO_4 and Pt combination. XRD analysis of the yield showed peaks at 2θ = 26.41°, 42.50°, 44.65°, 54.74°, and 77.61°. The calculated particle size was 1.47 nm and the number of layers was 4.4. Moreover, Raman spectroscopy confirmed the presence of G, D, and 2D peaks. The number of layers for the yield obtained using Pt and K_2SO_4 was 4-5, according to Raman spectroscopy. Formation of 4-layer graphene can be inferred from XRD analysis and Raman spectroscopy. The density of the yield was 108.26 kg m^{-3}. The study is going on to use exfoliated graphite in the applications and synthesis of graphene.

Keywords: Natural graphite, electrochemical, exfoliation, Sulfate based, electrolytes

HIGHLY CONDUCTING LOW TRANSPARENT FLUORINE-DOPED TIN OXIDE THIN FILMS FOR OPTOELECTRIC APPLICATIONS

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Abstract

Fluorine-doped tin oxide (FTO) films are the most widely used transparent conductive substrates due to their inexpensive preparation, chemical inertness, and higher temperature stability. FTO films with 80% transmittance and sheet resistance (R_{sh}) value of ~10 Ω sq^{-1} are usually chosen for solar cell applications. There is a trade-off between optical transmittance and electrical sheet resistance, which limits the simultaneous increase in transmittance and decrease in sheet resistance. We changed the FTO layer thickness in this research and studied the sheet resistance, transparency, and film morphology. For this purpose, a series of FTO films was prepared on glass substrates by changing the film thickness by varying spray time. The precursor solution contained $SnCl_4.5H_2O$ and NH_4F in an iso-propanol solvent and was sprayed onto a soda-lime glass substrate at 500 °C. Fabricated FTO films' electrical, optical, structural, and morphological properties were compared with a commercially available FTO glass (CFTO) sample. In addition, a series of dye-sensitized solar cells (DSCs) was prepared using fabricated FTO films and CFTO. The sheet resistance of FTO film can be reduced up to ~1 Ω sq^{-1} while keeping the resistivity around 3.54×10^{-4} Ω cm, by using the spray pyrolysis technique. Energy conversion efficiencies of DSCs can be improved by using FTO films with low transparency and low sheet resistance. This study's highest recorded energy conversion efficiency (5.14%) was related to a FTO film with 34.2% transmittance and 3.04 Ω sq^{-1} sheet resistance, which was much higher than the efficiency recorded from the standard commercial FTO films (4.74%). The results indicate the transparency of FTO is not a dominant factor, and translucence FTO films with carefully controlled light scattering properties may be used in fabricating dye solar cells with superior efficiency.

Keywords: DSCs, FTO, spray pyrolysis, sheet Resistance, optical transparency

COMPARISON OF ONE-WAY ANOVA TEST AND WELCH ONE-WAY ANOVA TEST WITH KRUSKAL WALLIS TEST IN COMPARING THE MEAN

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Abstract

Large samples gathered from normal populations can be subjected to parametric tests. If the data are non-normal and the sample size is small (less than 30), non-parametric tests are used. The objective of this study is to compare the percentage of not rejecting the null hypothesis (H_0) of the one-way ANOVA test (OWA) (for homogeneous data), the Welch one-way ANOVA (WOWA) (for non-homogeneous data), and the corresponding non-parametric test, the Kruskal Wallis test (KW), on small samples using real data. 6,000 cancer patients enrolled in treatments at Apeksha Hospital in Maharagama provided real data. In 2011, 2012, and 2013, they were used to validate the aforementioned tests' behaviour when the required assumptions were violated. The three tests were performed 250 times on four samples chosen at random from four types of cancer; Oral, Thyroid gland, Cervical, and Breast. The process was repeated with different sample sizes of 10, 15, and 20. According to the KW test, there is a more than 80% probability that the mean incidence age for four cancer types will be equal. Regardless of whether the sample size is too small (10), OWA and WOWA have a 55.6% and 51.8% probability of not rejecting the H_0, respectively. Even though , the sample sizes are less than 30, these results lead to a considerable proportion of correct conclusions when the sample size increases. When the sample size is 20, the relevant probability of not rejecting the H_0 of the WOWA test approaches that of the KW test. Thus, in conclusion, WOWA is more accurate for non-homogeneous data than the OWA test for both small and large samples.

Keywords: ANOVA test, Welch ANOVA test, Kruskal Wallis test, null hypothesis, assumptions

STUDYING MICROSEISMICITY IN THE CENTRAL PART OF SRI LANKA USING A WAVEFORM SIMILARITY TECHNIQUE

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Abstract

Seismology is the scientific study of seismic sources, the structure of the earth's surface, and tectonic plates. The study of earthquakes provides significance in understanding the earth's internal structure. Sri Lanka has been recognized as an aseismic or Stable Continental Region (SCR) because of its location on the Indo-Australian Tectonic plate. However, small earthquakes have been recorded in many parts of Sri Lanka these small events are called micro-earthquakes which have a magnitude less than 3 on the Richter scale. Most of the tremors occur in the central part of the country during 2020-2021. In order to identify the anonymous tremors a waveform similarity technique called the waveform Cross-Correlation method was used. The epicenters were found using the triangular method or particle motion analysis. The triangular method was used when the event was triggered in at least three stations. In the other case, particle motion analysis was used. From the information obtained from dwellers in the central region, 10 events were identified, but 6 events lie within the central region. Throughout this study, 5 anonymous microseismic activities were found that lies within the central region. Python was used as the simulation software throughout the research.

Keywords: Seismology, aseismic, micro-earthquakes, cross-correlation, triangulation

GRACEFUL LABELLING FOR STACK OF PRISMS

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Abstract
Graph labelling is one of the most prevalent research topics in graph theory as it is used almost everywhere such as in x-ray crystallography, coding theory, radar, astronomy, circuit design, etc. There are many graph labelling techniques like prime labelling, antimagic labelling, radio labelling, graceful labelling, lucky labelling, etc. A simple graph G is said to be a vertex graceful if there exists a vertex graceful labelling on the vertices of . Graceful labelling of G is a vertex labelling. Let f be the vertex graceful labelling function of G which is an injective mapping from $V(G)$ to $[0, |E(G)|]$ such that the edge labelling $f_\gamma: E(G) \rightarrow [1, |E(G)|]$ defined by $f_\gamma(uv) = |f(u) - f(v)|$ is also injective. $V(G)$, and $E(G)$ are the set of vertices and the set of edges of G respectively. In other words, if all the vertices of G can be labelled with the integers from 0 up to the total number of edges of G, $|E(G)|$ in such a way that the induced edge labels get the labelling from 1 up to $|E(G)|$, it is called the graceful labelling of G. Edge labels are computed by taking the absolute difference between the labels of the end vertices of that particular edge. There is a very famous conjecture in this area called the graceful tree conjecture that every tree is graceful and it is abbreviated as G. T. C. and this conjecture was put forward by Ringel - Kotzig. Over the past few decades, numerous studies have been conducted in this area, and several results have been obtained. In this research work, we introduce vertex graceful labelling for the graph of a stack of $p + 1$ prisms.

Keywords: Graceful labelling, stack of $p + 1$ prisms, graph, theory, vertex

CHEMICAL BATH DEPOSITED ZnO NANOWIRES FOR ANTIMICROBIAL WATER FILTERS

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Abstract

Water pollution is a widespread problem that jeopardizes our health. Unsafe water causes a significant number of deaths due to waterborne diseases, globally. Understanding the factors affecting the quality of water avails addressing this problem. In this sense, the microbial concentration of water is a vital parameter of interest. Recent studies have shown that nanoscale structures can act as antimicrobial agents. ZnO chemical compound forms structures of various shapes at the nanoscale (nanoparticles, nanowires, nanoflowers, etc.). In the case of ZnO nanowires, they can kill bacteria mainly due to three antimicrobial mechanisms; generation of reactive oxygen species, binding of Zn^{2+} ions with the membrane of microorganisms, and mechanical stress when contact with microorganisms. In this research, we synthesized ZnO nanowires on polypropylene (pp) substrates and studied the effectiveness of the pp substrate covered with nanowire arrays, in antibacterial water filtration. First, a seed layer was deposited using the spray pyrolysis technique (Seed solution: 3.69 g of $Zn(CH_3COO)_2$, 18.9 ml of Ethanol, 0.1 ml of Monoethanolamine, 100 ml of deionized water). Next, the chemical bath deposition technique (Precursor solution: 3.83 g of $Zn(NO_3)_2$, 2.82 g of Hexamethylenetetramine, 200 ml of deionized water) was used to grow nanowires on the seed layer. The initial pH value of the chemical bath was 6.5. SEM images were used to characterize the height, width, aspect ratio (height/width), surface-to-volume (S/V) ratio, and wire density of the ZnO nanowires. The antibacterial properties of ZnO nanowires were investigated against *Escherichia coli (E. coli)* bacteria. Here, 10 ml of bacterial suspension was filtered for 30 seconds. Then, the initial bacterial suspension and the filtrate were cultured on Mueller Hinton Agar (MHA). When focusing on the results, the synthesis of ZnO nanowires on a polymer substrate was found to be possible. The dimensions of as-grown ZnO nanowires were 1.5 µm in height and 233 nm in width respectively. The aspect ratio and S/V ratio were found to be 6.43 and 1.78×10^{-2} respectively. XRD diffractograms with the highest peak corresponding to the 002 plane confirmed that the nanowires grown on pp substrate possess the hexagonal wurtzite structure. There was a reduction in colony-forming units/mL (CFU/mL) of the bacterial suspension after it was filtered through the membrane (from 3.78×10^7 to 3.52×10^7 CFU/mL) suggesting the membrane's potential in removing *E. coli* from contaminated water.

Keywords: ZnO nanowires, chemical bath deposition, polypropylene, antibacterial activity, *Escherichia coli*, water filtration.

EFFECT OF GRAPHENE OXIDE CONCENTRATION ON ELECTRICAL PROPERTIES OF REDUCED GRAPHENE OXIDE COATED FLEXIBLE PAPER

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Abstract

Reduced graphene oxide (rGO)-coated flexible papers are effective in applications like bioelectrical electrodes, water purification, and sensors due to their interesting properties. rGO-coated paper is fabricated by vacuum filtration of graphene oxide (GO) and then reducing GO-coated paper using chemical or thermal reduction. Strong reducing agents such as hydrazine hydrate which are used for chemical reduction, exhibit a toxic nature that halts the use of rGO-coated paper in sensitive applications like bioelectrical electrodes. So, it is necessary to use green agents like L-ascorbic acid. In most applications, the electrical properties of rGO-coated paper are more useful. The GO concentration is an important parameter that changes the conductive nature of the rGO-coated paper. This study presents the effect of GO concentration on the electrical properties of rGO-coated cellulose membrane (CM) filter paper. Hummer's method was used to synthesize GO using Sri Lankan graphite. Deposition of GO on the CM filter paper was carried out using the vacuum filtration technique and the GO-coated CM filter paper was reduced at 70 ºC using L-ascorbic acid. X-ray diffraction confirmed the successful synthesis of GO, reduction of GO-coated CM filter paper, and structural changes. In oxidation, the d-spacing of graphite has been increased and eventually decreased after reduction but is not lower than that of graphite due to residual oxygen-containing functional groups (OFGs). The sheet resistance of rGO-coated CM filter papers exhibits an exponential variation with GO concentration. Under less GO concentration, insulating properties of CM filter paper dominate and with the increase of GO concentration, conducting properties of rGO dominate drastically and get saturated. The lowest sheet resistance of 39.87 Ω Sq^{-1} was recorded for the GO concentration of 500 mg L^{-1}. Therefore, it is evident that optimization of electrical properties of the rGO-coated CM filter paper can be acquired by controlling the GO concentration which is useful in potential applications.

Keywords: Cellulose membrane filter paper, L-ascorbic acid, reduced graphene oxide thin films, sheet resistances, vacuum filtration.

DEVELOPMENT OF A LOW-COST SOLAR DRYER FOR WOOD PLANKS

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Abstract

Solar wood dryers are not yet locally manufactured in or imported to Sri Lanka. Small and medium-scale wood industrialists are not aware of the necessity to season wood. They cannot purchase good wood dryers due to the lack of capital. Presently, the local wood industry is struggling with high energy costs and power interruptions. The objective of this research was to develop the prototype of a low-cost wood dryer based on simple technology which uses solar power as the main energy source. A dehumidifier unit was added to increase efficiency. The kiln can be easily operated due to its four independent movable units. The first wood drying trial was conducted using the prototype of the basic solar dryer. Wood stack which contains 23 numbers of ¾"x6"x18" Jak wood planks including two samples were dried to find out the drying period to achieve commercially accepted moisture content. According to the results, all wood planks were dried to the commercially accepted 12% moisture content within 14 days. The second trial was conducted with the added dehumidifier unit using another 23 numbers batch of the same dimensional Jak samples. All wood planks used for the second test were dried to 12% moisture content within 11 days. The third test was conducted to check the differences between the internal and external temperatures of the kiln. The test was conducted for two days during the daytime. On the first day, the average external temperature was 35.6°C and the average internal temperature achieved was 39.5°C. On the second day, the average external temperature was 34.0°C and the average internal temperature achieved was 40.2°C. The highest temperature difference was 9.0°C. The obtained results show that the prototype solar dryer can be developed into an efficient, commercially viable product.

Keywords: Solar wood dryer, season, wood stacks, moisture content, dehumidifier unit

ACTIVATED CARBON AS ELECTRODE MATERIAL FROM LOCAL JACK-WOOD FOR SUPERCAPACITORS

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Abstract

High demand in the consumption of energy instigates the advancement of various types of energy conversion and storage devices. Supercapacitors (SCs), as foremost among the energy storage devices, have attracted significant attention and can be used in a broad range of applications by taking benefits such as lightweight, micro-size, high power density and extensive cycle life. From this interpretation, extensive studies have been conducted, especially on improving electrode materials, and considerable progress has been achieved in developing both the primitive and applied fields of supercapacitors. The performance of SCs can be appraised with regard to the electrochemical properties determined through a synthesis between the electrode and the electrolyte materials. In this work, biomass-based activated carbon (AC) was prepared as electrode material, while aqueous H_2SO_4 (1M) was used as the electrolyte. Porous carbon material, AC, with a high surface area, is prepared by carbonization of the Jack-wood (*Artocarpus heterophyllus*) samples in this study. The activation was performed via a chemical process using NaOH as the activating agent. The AC electrodes were prepared on an FTO substrate to assemble SCs. The electrochemical properties of AC-based SCs were evaluated by using cyclic voltammetry and galvanostatic charge-discharge studies, which showed a relatively high specific capacity of 147.1 F g^{-1} at 2 mV s^{-1} scan rate along with the 1M H_2SO_4 electrolyte. Developed supercapacitors demonstrated a power density of 68.47 W kg^{-1} (Energy density of 8.02 Wh kg^{-1}). Furthermore, SCs showed excellent rate capability and cycling stability with ~94.98% of initial capacitance after 1000 cycles.

Keywords: Supercapacitors, cyclic voltammetry, galvanostatic charge-discharge, activated Carbon, Jack-wood

DESIGNING AND FACRICATING A BICYCLE WITH BOTH ROWING AND PEDALLING MECHANISMS

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Abstract

A conventional bicycle can be considered as an exercising apparatus as much as a mode of transportation and recreation, which is propelled and steered by human effort. Though cycling provides an excellent cardio workout, it mainly strengthens the lower body including hips, knees, and ankles, while providing slight or no exercise to the upper body both indoors and on flat terrains. As a solution to this drawback, the design and fabrication of a cycle that can be propelled asynchronously by rowing and pedalling motion while providing a workout for both the upper and lower body is developed. The design consists of a frame, front and rear wheels, a slide rail, a lever arm, a two-way steering mechanism, a chain pedalling arrangement, and a spring incorporated rowing mechanism that converts the user's physical effort to propel the bicycle. The fulcrum extension back and forth, and the length of the lower portion of the lever arm, are made adjustable in order to optimize the performance and to provide flexibility in exercising for the user's upper and lower body. Rowing and pedalling modes are asynchronous and can be switched from one to the other as per the user's requirement. During the rowing phase, the attached spring is extended and contracted when the rowing arm moves along the pivoted point in order to provide the movement of the bicycle with a mechanical advantage. The two modes are completely isolated by using two separate free wheels for each mechanism. Steering of the bicycle is completely facilitated by a steering mechanism incorporated with cables. Safety features including side-pulled caliper brakes, shock absorbing dampers as well as ergonomically conductive seating and gripping arrangements are also incorporated in the design. The model could be further upgraded as a commercial product with several added features.

Keywords: Rowing, pedalling, dual-mechanism, bicycle, asynchronous

SLEEP MUSIC RECOMMENDATION PLAYLIST GENERATOR BASED ON HUMAN EMOTIONS USING CNN AND KERAS CLASSIFIER

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Abstract
The author seeks to recognize human emotions for the playlist recommendation system in this study. Before going to bed, the user is introduced to new music platform features by the recommendation system. The proposed architecture will make an effort to develop a music recommendation system using survey questions and user Face emotion recognition. This essay presents the problem, the research gap, the challenge, and the strategy the author intends to employ over the next several months. They were previously addressed as Music Recommender System Based on Genre using Convolutional Neural Networks based on the similarity of features on the audio signal. The system includes facial recognition and many other components used in the evaluation. Consumers needed a new concept to understand concepts more clearly. Thus the competitive deployment based on the cooperation model that has been the standard core technology for more than ten years cannot be recognized as the only recommended model. This study proposes a Deep Learning-based approach to playlist creation that considers the user's previous song selection history and present mood. Using this approach, we hope to build a playlist based on the user's emotions and incorporate their current situation, mood, and song preferences for a more personalized experience. Convolutional Neural Network development has considerably improved processes like object face detection, image classification, and after-emotion detection. In the recommended method, we classify music using an Artificial neural network (ANN) with Keras Classifier and identify emotions using a convolution neural network (CNN). According to the experimental findings, the suggested model obtained 85% accuracy utilizing the FER-13 dataset, which contains approximately 14k facial pictures. We used several song attributes collected directly from the Spotify music player for the classification process.

Keywords: Convolutional Neural Networks (CNN), Artificial Neural Network (ANN), Deep Learning (DL), Face Emotion Recognition (FER), sleep music

CONSTRUCTION AND APPLICATION OF A PORTABLE MUON DETECTOR

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Abstract

Particle physics studies the fundamental aspects of nature, the very building blocks of the universe, and have revolutionized the way we observe our known universe. With particle physics being an extremely important field in modern physics, undergraduate students will benefit immensely through early exposure to the field. Even though working with commercial-scale accelerators and detectors is ideal, not all institutions have such facilities. Thereby, a low-cost muon detector was built according to the design of the desktop muon detector of the Massachusetts Institute of Technology. A plastic scintillator was used as the scintillation material in the detector due to its low cost and ability to be shaped into the required shape and size. A silicon photomultiplier chip was used as the electronic light sensor as it is much cheaper, smaller, and good for detecting excitation energies of charged particles as opposed to the use of photomultiplier tubes. Other components include basic electronic components. This study is important because by constructing, calibrating, and deploying a single detector, viable results were obtained. Variation of the cosmic ray flux with altitude at different locations in Sri Lanka was obtained. The result shows a non-linear increase of flux with altitude as theorized by the Pfotzer curve. Moreover, the data obtained from the constructed portable muon detector follows a Poisson distribution where the theoretical and experimental distributions closely correlate, thereby confirming the detection of truly random events. This detector provides a new avenue of research for students in Sri Lanka who are interested in this exciting field of physics.

Keywords: Cosmic ray muon flux, particle physics, poisson distribution of cosmic rays, portable muon detector, modern physics

INTERACTION BETWEEN Li^+ ION AND ETHYLENE CARBONATE: A COMPUTATIONAL STUDY

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Abstract

The development of high-performing electrolytes is necessary to improve secondary batteries and dye-sensitized solar cells. Ethylene carbonate (EC) and lithium-ion are commonly used in electrolyte applications in lithium-ion batteries and dye-sensitized solar cells due to their many favorable properties. Examining and understanding the interactions between Li^+ ions and EC are vital to design electrolytes for high-performance rechargeable batteries and dye-sensitized solar cells. In this study, the structural and vibrational properties of isolated EC and $Li[(EC)n]^+$, where n = 1,2 clusters are studied using hybrid density functional theory. Initially, the molecules were geometrical optimized and vibrational modes were calculated using the Gaussian 09 software, utilizing B3LYP functional and the basis set of 6-311G (d). The isolated EC molecular structure was found to be non-planar with C_2 symmetry. When Li^+ ion coordinate with EC, the system maintains a high symmetry. The variations of structural parameters of the EC molecule (bond lengths, bond angles, dihedral angles) were investigated. Infrared (IR) frequencies for the isolated molecule and $Li[(EC)n]^+$, where n = 1,2 clusters were assigned by observing the vibrations via Gauss View 6.0 software. Then the variation of IR frequencies in these small clusters was investigated as the n value increased. It was found that the Li^+ ion affects the vibrational frequencies of the C=O bond and its neighboring bonds, such as C–O in the EC molecule, and barely affects the CH_2 group. Further, this study revealed two new peaks at around 100 cm^{-1}, which have not been recognized in previous studies. These peaks relate to Li^+ interactions with oxygen in the C=O bond of EC when they are in close proximity. This implies that Li^+ and EC interactions can alter the conductivity in Li-EC-based electrolytes. The investigation continues to expand the calculations for higher order n values and compare the vibrational modes calculated with experimental observations.

Keywords: Ethylene Carbonate, Li-EC electrolytes, Li EC interaction, computational calculations, vibrational modes

PHOTOCATALYTIC DEGRADATION OF METHYLENE BLUE DYE IN AQUEOUS MEDIA USING Ag DOPED HOLLOW TiO_2 NANOPARTICLES

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Abstract

Environmental pollution has become a major issue worldwide. Dye is one of the non-biodegradable organic pollutants that mix with water. The photocatalytic degradation of organic pollutants is an advanced process advocated in environmental remediation [1]. TiO_2 is a common catalyst that is used for photocatalysis [4]. In this study, Ag-doped TiO_2 hollow nanoparticles were used as a catalyst to determine the photocatalytic degradation of methylene blue dye in aqueous media under irradiation of visible light. These nanoparticles were synthesized by a sacrificial core (AgBr) method. Ag-doped TiO_2, TiO_2 and AgBr nanoparticles were synthesized using the same method for comparative purposes. The photodegradation efficiency of Ag-doped hollow nanoparticles showed a significant enhancement due to silver doping and the formation of hollow structures for TiO_2. The UV visible analysis showed that the Ag-doped TiO_2 hollow nanoparticles have a higher degradation efficiency of 84.6% under visible light irradiation for 2 hrs. The other particles showed a degradation efficiency of 72.4 %, 31.8%, and 47%, for Ag-doped TiO_2, TiO_2 and AgBr nanoparticles, respectively. Therefore, it can be observed that the highest degradation efficiency of methylene blue was shown when Ag-doped TiO_2 nanoparticles were used as the catalyst. Although there have been many studies done on methylene blue degradation using Ag-doped TiO_2 nanoparticles, only a few studies have used hollow nanostructures. Further, the obtained results confirm the past studies.

Keywords: Water purification, Methylene blue dye, hollow nanoparticles, Ag-doped TiO_2, photocatalytic

INNOVATION PATHWAYS FOR EXISTING GREEN ROOF TECHNOLOGY IN SRI LANKAN CONTEXT

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Abstract
Rapid urbanization has reduced arable land, and the lack of vegetation in urban environments causes issues such as the urban heat island effect. Other than using the accessible roof area for vegetation to reduce such impacts, Green Roof Technology (GRT) can support cities to adapt to climatic changes by decreasing excess demand for artificial temperature reduction, while providing other advantages such as reduced urban runoff, increased animal habitats, etc. Although numerous research were conducted on GRs to explore their types, cooling effects, vegetation, and technology, not many studies have explored the implementation capacity of green roofs in specific places, which is essentially influenced by contextual factors. As a way of exploring those factors, this research identifies major stakeholders through the literature survey, and based on their perceptions, identifies key cost, technology, and social parameters relevant for GRT implementation in Sri Lanka. Open-ended questionnaire survey for identified stakeholders through stratified sampling was utilized as the methodology. Considering public perspectives, GRT was identified as a contemporary country need. The identified parameters through the questionnaire survey were categorize into positives and negatives. Further, a SWOT analysis of detailed responses has shown the strengths, weaknesses, opportunities, and threats of the existing Green Roof Technology (GRT) in the Sri Lankan context. These parameters were further observed as directed towards pathways of innovation that are either disruptive or adaptive. The study showed that although the current global dialogue surrounding climate change suggests GRT as an innovative technology, there are a considerable amount of barriers along with a lack of improved design guidelines and adaptation to technological advancements that hinder sustainability. Overall, the study allows a better understanding of the innovation adaptation process of existing GRT, therefore, would contribute to the opportunity for its sustainable innovation and adaptation.

Keywords: Green roof technology, innovation-adaptation, SWOT analysis, innovation pathways, disruptive innovation

IMPROVED AND AUTOMATED AUXILIARY DIESEL BURNER SYSTEM FOR INDUSTRIAL INCINERATORS

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Abstract

Diesel-fired burners are the most used method in Sri Lanka industries for heating purposes, especially in incinerators. This project is mainly focused on the design of an improved, automated diesel-fired burner system for heat treatment furnaces, especially for clinical waste management. When managing clinical wastes, they cannot be recycled, reused, or disposed of in landfill sites and the only way is to incinerate them under a specified temperature range. There must have an efficient, real-time controlling burner operation with these types of incinerators to maintain the specified temperature inside the incinerator to ensure no organic or living material can survive after the treatment process. Most of the existing industrial diesel burners are not optimized to operate with an inside temperature of the incinerators and should be operated manually since they do not have adequate controlling systems. Further, they cannot be modified as required. To ensure proper incineration, the project was done with the purpose of designing an efficient diesel-fired auxiliary burner with an automated controlling system at a low cost. The proposed burner can be initialized with minimum and maximum operating temperature values manually. It will real-time sense the inside temperature of the incinerator and shift between switch ON/ OFF status according to the initialized operating temperature values and current temperature as a closed-loop control system. Further, the burner has been fabricated by using locally sourced materials at low cost and improved for obtaining 60 degrees of flame geometry and 640 ml min^{-1} fuel consumption by integrating a customized nozzle assembly. It also minimizes electricity power consumption and labour cost by automating the system according to operating temperature. This product is better for incineration treatments without involving humans. It can be used for various incineration purposes, not only for clinical waste since it has qualitative functioning and low manufacturing cost.

Keywords: Clinical waste, burner, temperature, industrial, incineration,

INVESTIGATION OF CHARGE CARRIER TRANSPORT PARAMETERS IN POLY(METHYL METHACRYLATE)-BASED POLYMER ELECTROLYTES USING ELECTROCHEMICAL IMPEDANCE ANALYSIS

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Abstract

Polymer electrolytes play an important role in numerous electrochemical technologies including biomedical applications, dye-sensitized solar cells, Li-ion batteries, supercapacitors, and sensors. Understanding the factors affecting the ionic conductivity of a polymer electrolyte requires the determination of charge transport parameters. In this study, poly(methyl methacrylate) (PMMA)-based polymer electrolytes were prepared using the solution cast method and they were characterized by analyzing the DC conductivity, the frequency dependence of the AC conductivity, and the complex dielectric constant. These analyses were conducted using electrochemical impedance spectroscopy (EIS) in the frequency range of 20 Hz – 10 MHz, by varying the temperature from 300 K to 343 K. The charge carrier density (n), diffusion coefficient (D), and ionic mobility (μ) were calculated using a model where the said parameters are related to peak coordinates of dielectric loss tangent curves. Before the in-depth study of PMMA-based polymer electrolytes, the above model was tested on propylene carbonate (PC) + KI liquid electrolyte systems. Three polymer electrolyte samples with compositions; (PMMA + $LiClO_4$), (PMMA + PC + $LiClO_4$), and (PMMA + PC + $LiClO_4$ + TiO_2) were prepared to study the effects of plasticizers and inorganic fillers on n, D, and μ. The effects of temperature on n, D, and μ were also studied. The results show that the enhancement of the electrical conductivity with increasing temperature is attributed to the increase in the charge carrier density. It is found that, at 300 K, more than 48% of total Li^+ ions in PC-plasticized samples contribute to charge transport. However, in this case, the increase in mobility seems insignificant.

Keywords: Electrochemical impedance analysis, polymer electrolytes, charge carrier density, diffusion coefficient, ionic mobility

SOYA FLOUR AS A SUSTAINABLE FILLER TO PARTIAL REPLACEMENT OF CARBON BLACK IN TIRE TREAD COMPOUND

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Abstract

Due to the shortage of conventional raw materials, there is a tendency to move towards sustainable alternatives for raw materials in different industries. Biomaterials, as one of the sustainable alternatives, have been utilized in the production of different compounds. Soya protein is one such biomaterial that has been used successfully in rubber compounds. Dry soya flour (SF) has about 2 GPa shear elastic modulus. Thus, it is rigid enough to be considered a semi-reinforcing filler. This study aims to partially replace the general filler carbon black (CB) with SF in the tire tread compound. When replacing 10 phr of CB with SF, a slight reduction of tensile strength and considerably high abrasion loss (105% improvement over the control) were observed. When the same amount of SF was used with a silane coupling agent, it shows comparable properties with respect to the control. Silane has polar groups and non-polar hydrocarbon chains. Those polar groups can interact with polar groups available in SF, while the non-polar part can interact with NR. Then 10 phr of SF was tested with calcium sulfate dehydrate (CSD) as a coupling agent. CSD contains Ca^{+2}, which makes interactions between polar groups available in SF and NR (NR contains about 3% (w%) of protein moieties). It also shows higher abrasion loss (about 60% improvement over the control), displaying the negativity of the addition. However, all the trials show acceptable behaviour with respect to aging and blooming tests. Thus, SF can be used as a bio-based filler to replace 10 phr of CB using a silane coupling agent to reach the sustainability approach in tire production.

Keywords: Tire compounding, tire tread, soya flour, Carbon black, silane

INVESTIGATION OF LONG-TERM STABILITY OF DYE-SENSITIZED SOLID-STATE SOLAR CELLS SENSITIZED WITH INDOLINE DYES USING CUPROUS IODIDE AS THE HOLE COLLECTOR

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Abstract

Over recent years, there has been a growing interest in dye-sensitized solar cells (DSCs) owing to their low cost of production, simple fabrication technology, low toxicity, and decorative nature. However, there are certain drawbacks associated with liquid electrolyte based DSCs, including leakage of the electrolyte and the dye due to faulty sealing, and the corrosive nature of the employed electrolyte, which would lead to deterioration of the counter electrode. Liquid electrolytes could be replaced with p-type solid semiconductors to solve issues associated with liquid-type DSCs. This study was conducted to investigate the durability of dye-sensitized solid-state solar cells (DSSCs) sensitized with D131 dye that uses CuI as the hole conductor. In this work, TiO_2 films with a thickness of 15-17 µm were fabricated by depositing Degussa P-25 TiO_2 nanoparticles containing TiO_2 colloidal suspension on the conducting glass substrate. Then, these cells were sensitized with the D131 dye and CuI was deposited on the working electrode employing triethylamine thiocyanate as the crystal growth inhibitor. Initially, an overall efficiency of 2.72% was obtained for this DSSC with the corresponding cell parameters of open circuit voltage 0.49 V, short circuit current density 10.22 mA cm^{-2}, and fill factor 0.54 under 1.5 AM illumination. The incident photon to current conversion efficiency (IPCE) exceeds 55% in a wide spectral range from 405 to 520 nm, reaching a maximum of 62% at 430 nm. A 50.5% decrease in overall efficiency and a 25.8% decrease in maximum IPCE were reported for this DSSC after 90 days. The lowest unoccupied molecular orbital (LUMO) of the D131 dye extends to the anchoring carboxylic group. This allows D131 dye to form a strong bond with the TiO_2 surface, making it highly stable. These findings indicate that DSSCs fabricated employing D131 as the sensitizer and CuI as the hole collector offer prolonged stability even without a sealant.

Keywords: Dye-sensitized solid state solar cells, stability, Cuprous iodide, Indoline, dyes, Titanium dioxide

INVESTIGATION OF THERMOELECTRIC PERFORMANCE OF COPPER (I) THIOCYANATE – GRAPHITE COMPOSITE PELLETS

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Abstract

Thermoelectricity is the direct conversion of heat energy into electricity. Recently this phenomenon has been applied as an efficient waste heat recovery mechanism. Thermoelectric generators (TEGs) are incorporated in generating thermoelectricity under applied temperature differences. The usage of expensive and toxic rare earth materials such as Tellurium in room temperature TEGs have limited the commercialization of this technology. Copper (I) thiocyanate (CuSCN) has recently earned significant attention as a p-type semiconductor due to its excellent hole-transporting characteristics. This project focuses on the investigation and optimization of the thermoelectric properties of CuSCN pellets by producing a composite with a carbonaceous material. Pellets pressed with a diameter of 13 mm and a thickness of 1.5 mm using commercial CuSCN powder were used to investigate thermoelectric properties. Graphite was used as a suitable material to modify the thermoelectric performance of CuSCN pellets. Electrical conductivity, thermal conductivity, and Seebeck coefficient were measured for CuSCN pellets as well as for pellets prepared using graphite-incorporated composite (G-CuSCN). The figure of merit values was also calculated at the respective temperatures. Any additional peaks could not be observed in the XRD spectra of G-CuSCN powder when compared to the XRD spectra of undoped CuSCN. G-CuSCN showed a positive Seebeck coefficient of 1.04 mV K^{-1} at an average temperature of 394 K, confirming the p-type semiconductor nature of this material. G-CuSCN resulted in a figure of merit value of 4.68×10^{-8} at an average temperature of 343 K. CuSCN and G-CuSCN pellets generated maximum output power of 29.9 and 413.3 nW at average temperatures of 400 K and 350 K (Temperature differences of 146 K and 96 K), respectively. The G-CuSCN pellets exhibited enhanced performance needed for an efficient TEM revealing that the addition of graphite could improve the thermoelectric performance of CuSCN.

Keywords: CuSCN, renewable energy, seebeck effect, semiconductors, thermoelectricity

UTILIZING BIPARTITE GRAPH EDGE COLORING TO SOLVE A TRANSPORTATION PROBLEM

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Abstract

Transporting commodities from a set of sources to a set of destinations while minimizing the overall cost of transportation is known as a transportation problem (TP). This particular type of linear programming problem (LPP) involves moving items from one source to another while taking into account their respective supply and demand. The Hitchcock Problem is another name for it. In the literature, many methods for resolving TP have been established. Solutions in TP come in two different categories. Such as an Initial Basic Feasible Solution (IBFS) and an Optimal Solution (OS). The North-West corner rule, Minimum Cost Method, and Vogel's Approximation Method (VAM) can be used to find an IBFS, and the Modified Distribution (MODI) Method and the Stepping Stone Method can be used to find an OS for the TP. In this manuscript, an edge coloring of a bipartite graph is used to analyze the best technique for solving both balanced and unbalanced TP. Initially, the TP is converted into a graphical representation, and afterwards, using the proposed new algorithmic rule, we can obtain the optimal or near-optimal solution for TP. This strategy establishes a connection between the TP and graph theory and begins the search for possible TP solutions. When comparing the obtained results with those of other well-known meta-heuristic algorithms, it should be noted that this technique takes the fewest steps to reach optimality or a state that is close to optimality.

Keywords: Transportation problem, bipartite graph, edge coloring, initial basic feasible solution, optimal solution

RADIO FREQUENCY IDENTIFICATION BASED VEHICLE RECORDING SYSTEM FOR PRIVATE EDUCATION INSTITUTE CAR PARK IN SRI LANKA

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Abstract

Radiofrequency identification (RFID) technology, also known as radio frequency identification, reduces human labor and error. RFID technology is used for keeping track of inventory, keeping an eye on products while they are being made or put together, controlling and letting people into parking lots, keeping track of containers or pallets, and many other things. At the moment, a security guard lets people into the parking lot through a manual entry system. Therefore, institutions need to hire a security guard to monitor the premises. Also, the guards must keep an eye on all vehicles and people entering and leaving the property. As a result, unauthorized vehicles or people can easily access the buildings. To solve this problem, a vehicle recording system using RFID technology was proposed to track the movement of vehicles entering or leaving a specific area or location by scanning the RFID tag or card. Then, opening and closing the gate used a servo motor that gets feed from a microcontroller. The goal of this research was to use a WiFi-capable microcontroller (ESP8266) to create an RFID-based vehicle recording system. Therefore, the information was transmitted onto the Internet of Things (IoT) based Thingspeak cloud platform via Wi-Fi technology. The database was developed using MariaDB to retrieve data from a cloud environment and PHP was selected as server-side scripting to access those data. As result, this system maintained the records of vehicles that were coming and going through the gate of the car park in an educational institution. In conclusion, the development of this system is primarily to reduce human intervention and apply intelligent technologies related to the field of automation to our day-to-day applications and make human lives more comfortable.

Keywords: RFID, RFID tag, ESP8266, parking system, IoT

GOLD AND PALLADIUM SPUTTERED DYE-FREE TiO_2 PHOTO-ELECTRODES FOR SOLAR CELL AND SENSOR APPLICATIONS

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Abstract

Photo-energy harvesting devices are one of the best candidates to fulfill the immerging power crisis of today's world due to the abundant supply of cheap and environmentally friendly solar energy. The main purpose of this research was to develop multi-layered TiO_2 photo-electrodes with DC sputtering of gold (Au) and palladium (Pd) to increase efficiency in dye-free photo-electrochemical (PEC) solar cells and light sensors. Motivated by their plasmonic properties and stability, Au/Pd nanoparticles were used to study the effect of Au nanoparticle coatings on TiO_2 films by a DC sputtering method. These cells with the Au/Pd coating resulted in an increase in efficiency by 2.7% and showed improved short circuit current densities (J_{sc}) with respect to photo-anodes without the Au/Pd nanoparticles coating. The surface plasmon resonance (SPR) was observed in the absorption spectra of the Au/Pd coated TiO_2 films and thus, the bandgap energy of the photo-electrodes got reduced. Also, an additional band associated with the SPR level could be seen in the Tauc plots of Au/Pd coated electrodes from 30 s to 2 min sputtering times (1.62 eV for 2 min Au/Pd electrode), confirming this effect. The PEC cell assembled with 30 s (sputtering time) Au/Pd deposited electrode showed the highest photo response. J_{sc}, fill factor, and efficiency were of 0.31 mA cm^{-2}, 0.66 and 0.119%, respectively. It can be concluded that the fast electron-hole transportation and reduced charge recombination due to the SPR level must have caused the increase in efficiency.

Keywords: Dye-sensitized solar cells, surface plasmon resonance, DC sputtering, gold nanoparticles, dye-free photo-electrochemical solar cells

ENVIRONMENTAL POLLUTION &
NATURAL RESOURCES MANAGEMENT

OPTIMIZATION OF BIODIESEL PRODUCTION FROM HIGH-FREE FATTY ACID-CONTAINING COCONUT OIL

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Abstract

Biodiesel is still not cost-effective due to the high price of fixed oils and imported methanol, and therefore, can be produced using high FFA (Free Fatty Acid) coconut oil and locally available ethanol cost-effectively. In the present study, the oil expelled from "poonac" was used. The titration determined the FFA content, and the obtained oil was pretreated with concentrated sulfuric acid before transesterification. After the pretreatment, base-catalyzed transesterification was done according to a published method. Biodiesel was tested on the total acid number, viscosity, cloud point, copper corrosion, water and sediment, and flash point as per ASTM (American Society for Testing & Materials), D6751. The results showed that the FFA content was 7.2%. The conversion efficiency of 'poonac oil' to ester, increased at 50-55 °C temperature. The conversion rate dropped when the reaction temperature was increased beyond 70 °C, which caused a loss of ethanol due to the temperature reaching close to the boiling point. The minimum concentration of potassium hydroxide (0.4%) didn't complete transesterification. Similarly, increasing the potassium hydroxide content hadn't positive effect on the ethyl ester yield. The optimum time was calculated as 1 hour for the transesterification. Again, the ethyl ester yield reduced when the concentration of potassium hydroxide reached more than 0.8%. Therefore, the optimum concentration of the catalyst was determined as 0.5%. The produced ethyl ester had a total acid number (mg KOH^{-1} g^{-1}) of 0.53, a viscosity (at 40 ^oC CST^{-1}) of 5.077, a cloud point (^oC) - +10, a copper corrosion of 1 a, water and sediment of (v/v%), max - <0.01, and a flash point (^oC) of 123.0. When compared with the ASTM standards for biodiesel, the above values were close to each other. Therefore, it can be concluded that the standard biodiesel could be produced with underutilized coconut oil cost effectively.

Keywords: Biodiesel, high FFA, ASTM, poonac oil, ethanol

DO LAND USAGE IN THE RIVER BASIN AFFECT THE QUALITY OF WATER IN THE NILWALA RIVER?

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Abstract

This study intends to investigate the water quality variation along the Nilwala river, concerning land uses of the river basin. Sampling was conducted for eight months from March 2019 to October 2019 at eight locations situated between 6.2261^0N to 5.9461^0N latitudes and 80.4953^0E to 80.5488^0E longitudes along the main river. Water quality parameters such as chemical oxygen demand (COD), biological oxygen demand (BOD), pH, electrical conductivity (EC), temperature, alkalinity, hardness, chloride, nitrate, and phosphate were analyzed using APHA 23rd edition of standard methods for the examination of water and wastewater. Experimental results were statistically analyzed by One-way ANOVA using Minitab 17. All parameters showed statistically significant differences among each location ($p<0.001$). Water at Sapugoda showed the highest alkalinity (63.57 ± 0.1 mg l^-), paddy fields are prominent in that area. Fertilizers may be caused to the highest alkalinity in the water at sapugoda. Water at Akuressa bridge and Sapugoda have the highest pH (8.2 ± 0.1). Akuressa is a semi-urban area. Industrial waste and flooding may be caused to pH increment of those locations. Water at Matara Mahanama bridge has the highest EC (0.32 ± 0.004 ms cm^-), highest hardness (85.82 ± 0.03 mg l^-), highest chloride (61.0 ± 0.02 mg l^-) and highest nitrate (2.11 ± 0.02 mg l^-). Matara is an urban area, which is close to the estuary. Mixing of seawater may lead to the highest EC and highest chloride. Industrial effluent and hospital waste might also affect the water quality at this location. Water at Uruboku Aru bridge has the highest BOD value (1.2 ± 0.006 mg l^-). It is a rural area, which has tea cultivations as prominent. Water at Bandaththara has the highest COD value (18.6 ± 0.02 mg l^-) and highest temperature (29.32 ± 0.032 °C). This may be due to the Boiler action and effluents of bandaththara power plant. Nilwala river is not contaminated with soluble phosphate.

Keywords: Nilwala river, water pollution, land use, pH, COD

ALTERED EXPRESSION OF CYP-19 GENE IN ZEBRAFISH IN RESPONSE TO TRIBUTYLTIN

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Abstract

Toxicological research using zebra fish as a model has received considerable interest due to endocrine-disrupting chemicals abundantly found in the aquatic environment. Tributyltin (TBT) is one such endocrine disrupting compound that can increase testosterone levels in animals, resulting in reproductive impairments. It inhibits the aromatase system dependent on cytochrome P-450 (CYP-450), which catalyzes the aromatization of androgens (androstenedione and testosterone) to estrogens. This study was aimed at determining the effect of TBT by measuring the expression of the CYP-19 gene in adult zebrafish after four months of exposure to different TBT concentrations (1 ng/L, 10 ng/L and 100 ng/L). Quantitative relative expression of the reproductive CYP-19 genes was determined by real-time RT-PCR on RNA from fish brain. Relative expression of the CYP-19 gene was calculated with the 18S control gene by using the $2^{-\Delta\Delta CT}$ method. The results revealed that the relative gene expression levels of the CYP-19 gene in female zebrafish brain were 1±0.2, 1.2± 0.3 and 5.3±0.2 at 1, 10, and 100 ng/L TBT exposure levels, respectively, whereas in male zebrafish brain were 1.8±0.1, 1.7±0.2 and 0.5±0.2. CYP-19 expression was considerably reduced ($p< 0.05$) in TBT treated female fish at 10 ng/L and 100 ng/L. The difference in mRNA gene expression between 1 ng/L treated female fish and the control was also not significant ($p>0.05$). The difference in CYP-19 gene expression between TBT treated male zebrafish and the control was insignificant ($p>0.05$). Females had a higher brain-specific CYP-19 mRNA downregulation than males, concluding the endocrine toxicity of TBT on adult zebrafish and the sexual disrupting effect on female zebrafish.

Keywords: Tributyltin, CYP19 gene, Zebrafish, aromatization, gene expression

DECOLORIZATION OF TEXTILE DYES BY IMMOBILIZED *Aspergillus aculeatus*

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Abstract

Textile dye-contained wastewater is rated as the second major polluter in Sri Lanka after the natural rubber industry. Treatment of synthetic dye-contained textile wastewater effluent is essential as existing physico-chemical treatment methods are costly and negatively impact the environment. The present study evaluates the decolorization and detoxification potential of CI Direct Blue 201 (DB), Cibracorn Blue (CB), Moxillon Blue (MB), Shineperse Red UNSE (SR), and Shinezol Black GSP (SB) dyes which extensively used in the Sri Lankan textile dyeing industry, using immobilized *Aspergillus aculeatus*. The *A. aculeatus* was immobilized on cylindrical polyurethane sponges (r= 1.5 cm, h= 3 cm) supported by a polyethylene plastic net and incubated at room temperature for 5-7 days until cover the whole surface of the sponges. Ten sponges were introduced into glass tanks containing 1 L of the filter-sterilized textile dyes (50 mgL^{-1} initial concentration) separately, without supplementing any nutrients. All the experiments were carried out in triplicates and controls were maintained with the sponges without immobilization of fungi. Decolorization was calculated by measuring the changes of the absorption through UV-Vis spectrophotometer at the relevant wavelength of each dye. The effect of different initial dye concentrations and the consecutive addition of dye were evaluated. The toxicity of the decolorized dye solutions was evaluated by measuring the seed germination percentages of *Oryza sativa* and *Vigna radiata* seeds. The immobilized *A. aculeatus* showed complete decolorization (100%) of DB, CB, MB, SR, and SB dyes at 2, 2, 4, 5, and 6 days of incubation, respectively. Control set-up showed 2-5 % decolorization at the seven days of incubation. The descending decolorization pattern was observed for all textile dyes as a response to the increasing initial dye concentrations. Phytotoxicity assay confirmed the detoxification of all selected dyes which decolorized by immobilized *A. aculeatus*. Hence, the present design can be further modified to develop a micoremediation-based treatment plant to treat textile wastewater as a low-cost and environmentally friendly green approach.

Keywords: *Aspergillus aculeatus*, textile dye, decolorization, micoremediation, immobilization

FLORISTIC SURVEY IN DOMBAGASKANDA FOREST RESERVE, KALUTARA DISTRICT, SRI LANKA

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Abstract

Dombagaskanda forest reserve is a lowland tropical rainforest found in Kalutara District of Sri Lanka which extends across an area of 262 hectares. It has Bodhinagala forest hermitage in its heart and, as a result, faces disturbances and anthropogenic pressure. This study was carried out to examine the floristic composition and diversity along the topographic gradient and to record the endemic and threatened plant species of the forest reserve. Plots of size 20m×20m, 5m×5m and 1m×1m were laid to record woody perennials of diameter≥5cm, saplings of height≥1m and seedlings of height<1m respectively. A total of 18 plots were sampled, six each for the ridge, mid-slope, and valley in purposively selected undisturbed areas of the forest. A total of 98 species belonging to 55 families and 76 genera were recorded. Out of the identified species, 41 (43%) are endemic, 53 (57%) are indigenous, two are invasive, and one is exotic (3%). Eighteen globally threatened and 33 nationally threatened species were recorded. According to the relative density values, the most common species is *Horsfieldya iryagedhi*, and the most common family is Myristicaceae, which is also the most dominant family at all topographic levels considered. The most dominant species in the ridge and mid slope is *Horsfieldya iryagedhi*, and in the valley, *Artocarpus nobilis*. High average diameter was observed in the mid slope of the forest. High sapling and seedling-diversity was observed on the mid slope and ridge, respectively. Looking at Shannon's diversity indices, there is no significant difference (p value>0.05) in diversity, evenness, and dominance in all three topographic levels. The forest is not dominated by Dipterocarpaceae species like the other wet zone lowland rainforests and is more inclined towards the Vitex-Dillenia-Chaetocarpus-Anisophylla community.

Keywords: Dombagaskanda, Bodhingala, threatened species, endemic species, *Horsfieldya iryagedhi*

ACUTE TOXIC EFFECTS OF MICROCYSTIN-LR (MC-LR) ON ZEBRAFISH (*Danio rerio*) EMBRYOS

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Abstract

Cyanobacteria, also known as blue-green algae are single-celled photosynthetic species. They form algal blooms under eutrophic conditions in water bodies and many of them produce harmful toxins. Cyanobacterial toxins are intra-cellular secondary metabolites. One of the most toxic variants, Microcystin-LR (MC-LR) has become an emerging environmental threat to aquatic wildlife and human health. Upon ingestion, fish actively absorb microcystins and they act as effective inhibitors of protein phosphatase 1 (PP1) and protein phosphatase 2A (PP2A); critical regulators of embryonic development in fish. This study was conducted to evaluate the toxic effect of MC– LR on the early embryonic development of fish and the Lethal Concentration 50 (LC_{50}) of MC-LR using zebrafish as the model organism. MC-LR was extracted using *Microcystis* sp. bloom samples collected from Beira Lake, Colombo. Initial concentration was measured using the HPLC method. Zebrafish embryos were exposed to 0.1 μgL^{-1}, 0.5 μgL^{-1}, and 1.0 μgL^{-1} concentrations of MC-LR after 1 hour of post fertilization (hpf) and observed up to 96 hpf while using distilled water as the control. The experiment was triplicated using three different batches, with 36 fertilized embryos for each. Embryos recorded 94.4%, 33.3% and 0% survival rates and 62±1.15 hpf, 70±0.58 hpf and 78±1.15 hpf of hatching time at each concentration, while in control they were 100% and 52±1.15 hpf respectively. More than 70% of embryos showed morphological abnormalities under the optical microscope such as pericardial oedema and bent body axis in both 0.5 μgL^{-1} and 1.0 μgL^{-1} concentrations. LC_{50} was 0.37 μgL^{-1} of MC-LR. Thus, the study indicates dose dependent susceptibility of Zebrafish embryonic development to MC-LR, even at lower concentrations (0.1 μgL^{-1}) under laboratory conditions.

Keywords: Embryonic development, hatching time, LC_{50}, Microcystin-LR, Zebrafish

FACTORS AFFECTING HABITAT SELECTION BY SRI LANKAN GREEN PIT VIPER, *Craspedocephalus trigonocephalus* IN THE WET ZONE OF SRI LANKA

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Abstract

Factors influencing the habitat selection of *Craspedocephalus trigonocephalus*, an endemic, Sri Lankan viper locally known as Palapolaga, were studied in the wet zone from April 2021 to March 2022. This species shows a wide distribution in the three climatic zones of the island, except in the higher hills and arid zones. The macro-habitats were classified as forest, riparian, and open habitats. By randomly dividing the habitat into four quadrants and a $1m^2$ plot with the snake's location at its center, the preferred microhabitat was identified, and habitat variables were recorded. The number of individuals was counted within a 2m belt on either side of the transect and up to 20m vertically. Altogether 49 individuals were identified in the three habitat types surveyed. A high encounter rate was recorded in riparian habitats, which included areas with thick vegetation. Ambient temperature, distance to the stream, canopy cover, and light intensity were significantly affecting the occupied microhabitat. There was no statistically significant ($P > 0.05$) difference between the number of individuals and the detection time, showing that *C. trigonocephalus* was observed at any time of day and at any frequency. The highest average percentage of individuals perching on plants was observed to be 42.85 %. The most preferred perch height was found to be 3-10 m (mid-story) which accounted for a total of 43.85% of encounters. The present study in the wet zone of Sri Lanka generated important data regarding the habitat selection of *C. trigonocephalus*. This may aid in the present and future conservation (in-situ and ex-situ) and management of this unique endemic reptile species as well as its preferred habitats as a whole.

Keywords: *Craspedocephalus trigonocephalus*, habitat selection, macro habitat, microhabitat, wet zone

DETERMINATION OF WATER QUALITY STATUS AND CONTAMINATION LEVEL OF *E. coli* IN NEGOMBO LAGOON, SRI LANKA

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Abstract

Negombo lagoon is a bar-built estuary with a surface area of around 3,200 ha. It is an important aquatic resource with extensive biodiversity. However, the accelerated urbanization and industrialization-related anthropogenic activities cause a rapid depletion of water quality in the Negombo lagoon. The direct discharge of household and hotel effluent from point and non-point sources leads to the contamination of lagoon water by faecal coliform bacteria (*Escherichia coli* (*E. coli*)). The objective of the present study was to evaluate the contamination status *E. coli* in the Negombo lagoon while evaluating the fluctuation pattern of water quality throughout the year. The sample collection was done monthly from September 2021 to August 2022; 10 surface water samples were collected from different peripheral and middle locations in the lagoon. The quantification of *E. coli* was done following the Most Probable Number (MPN) method, and water quality analysis was conducted using the APHA standard methods. The study's results indicated that all the collected water samples were heavily contaminated with *E. coli*, and the number of *E. coli* in all the samples was more than 1100 ± 100 MPN/100 mL. The mean $N\text{-}NO_3^-$, $N\text{-}NO_2^-$ and $N\text{-}NH_4^+$, Total Phosphate, and Chemical Oxygen Demand (COD) concentrations were 0.025 ± 0.004 mg/L, 0.025 ± 0.002 mg/L, 0.020 ± 0.002 mg/L, 0.050 ± 0.005 mg/L and 770.5 ± 20.4 mg/L, respectively. Therefore, the study results concluded that the lagoon is contaminated with *E. coli* which may cause the spread of fish-associated zoonotic pathogens and indirectly cause severe sickness in humans. Further, the deterioration of water quality in the lagoon has caused it to exceed the maximum permissible COD level, which is suitable for aquatic life as per the SLSI standard level in Sri Lanka.

Keywords: – Negombo lagoon, water quality parameters, MPN method, *E. coli*, Chemical Oxygen Demand (COD)

DETERMINATION OF REMOVAL EFFICIENCY OF AMOXICILLIN RESISTANT BACTERIA AND AMOXICILLIN RESISTANT GENES FROM THE CONVENTIONAL WATER TREATMENT PROCESS IN A HOSPITAL

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Abstract

Amoxicillin-resistant (AMXr) bacteria and amoxicillin resistance genes (ARGs) pose a severe problem globally as amoxicillin is a common antibiotic used to treat bacterial infections. Due to the global spread of resistant bacteria, the effectiveness of antibiotics, which have transformed medicine and saved millions of lives, is in danger. The present study focuses on the detecting AMXr bacteria and ARGs in the wastewater released from hospitals after the treatment, which is important to analyse the removal efficiency of emerging contaminants via conventional treatment processes. The present study screened AMXr bacteria using the standard pour plate method spiking AMX. ARGs were screened using the *OPR D, bla OXA* and *amp a* genes. Results of the study revealed that the AMXr bacteria and genes were present in all water samples collected after the conventionally treated water. The AMXr bacterial percentage in samples varied between 0.001% to 0.01% in influent water, between 0.002% to 0.03 % in aeration water, between 0.003% to 0.01% in sand filtered water and between 0.3% to 0.4% in effluent water respectively. Results showed that each step in conventional treatment process was positive for *bla oxa* gene except raw water sample. Only raw water and sample after aeration was positive for *OPRD* gene. However, none of the samples was positive for *amp a* gene. The study's results showed that the release of antibiotics into the environment would lead to antibiotic-resistant bacteria and compromise the effectiveness of antibacterial therapy; the infectious organisms become resistant to more antibiotics. The experiments conducted in this study prove that amoxicillin-resistant genes and amoxicillin-resistant bacteria are present in hospital wastewater, but the highest is present in treated water. Therefore, it is necessary to develop and apply innovative treatment technologies to protect people from silent killers who will no longer be susceptible to antibiotics in the future, which has been identified as a challenge in the health sector.

Keywords: Amoxicillin, resistance, resistance genes, treatment, hospital

WATER QUALITY AND MICROBIAL CONTAMINATION STATUS OF GROUND AND SURFACE IN CHRONIC KIDNEY DISEASE OF UNCERTAIN AETIOLOGY (CKDu) HIGH PREVALENCE POLONNARUWA IN NORTH CENTRAL PROVINCE, SRI LANKA

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Abstract

Consumable water in Sri Lanka's arid agricultural areas has been researched for more than 20 years as a potential factor contributing to the widespread Chronic Kidney Disease with unknown aetiology (CKDu). Due to intensive agriculture that relies mainly on irrigation, excessive pesticide use, and a growing human population that results in over-extraction and wastewater discharges, these water bodies are progressively at risk of contamination. The research aimed to pinpoint the high incidence CKDu areas in the Polonnaruwa district and the consumable water quality in human settlements. In 27 sources, the present study identified the microbiological and physio-chemical parameters (20 groundwater and 7 surface water). The standard protocols were followed for all of the sampling and laboratory water quality analyses. The study's findings revealed that 17 locations, including three surface water reservoirs and 14 groundwater wells, were contaminated with faecal coliform bacteria and did not meet Sri Lankan drinking water quality standards (SLSI) or World Health Organization (WHO) standards. The pH of the reservoir waters ranged from 8.10 to 8.80, with Girithale tank having the highest pH (8.80) exceeding the acceptable range for drinking (6.59 – to 7.77). The Nawagama, Dehiattakandiya location had the maximum Electrical Conductivity (EC) (1109.00 µS cm^{-1}).Sansungama, Kaudulla, has the highest nitrate concentration (12.51±0.34 mg L^{-1}) greater than the SLS guidelines (10 mg L^{-1}). Theldeniyaya, Girandurukotte had the highest fluoride (1.65±0.01mg L^{-1}), hardness (477.33±2.31 mg L^{-1}) and alkalinity (212.67±1.15 mg L^{-1}), indicating that the catchment areas had significant mineral and metallic compounds that may have an effect on public health. Thus, the study area is high prevalence hotspots for CKDu, and poor drinking water quality could affect the kidneys.

Keywords: CKDu, ground and surface water, microbial contamination, Polonnaruwa district, water quality

DEVELOPMENT OF A TANNIN-BASED POLYMER MATERIAL FOR MICROALGAE HARVESTING

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Abstract

Recently, plant-based biopolymers have been receiving much attention in the field of microalgae harvesting because of their sustainability and the eco-friendly nature. Replacing the synthetic polymers that are used for microalgae biomass recovery with cationic plant-based bio-polymers give not only a competitive advantage but also, they possess unique properties such as higher flocculation efficiency than synthetic polymers. Thus, this study focused on synthesizing a tannin-based cationic bio-flocculant that was extracted from *Terminalia chebula* (Aralu) and further introducing quaternary nitrogen to the tannin oligomer through the Mannich reaction using formaldehyde and diethylene triamine (DETA). The synthesis of the quaternary amine was confirmed by the Fourier Transfer Infrared Spectroscopic (FTIR) analysis. Scanning Electron Microscopic (SEM) analysis revealed that higher amount of microalgae can be adsorbed onto the synthesized polymer flocculant as it has a micro-porous structure. Thermogravimetric analysis (TGA) and Differential Scanning Colorimetric (DSC) analysis confirmed that the developed polymer flocculant is thermally stable up to 305 °C. The effect of flocculant parameters was studied by varying the flocculant dosage. The 20 mg L^{-1} flocculant dosage of quaternized tannin with the lowest amount of formaldehyde crosslinking agent displayed the highest removal efficiency of 30.64%. Furthermore, phytotoxicity analysis using seed germination test after treating the natural water samples with the developed polymer flocculants confirmed the nontoxicity of the developed tannin-based cationic polymer flocculant. Regeneration and reusability studies were also investigated at neutral conditions. It can be concluded that the natural tannin-based materials could be converted to microalgae harvesting materials with simple chemical modifications.

Keywords: Plant-based biopolymers, cationic bio-flocculant, quaternary nitrogen, microalgae harvesting, characterization

EVALUATION OF DEGRADING ABILITIES FOR THE POLYCYCLIC AROMATIC HYDROCARBONS BY *Trichoderma harzianum* P_4M – 16: MYCOREMEDIATION APPROACH TO GREEN AIR

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Abstract

As highly toxic pollutants, polycyclic aromatic hydrocarbons (PAHs) are released into the air by different anthropogenic sources. The phyllosphere contains different microorganisms, and fungi take a special place since some of them can degrade PAHs. In particular, *Trichoderma harzianum*, which has been widely studied due to its extensive physiological and genetic adaptations to degrade PAHs. Therefore, this research attempt was to determine the PAHs degradation capability of the phyllosphere inhabited by *Trichoderma harzianum*. *Trichoderma harzianum* P_4M – 16 was isolated from leaf samples collected from Panchikawatta, Orugodawatta, Pettah, Maradana, Colombo Fort, and Sapugaskanda urban areas in Sri Lanka. 66 samples were subjected to the study. Furthermore, PAHs degradation ability of isolated *Trichoderma harzianum* P_4M – 16 was screened using plate assay and confirmed through High Performance Liquid Chromatography (HPLC) analysis. The effects of produced by-products from the biodegradation process on living beings have also been evaluated using phytotoxicity towards *Vigna radiate* seeds. According to the results, out of thirty five morphologically different fungal cultures *Trichoderma harzianum* P_4M – 16 showed higher PAHs degradation capability. HPLC analysis results revealed that *Trichoderma harzianum* P_4M - 16 (Accession number: OP101173.1) showed the highest degradation in phenanthrene (77%) and 64%, 63%, and 57% in naphthalene, pyrene, and anthracene, respectively. Naphthalene degradation was leads by Mnp activity (76.54 UmL min $^{-1}$) while, anthracene degradation was led by Laccase enzyme activity (68.55 UmL min $^{-1}$). Both pyrene and phenanthrene degradations were led by Lip activity with 22.43 UmL min $^{-1}$ and 53.23% UmL min $^{-1}$ respectively. In this study, we found a clear correlation between enzyme activity and PAHs degradation in isolated fungi. The findings of the present research study clearly explain the potential use of phyllosphere *Trichoderma harzianum* P_4M – 16 in the remediation of environmental pollutants like PAHs.

Keywords: *Trichoderma*, polycyclic aromatic hydrocarbons, bioremediation, HPLC, enzyme activity

WATER QUALITY, SPECIES COMPOSITION AND ABUNDANCE OF ALGAE, CYANOBACTERIA AND ZOOPLANKTON, AND WATER QUALITY IN PARLIAMENT LAKE

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Abstract

Parliament Lake is an important water storage area in Sri Jayewardenepura Kotte. The lake is connected by a vast network of canals. With recent population growth and urbanization, the water quality in this network has deteriorated significantly. It was caused by cyanobacterial blooms in the lake and canal system. The purpose of this research was to evaluate the water quality and trophic state of Parliament Lake, as well as to identify the species composition and abundance of algae, cyanobacteria and zooplankton. To represent the entire lake, ten sampling locations were chosen. In March and April of 2022, surface water samples were collected. For all sampling and laboratory water quality analyses, standard protocols were followed. The measured water quality parameters were compared to aquatic life standard values. The pH, Dissolved Oxygen, conductivity, total nitrate and phosphate of the water were all within the specified limits. The recorded values were ranged within 6.52- 8.16 mg L^{-1}, 1.64-7.91 mg L^{-1}, and 206.2-310.8 S cm^{-1}, respectively. The values for total nitrate, total phosphate, and chlorophyll-a were 0.22-2.46 mg L^{-1}, 0.01-0.2 mg L^{-1}, and 2.33$\pm$ 0.68-12.87$\pm$ 0.55 mg L^{-1}, respectively. The chemical Oxygen Demand values recorded were above the acceptable ranges for aquatic life. Cyanobacteria, algae and zooplankton had cell densities of over 18,000, 11,900 and 870 cells per mL, respectively. The current study found four different cyanobacterial species, including *Microcystis* sp., *Cylindrospermopsis* sp., *Oscillatoria* sp., and *Spirulina* sp., as well as nine algae species, including *Melosira* sp., *Scenedesmus* sp., and *Pediastrum* sp. Four rotifer species: *Brachionus* sp., *Keratella* sp., *Trichocera* sp., *Filinia* sp., one copepod species: *Tigriopus* sp., and one cladoceran species: *Daphnia* sp. were found in the lake. The study indicates that sudden algae and cyanobacteria blooms leading to eutrophic states are possible, with potential bloom-forming and toxin-producing species in the lake.

Keywords: Parliament Lake, water quality, cyanobacteria, algae, zooplankton

HEALTH SCIENCES & NUTRITION

THE USE OF MEDICINAL PLANTS FOR THE PREVENTION OF COVID-19 IN SRI LANKA: AN ONLINE CROSS-SECTIONAL SURVEY

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Abstract

With the lack of specific treatments against COVID-19, Sri Lankans are seeking alternative treatment options such as herbal medicines as preventive measures and treatment options against COVID-19. This study aimed to estimate the prevalence of using such alternatives by Sri Lankans during the pandemic and assess the self-perceived effectiveness and adverse effects of herbal medicines from the perception of participants. An online cross-sectional survey was conducted on the general public. Data were collected using a questionnaire. A total of 804 participants were included in the study. Descriptive analysis was performed for all variables. A Chi-square test was performed to determine the association between the studied variables. Among the participants, 90.42% reported using herbal medicines as preventive measures against COVID-19, whereas 86.69% used them to treat respiratory symptoms. Coriander and ginger were the most commonly used medicinal plants as preventives and in the treatment of respiratory symptoms. These herbs were perceived to be effective in alleviating respiratory symptoms by more than 85% of their users. A minority of the consumers (15.4%) experienced adverse effects associated with the use of herbal medicines as preventive measures. The use of herbal medicines as preventive measures was associated with the age ($p=0.032$) and education level ($p=0.000$) of participants. Besides, the current study highlights the perceived effectiveness of some medicinal herbs in treating respiratory symptoms and recommends future research to evaluate the crude extracts of each plants for effectiveness by using clinical trials and then compounds with potential pharmacological effects can be isolated.

Keywords: COVID-19, herbal medicine, medicinal plants, natural products, Sri Lanka

COVID 19 S' EFFECT ON MOOD STATUS AMONG NATIONAL FOOTBALL PLAYERS IN A BIO-BUBBLE DURING THE PANDEMIC

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Abstract

The COVID-19 pandemic almost brought the entire world to a standstill including the sports industry. It increased psychological issues among athletes such as stress, anxiety, depression, and decreased mental well-being with the fear of COVID-19. Athletes are experiencing high-stress levels during the pandemic than the non-pandemic situations. To prevent athletes from infecting the coronavirus, they have been enrolled on a special environment called the bio-bubble during competitions. The present study aimed to examine the fear of COVID-19's effects on national football players' mood variables in a bio-bubble during the pandemic. A cross-sectional study was conducted using forty-six national male football players (n = 46) using a purposive sampling technique whose age ranged from 19 to 31 (22.2±3.1) with playing experience of more than 5 years (7.15±2.9) in football. The data were collected using the Brunel Mood Scale (BRUMS) and Fear of COVID-19 standard self-reported questionnaires. Data were analysed using SPSS statistical software and the significance level was set at 0.05. Data were not normally distributed. Hence, the Spearman correlation test was used to find the correlation between fear of COVID-19 with mood variables. Results revealed that there is significant positive correlation between fear of COVID 19 and anger (r = 0.377, p = 0.010), confusion (r = 0.532, p = 0.000), depression (r = 0.467, p = 0.001), and tension (r = 0.379, p = 0.009). Vigour mood variable (r = -0.348, p = 0.018) showed significant negative correlation with fear of COVID-19. Significantly, the modifications to environmental factors were coupled with outcomes for psychological health. According to the findings, the fear of COVID-19 directly affects the mood variables among football players, and it negatively impacts athletes' vigour. It can be concluded that the players are vulnerable to this pandemic and their performance could be decreased with the presence of negative mood variables.

Keywords: Bio-bubble, Covid-19 pandemic, fear of Covid-19, mood, football players

USER PROFILES OF WALKING TRAIL USERS AROUND URBAN AREAS IN SRI LANKA

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Abstract

Regular physical activities (PA) provide multiple health benefits and walking is an effective and cheap option for PA. Built walking trails are used to address the issue of physical inactivity, particularly in the urban population. There are several state-sponsored walking trails in Colombo urban neighborhood. Government plans to duplicate the same model in other cities as well. However, it is worthwhile to examine the user profile and assess whether the already-built walking trails carry significant benefits for the users. The present study was undertaken to determine the user profile of walking trail users in urban settings. A survey was conducted at Independent Squire (ISQ) and Bellanwila (BEL) walking trails randomly recruiting 131 participants (n = 131). Data were summarized using descriptive statistics adopting SPSS software. Findings revealed that most users were from the middle class, well-educated with no access to any other PA. Walkers residing within a radius of 3.5-4.0 km attended the trail three days a week around 3.00-6.00 pm time. The walking distance was measured using the distance markers displayed on the trail. The median distance walked per day was 2050 m (*IQR*=1000) and 4095 m (*IQR*=2000) within 44 min (*IQR*=32) and 62 min (*IQR*=20) at ISQ and BEL respectively. 68% of the walkers completed PA much lower than the WHO recommended level. This indicates the knowledge gap present on the actual requirement of health-enhancing PA. BMI of all the age categories irrespective of gender or trail belongs to either overweight or obese categories suggesting the need for systematic PA. Among the walkers, 68% in ISQ and 72% in BEL reported type-II diabetes mellitus indicating the need for health-enhancing walking guidelines. Habits of smoking and consumption of alcohol are 31.5% and 48% respectively in males and not prevalent among females. The purpose of walking for females was to reduce weight while maintaining fitness for males. In conclusion, a walking trail is an excellent tool to perform physical activity but awareness of the technical characteristics of walking is needed.

Keywords: Physical activity, walking trail, user profile, BMI, walking guideline

KNOWLEDGE PRACTICE, AND ATTITUDE REGARDING HPV VACCINATION AMONG THE UNDERGRADUATES OF WESTERN PROVINCE, SRI LANKA

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Abstract

The HPV vaccine is safe and effective in preventing cervical cancer and HPV-related infections. Lack of appropriate knowledge and negative attitudes towards HPV vaccination are considered major reasons for the poor acceptance of the vaccine. Current undergraduates are in the age range with the highest risk of exposure to cervical cancer and HPV-related infections. Therefore, this study was conducted to investigate the knowledge, practices, and attitudes regarding HPV infection and HPV vaccination among undergraduates and identify the factors influencing them. A cross-sectional study was conducted among undergraduates of Western Province, Sri Lanka. The participants were randomly selected for the study, after obtaining informed consent. Data was collected using a pre-tested and validated questionnaire. Having good knowledge was defined as answering 8(50%) or more questions in the knowledge section, correctly. The mean age was 23.9 years (+-SD=2.37), and most of the participants were female (79.7%). Out of 390 participants, only 107 (27.43%) displayed good knowledge, and only 56 (14.4%) had received HPV vaccination. Among the unvaccinated, 135 (34.6%) were unwilling to take the vaccine. A significant association ($p<0.05$) was found between total knowledge and factors like gender, course of study, year of study, HPV related cancer history among families. The education level of the mothers and their district ($p>0.05$) had no significant association with the total knowledge. Knowledge, attitudes, and practices regarding HPV vaccination among undergraduates are poor. The study also found that undergraduates are willing to know more about HPV infection and HPV vaccination. Targeted health education interventions would be necessary to increase the acceptance of vaccination among this population.

Keywords: HPV vaccine, knowledge, attitude, practices, Western province undergraduates, Sri Lanka

ADVERSE EFFECTS, KNOWLEDGE AND ATTITUDE RELATED TO FACE MASKS USAGE DURING COVID-19 PANDEMIC AMONG A SELECTED GROUP OF PROFESSIONALS IN WESTERN, SOUTHERN, CENTRAL AND UVA PROVINCES OF SRI LANKA

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Abstract

COVID-19 is a highly transmissible viral infection caused by the SARS-CoV-2 virus and the WHO has recommended the usage of face masks as a mandatory preventive measure. Several studies have reported adverse effects that occur due to prolonged usage of face masks. Hence, this study aims to analyse the knowledge and the attitude related to the usage of facemasks, and possible adverse effects among selected healthcare professionals and bank / office staff in selected four provinces of Sri Lanka. A descriptive cross-sectional study was carried out among conveniently selected 366 healthcare professionals and bank / office staff using a pre-tested questionnaire distributed physically in conveniently selected banks and hospitals of Western, Southern, Central and Uva provinces of Sri Lanka. Descriptive statistics were used to analyse the data using SPSS 25 package. Among the total population (n=336), 54.6% (n=200) were bank / office staff followed by 45.4% (n=166) of healthcare professionals. The majority of participants were with poor knowledge (67.2%) and good attitude (74.9%) related to the usage of face masks. Adverse effects such as, pain behind the ears (34.4%), excessive sweating (33.1%), headache (28.1%), shortness of breath (26%), acne (23%), dry mouth (22.4%), itchiness in the nose (11.7%), nasal blockage (10.4%), skin breakdown (6.8%), faintishness (6%), redness in eyes (2.2%), skin rashes (1.4%) were identified due to prolonged usage of face masks. The most used types of face masks were disposable surgical masks (68.30%), KN 95 masks without exhalation valves (56.01%) and N95 masks (27.32%). Among the above disposable surgical mask users, KN95 mask users, and N95 mask users, the majority have experienced, pain behind the ear (33.6%), headache (32.68%) and excessive sweating (40%) respectively. Hence, the findings of this study allows the community to select the most suitable type of face mask according to their adverse effects.

Keywords: COVID-19, face masks, knowledge, attitude, adverse effects

DEVELOPMENT OF AN INSTANT COCOA-BASED BEVERAGE INFUSED WITH CINNAMON (*Cinnamomum zeylanicum*) AND CURRY LEAVES (*Murraya koenigii*)

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Abstract

This study was conducted to develop a cocoa-based beverage utilizing cocoa, cinnamon, and curry leaves powder. Cocoa is rich in phytonutrients but low in fat and sugar. Cinnamon is a spice that lowers blood sugar levels and delivers many other impressive health benefits, as well. Curry leaves are rich in fibre, which slows down digestion, preventing sudden spikes in our blood sugar levels. In this study, two formulations of cocoa-based beverages containing cocoa powder: cinnamon powder: and curry leaves powder (7:0.1:0.1 and 5:0.1:0.1) were developed. The most preferred formulation was selected for further analysis using a 5-point hedonic scale for a sensory panel and responses were analyzed using Minitab®20. Physicochemical properties, microbial quality, and proximate composition were further assessed. The pH value of the sample was between 6.1 - 6.4 at 27 °C, while the total soluble solids of the chocolate beverage varied between 10.38 - 10.75 Brix. In the tested sample, there was an absence of total E.coli at 30 °C tested for 72 h. The counts of molds and yeasts exhibited 3.1×10-4 CFU per ml at 25 °C for 5 days while the aerobic plate count was 3.5×10-4 CFU per ml at 30 °C for 72 h. According to the SLS specifications, the microbial counts were within the acceptable range. The carbohydrate content in the beverage was 13.4 % by mass and it had 59.8 kcal per 100 g of energy content. This beverage contributes less sugar to the blood, hence most likely to be preferred by diabetic patients. The fat content was 0.6% by mass and the protein content % by mass was 1.0. The low-fat content may provide physical recovery benefits for athletes after vigorous workouts. The developed product can be further evaluated for its texture profile and can be flavoured with different spices based on the requirements of the consumers.

Keywords: Cocoa-based beverage, cinnamon, curry leaves, infused, instant

RISK FACTORS CONTRIBUTING TO THE INFECTION OF TOXOPLASMOSIS AMONG CANCER PATIENTS IN THE SRI LANKAN CONTEXT

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Abstract

Toxoplasmosis is a widespread disease caused by the parasite *Toxoplasma gondii*. The definitive hosts of this disease are the members of the family Felidae, including domestic cats. Most infected individuals are asymptomatic, but it could be life-threatening to immunocompromised patients. The objective of the study was to determine the association of risk factors in the prevalence of toxoplasmosis among cancer patients. A questionnaire was used to collect socio-demographic and health-related data. Patients were screened for toxoplasmosis, using an Enzyme-Linked Immunosorbent Assay (ELISA). Based on ELISA results, patients were categorized as uninfected, infected (acute or past), or indeterminate. Among the 321 participants, 33% of patients with acute infection, 40% with past infection, 45% of uninfected patients, and 47% of indeterminate patients, were cat owners. Additionally, several other contributing factors were identified such as 14% of patients with acute infection, 14% with past infection, 15% of negative patients, and 27% of indeterminate patients were drinking unsafe water. The results did not show any association between toxoplasmosis and the presence of cats or any other factors. The reason could be due to the extra careful lifestyles of cancer patients under immunosuppressive therapies. Contact with cats is generally considered the main risk factor. Although these patients have cats at home, they might be avoiding any physical contact with them. Extending the search for more risk factors is recommended to identify the possible source of infection in this category of patients in the Sri Lankan context. Furthermore, educating patients on toxoplasmosis would help them to adopt specific preventive measures.

Keywords: Toxoplasmosis, parasitic, cancer, *T. gondii*, immunocompromised

DEVELOPMENT OF A REMOTE PHARMACY MEDICATION MANAGEMENT SERVICE FOR PATIENTS

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Abstract

Providing remote clinical pharmacy services can improve patients' safety when such services are physically inaccessible. Telemedicine was a solution during the COVID-19 restrictions, in most countries. However, this concept was new to Sri Lanka. Therefore, a need has arisen for proactive preparation for the provision of remote clinical pharmacy services in future crisis situations. The objective of this study was to review the literature on methodologies adopted internationally to provide remote pharmaceutical care services to patients, and to develop a standard operating procedure (SOP) to provide selected remote clinical pharmacy services to patients. Articles published from the year 2010 to 2022 were searched using the keywords, 'Tele-pharmacy', 'Video-conferencing', 'COVID-19', 'Remote-pharmacy', and 'Tele-conferencing'. Only the articles that described the procedure for providing remote clinical pharmacy services were selected for the review. A preliminary SOP was prepared by the researchers, based on the literature. Semi-structured interviews were conducted among experts to validate the content of the drafted SOP. Thematic analysis was used for this study. Eight articles that explained service procedures were used to develop the draft SOP. Six experts (Hospital pharmacists, N=2 (State), N=1 (Private); Pharmacy academics, N=2; Clinical pharmacologist, N=1) provided their opinions on the draft SOP. Accordingly, a 10-step SOP was finalized (Step 1: Receiving patient calls and assessing patient suitability; Step 2: Introducing the service and obtaining patients' consent; Step 3: Requesting appointment dates and uploading medical/medication/laboratory records to the system; Step 4: Confirming appointments and conveying preparatory details of consultations to patients; Step 5: Reviewing patient records prior to consultation by a pharmacist; Step 6: Providing online clinical pharmacy services to patients by a pharmacist; Step 7: Facilitating referral to prescriber/dispensing pharmacist if needed; Step 8: Issuing reports on patients' use of medication and recommendations; Step 9: Obtaining feedback from patients; Step 10: Recording/updating patient information on the database). In conclusion, a content-validated SOP was developed to provide selected clinical pharmacy services remotely to patients in Sri Lanka.

Keywords: Tele-pharmacy, video conferencing, COVID-19, remote pharmacy, teleconferencing

KEY BREEDING HABITATS OF DENGUE VECTORS IN KALUTARA DISTRICT, SRI LANKA

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Abstract

Dengue is considered one of the major vector-borne diseases in Sri Lanka, transmitted by *Aedes aegypti* and *Aedes albopictus*. It is essential to identify key breeding habitats to control vectors. Although both vectors have been reported in the Kalutara district, limited information is available on their key breeding habitats. Therefore, this study was conducted in two priority high-risk MOH areas in the Kalutara district to determine key breeding habitats of dengue vectors, from January to December 2018. The study area was divided into three sites and the surveys were carried out according to the national guidelines. The collected data were statistically analyzed using IBM SPSS statistics version 23, at α =0.05 level of significance. A total of 7,809 houses were surveyed, and 1,141 were found positive for dengue vectors. The highest positivity of *Ae. aegypti* larvae was recorded from urban sites with a significant difference (χ^2 = 47.664, df =2, p= 0.000), and the highest positivity of *Ae. albopictus* larvae was recorded in rural sites with a significant difference (χ^2 = 6.726, df =2, p= 0.035). During the survey, 5761 breeding habitats were observed, and 27.40% of breeding habitats were positive for dengue vectors. Although *Ae. aegypti* larvae were entirely found in artificial habitats, *Ae. albopictus* larvae were found in both artificial and natural habitats without significant differences (U= 49.00, p= 0.977). There was a significant difference in the use of breeding habitats by vectors (χ^2 = 38.883, df =11, p =0.00 for *Ae. aegypti* and χ2 = 45.284, df =11, p=0.00 for *Ae. albopictus*). This study revealed that the primary vector, *Ae. aegypti* invaded urban sites, as well as semi-urban sites, and was entirely bred in artificial habitats. Therefore, it is vital to consider artificial breeding habitats when planning vector control programs, to reduce both vector densities in a rational manner.

Keywords: Dengue, *Ae. aegypti, Ae. albopictus,* breeding habitats, vector

COMPARISON OF DYE BINDING METHODS FOR SERUM ALBUMIN MEASUREMENTS WITH CAPILLARY ELECTROPHORESIS METHOD

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Abstract

Serum albumin measurement is one of the most performed tests in the chemical pathology laboratory. Its significance in the diagnosis of nephrotic syndrome, assessment of the nutritional state, as a marker of chronic liver disease, and the evaluation of generalized edema is well known. Serum albumin is measured using several methods such as capillary zone electrophoresis (CZE), immunonephelometry (IN), immunoturbidimetry (IT), and dye-binding methods. No gold standard method is available to date. However, most of the clinical laboratories use dye-binding methods, bromocresol green (BCG) and bromocresol purple (BCP) methods for this purpose. Previous studies have shown that BCG and BCP assays yield discordant results. These discrepancies cannot be ignored, as crucial medical decisions are made upon the results of these assays. The objective of this study was to investigate the agreement and correlation of albumin measurements obtained by BCG and BCP methods with the CZE method aiming to quantify the extent of discrepancies between BCG and BCP methods, if any. A method comparison study was performed to compare BCP and BCG methods with CZE as a reference method, using retained blood samples (n=45) received for serum protein electrophoresis at the Teaching Hospital, Karapitiya. The statistical analysis of data using Bland Altman plots and Pearson correlation revealed that the CZE and BCP methods have a strong correlation and a good agreement. BCP method showed a higher correlation to CZE method ($r=0.910$; $p<0.01$)) with a mean difference of less than 1 g L^{-1} (95% limits of agreement -5.00 to 6.56). The mean difference between BCG and CZE methods was large (4.56 g L^{-1}; 95% limits of agreement, -2.34 to 11.46), although the correlation between the methods was strong ($r=0.875$; $p<0.01$). The study concluded that the BCG method has a higher overestimation of albumin concentration compared to the CZE method (positive bias) than the BCP method.

Keywords: Serum albumin, CZE, BCP, BCG, dye-binding

ASSOCIATION BETWEEN SCREEN TIME AND SELF-REPORTED DIGITAL DEVICES-RELATED VISION PROBLEMS AMONG UNDERGRADUATES AT THE UNIVERSITY OF SRI JAYEWARDENEPURA

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Abstract

Digital devices have become a major teaching and learning tool at universities. However, excessive usage of digital devices reduces the quality of human life, causing vision-related problems. The aim of this study was to assess the association between screen time and digital devices-related vision problems among undergraduates at the University of Sri Jayewardenepura. A descriptive cross-sectional study was conducted among undergraduate students from seven faculties of the university through convenience sampling. The pre-tested self-administered questionnaire, developed by investigators, based on prior literature included socio-demographic data, the pattern of using digital devices, and vision-related problems. It was distributed among 300 undergraduates via Google forms. Collected data were analyzed using SPSS (Statistical Package for Social Sciences) version 26. Data were summarized using descriptive statistics. Chi-square test was performed to analyze the association between variables. Ethical approval was obtained from the Ethics Review Committee of the Faculty of Medical Sciences at the University of Sri Jayewardenepura. 248 responses were used for the study, according to exclusion criteria. As per the results of the study, nearly 75% of the undergraduates (n=189) used digital devices for more than 4 hours. The most commonly reported vision-related problem was headache (84.3%, n=209). Furthermore, 82.3% (n=107) of the participants who used digital devices for more than 4 hours showed severe vision-related problems. Results of the chi-square test showed a significant association between screen time and vision-related problems (p=0.038). Notably, headache was reported as the most common digital devices-related vision problem in prior literature as well. Association between screen time and vision-related problems is also supported by previous studies. In conclusion, this study shows that increased screen time is associated with increased vision-related problems.

Keywords: Digital devices, vision-related problems, digital eye strain, digital screen, university students

MICROWAVE-ASSISTED BIOSYNTHESIS OF PALMYRA PULP-MEDIATED PHYTONANO ZnO PARTICLES AND THEIR ANTIOXIDANT POTENTIAL

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Abstract

Metal oxide nanoparticles (NPs) are widely regarded as possessing critical commercial applications. The physicochemical approach to nanomaterial synthesis has a high risk of being harmful. However, plant-mediated NPs synthesis has more sustainable benefits and allows unrestricted use in human consumer products. In the absence of conclusive reports in the prior literature, this study focused on the microwave-irradiated biosynthesis of ZnO NPs using palmyra pulp and evaluated their antioxidant properties using DPPH, FRAP, and ABTS assays. Phytochemical screening revealed the presence of significant amounts of bioactive compounds. The effects of various parameters (irradiation methods, ion precursor solution concentration, plant extract to metal ion solution ratio, pH, and incubation time) on green NPs synthesis were studied. The ion precursor solution containing a plant extract mixture was microwave-irradiated under optimal parameters for the synthesis of ZnO NPs. ZnO NPs were characterized by UV-Vis spectroscopy, FTIR, SEM, TEM, and XRD analysis. The absorption of surface plasmon resonance (SPR) peaks of ZnO NPs appeared at 358 nm under optimized conditions. FTIR confirmed the synthesis of the hexagonal phase of ZnO NPs at 733 cm^{-1} to 856 cm^{-1}. SEM analysis indicated that NPs exhibited a nanoflower arrangement of particles. The characterization by TEM confirmed the flower-shaped ZnO NPs with an average particle size of 87.53 ± 23 nm. XRD confirmed the hexagonal crystallinity of ZnO NPs. The ability of biosynthesized ZnO NPs to scavenge free radicals revealed strong antioxidant activity. At the highest concentration of 200 ppm, pulp-mediated ZnO NPs showed the most potent DPPH radical scavenging activity (71±2.8 %), and the IC_{50} value was 97.31 ppm. The ABTS assay revealed that the average IC_{50} value was 144.54 ppm. Besides, when the concentration of NPs was increased, pulp-mediated ZnO NPs demonstrated high FRAP scavenging power. All the antioxidant assays confirmed that the ZnO NPs display comparable antioxidant potential with reference to the standard, whereas pulp extracts displayed less antioxidant potential.

Keywords: Biosynthesis, microwave irradiation, ZnO nanoparticles, palmyra pulp, antioxidant activity.

NURSES' AWARENESS OF LEGAL ASPECTS RELATED TO NURSING PRACTICE AND NURSING REGULATION: BASED ON A SELECTED TEACHING HOSPITAL IN SRI LANKA

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Abstract

Nurses are the front-line workers who provide continuous care for patients and their families while ensuring their safety. After obtaining a diploma or a degree in nursing, nurses are registered under Sri Lanka Nursing Council (SLNC), and thereby legally accountable for the care they provide. The aim of this study was to assess nurses' awareness of legal aspects related to nursing practice and regulation, based on a selected teaching hospital in Sri Lanka. The cross-sectional study was conducted among 381 nurses selected through convenience sampling from the Colombo South Teaching Hospital, Sri Lanka. Data were collected using a pre-tested, self-administered, and structured questionnaire developed by researchers, with expert opinions. Data were analysed through descriptive statistics, using SPSS version 26. The mean scores were considered as cut-off values for awareness. The response rate was 90.3%. Nearly 93.7% were females. Most of the nurses (62%) had a good overall awareness of legal aspects (mean13.01±SD3.81). However, a lack of awareness was identified regarding assault, battery, patients' rights, privacy and confidentiality, and false imprisonment. Almost 65% had a good awareness of legal aspects related to nursing regulation (5.14±2.12). Low awareness was evident regarding the responsibilities of SLNC, its authority to enforce a code of ethics, and its powers to suggest changes to nursing curricula. Awareness of legal aspects related to nursing practice showed a significant association with previous learning about legal aspects ($p<0.001$) and having faced a legal problem in their practice ($p=0.03$). Most participants had a good level of overall awareness of legal aspects related to nursing practice and nursing regulation. However, inadequate awareness was observed regarding some legal aspects essential for patients' safety and nursing regulation. More education programmes related to legal aspects of nursing practice and nursing regulation should be implemented by the relevant authorities to ensure safe and effective nursing care.

Keywords: Nurses' awareness, legal aspects, nursing practice, nursing regulation, patients

IDENTIFICATION OF SEROLOGICAL BIOMARKERS FOR THE DETECTION OF LARYNGEAL CANCER: A PILOT STUDY

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Abstract

Laryngeal Cancer (LC) is the most common malignancy of the head and neck. With the recognition of the urgency for LC detection regardless of the stage, and the identification of autoantibodies (AAb) as a potentially valuable serological biomarker in cancer detection, this study aimed to detect AAbs in LC and investigate their role as a biomarker. AAb levels in 30 histologically confirmed LC patients and 30 healthy individuals were investigated by indirect enzyme-linked immunosorbent assays (ELISA). AAb levels were found to be significantly higher in the patient group compared to the control group (p = 0.019). Diagnostic performance of AAb level testing for LC detection reflected a sensitivity, specificity, positive predictive value, negative predictive value, and an accuracy of 70% each. The positive likelihood and negative likelihood ratios were 2.33 and 0.43, respectively. Patient AAb levels were determined to not significantly vary across different cancer stages (p = 0.708) and different time durations as per the first symptom appearance (p = 0.228), different time durations of medical attention (p = 0.231), and different degrees of risk factor exposure (p = 0.478). These results suggested that a significant level of AAbs can be detected among LC patients with good diagnostic performance irrespective of the stage, suggesting that the presence of AAbs in LC may highly reflect the potential to be utilized as a predictive biomarker for early diagnostics. A study with a larger sample size is required for further analysis.

Keywords: Laryngeal cancer, autoantibodies, biomarker, ELISA, diagnostics

IN-VITRO ANTIOXIDANT POTENTIAL OF *Evolvulus alsinoides*

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Abstract

Reactive oxygen species (ROS) are molecules that can destroy DNA, proteins, and fatty tissue of the body while changing how they function. According to the literature, oxidative stress on tissues is a major contributor to the development of cancer. The novel scientific world focuses on natural herbal remedies, as they have few or no side effects. *Evolvulus alsinoides* (L,) L. (Convolvulaceae) is a natural herbal plant found in Sri Lanka that is used in a variety of Ayurvedic preparations. However, its antioxidant activity remains unknown. Thus, the purpose of this study was to investigate the antioxidant properties of *E. alsinoides* using DPPH (2,2- Diphenyl-1-Picrylhydrazyl), H_2O_2 (Hydrogen peroxide), and Ferric Reducing Antioxidant Power (FRAP) assays. Plants were collected from the Badulla district, and plant materials were extracted into distilled water in a 1:3 ratio using the maceration technique. Two-fold dilution series were prepared: 0.25 g of plant aqueous extract powder dissolved in 1 ml of distilled water, starting from 0.25 g ml^{-1} to 4 $\times 10^{-4}$ g ml^{-1} concentration. As per the standard, ascorbic acid was used for all three assays. Then, the absorbance was measured by a UV double-beam spectrophotometer, and the IC50 values were calculated using *GraphPad Prism* software. Furthermore, the study was triplicated (If IC50 < standard IC50 is considered as having better antioxidant activities, if IC50 > standard IC50 is considered as less/not having antioxidant activities). When considering the DPPH assay, IC50 = 0.23 g ml^{-1} for the plant was observed, which was comparatively lower than the standard IC50 = 11.52 g ml^{-1}. This proved that this plant has antioxidant activity. In the H_2O_2 assay, the plant showed IC50= 0.02 g ml^{1}, which was compared with the standard IC50 = 0.03 g ml^{1}. In the FRAP assay, IC50= 0.05 g ml^{-1} for the plant was observed, which was comparatively lower than the standard IC50 = 0.32 g ml^{-1}. This proved that *E. alsinoides* has good antioxidant activity. Thus, scientific evidence supports the authentic use of Ayurvedic medicine in the treatment of cancer.

Keywords: Anti-diabetic, antioxidant, DPPH Assay, FRAP Assay, H_2O_2 Assay

EVALUATION OF THE ANTI-CANCER ACTIVITY OF *Syzygium caryophyllatum* (L.) ALSTON FRUIT EXTRACT

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Abstract

According to the WHO, cancer is attributed to one of the leading causes of death worldwide, accounting for nearly 10 million deaths in 2020. Currently available cancer treatments such as chemotherapy and radiotherapy could cause high toxicity to healthy human cells. Drugs derived from medicinal plants have an advantage over synthetic drugs since plant-derived components are more tolerable and mostly less toxic to healthy human cells. Previous studies have revealed the prevalence of anti-cancer activity in leaves of *Syzygium caryophyllatum*. However, studies investigating the anti-cancer activity of the fruit of this plant have not been conducted previously. Hence, this study was carried out to illustrate the probable anti-cancer properties of *S. caryophyllatum* fruit extract. The fruit extraction of fully ripened *S. caryophyllatum* was performed with ethanol in an exhaustive manner using the ultra-sonication method. The anti-cancer activity of the fruit extract was assessed by Sulforhodamine B assay using human oral squamous cell carcinoma (CRL-3240), and human normal gingival fibroblast (HGF-1) cell lines in dose-dependent (25 – 400 µg ml^{-1}) and time-dependent (24 h, 48 h, and 72 h) manner. The CRL-3240 cells treated with *S. caryophyllatum* fruit extract demonstrated significant differences ($p=0.007$) in cell viability in a time and dose-dependent manner. The 72 h post-treatment exhibited the highest cytotoxic effect in CRL-3240 cells with IC_{50} 93.80 µg ml^{-1} and showed a lesser cytotoxic effect on HGF-1 cells with IC_{50} 115.77 µg ml^{-1}. Upon prolonged exposure, the fruit extract showed high cytotoxicity to cancer cells compared to HGF-1 cells, suggesting minimum side effects on healthy cells. In conclusion, this study demonstrates the prevalence of anti-cancer activity of *S. caryophyllatum* fruit on oral carcinoma cells.

Keywords: Anti-cancer activity, human gingival fibroblast cell line, human squamous cell carcinoma, Sulforhodamine-B assay, *Syzygium caryophyllatum* fruit

DIETARY AND NON-DIETARY PRACTICES RELATING TO VITAMIN D STATUS AMONG UNDERGRADUATES IN A TERTIARY EDUCATIONAL INSTITUTE IN SRI LANKA

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Abstract

Recent studies show a high prevalence of vitamin D deficiency in Sri Lanka, despite abundant sunlight throughout the year. Undergraduates worldwide indicate an inadequacy of dietary and non-dietary practices related to vitamin D. The major causes of vitamin D deficiency are limited sun exposure, low intake of vitamin D-rich foods, and lack of physical activity. This descriptive cross-sectional study was conducted to assess the dietary and non-dietary practices related to vitamin D and its deficiency at a tertiary educational institution in Sri Lanka by using a pre-tested and validated self-administered questionnaire. It included questions regarding participants' general characteristics (9 items) and practices (10 items) which covered sun exposure habits, sunscreen use, physical activity, supplement taking, and vitamin D-enriched food consumption. Each practice question was graded and coded. The level of practice was classified as good, moderate, and poor using bloom's cut-off points of 33%, 66%, and 100% of total score for the questionnaire. Ethical approval was obtained from KIU ERC (KIU/ERC/21/111). Descriptive analyses were performed using SPSS version 25. Three hundred seventy-four undergraduates (male =95, female=279) were recruited to the study. The majority had a good practice level (39.0%, n = 146), while one-third of the participants had a poor practice level (29.7%, n = 111). Consumption of vitamin D-rich foods was low among the participants, with only 18.4% always consuming vitamin D-rich foods at least twice a week. Only 7.2% always read food labels and choose vitamin D-enriched foods, and 42.2% had never taken vitamin D supplements. The majority responded that they get exposure to direct or indirect sunlight daily. One-third said they often avoid intense sunlight to prevent tanning and use physical sun protective methods to avoid the sun. Most engaged in outdoor physical activities (36.1%) and used sunscreen (27.3%) when exposed to sunlight. Even though the majority had good practices, nearly one third of the participants had poor practices, which reflected almost the same findings as previous studies. Awareness programs need to be implemented since it directly affects the level of practices relating to vitamin D status.

Keywords: Practice, undergraduates, vitamin D, vitamin D deficiency, dietary

MORPHOMETRY-BASED RADIOMICS FOR PREDICTING THERAPEUTIC RESPONSE IN PATIENTS WITH GLIOMA FOLLOWING RADIOTHERAPY

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Abstract

Cancers like gliomas are difficult to treat and the complete elimination of gliomas after treatment might not be possible due to their complex and infiltrative nature. Therefore, assessment of therapeutic response after treatment is crucial to determine the future management strategies of such patients. Hence, this study was focused on investigating the potential of predicting therapeutic response in patients with glioma after receiving radiotherapy using a prediction model based on morphometry-based radiomics signature. 105 patients with pathologically confirmed gliomas following radiotherapy were retrospectively evaluated. Astrocytoma, oligodendroglioma, mixed glioma and glioblastoma multiforme were the selected gliomas and they were classified as Grade II, Grade III and Grade IV. The deidentified magnetic resonance images, segmented tumour regions of interest and clinical data were acquired from Brain Tumor Segmentation dataset and Genomic Data Commons Data Portal. Twenty-nine three-dimensional morphometric features were calculated for each patient. The predictive features were selected using Analysis of Variance f-test to construct a morphometry-based radiomics signature. After determining the appropriate machine learning algorithm, a prediction model was developed to predict the therapeutic response and its performance was evaluated. From 105 patients 54% of them were males and 46% of them were females. Their mean age was 51.5 + 14.5. The most predictive twenty features were selected to develop the morphometry-based radiomics signature and tumor grade exhibited the highest contribution. In addition to the morphometric features age, gender, tumor type and grade were also identified as predictive features. Random forest provided the highest accuracy to train the prediction model. An accuracy of 86% and Area Under Curve (AUC) value of 0.91 were achieved when the performance of the prediction model was evaluated. Therefore, the morphometry-based radiomics signature developed in this study could be utilized as a non-invasive biomarker for therapeutic response in patients with glioma following radiotherapy.

Keywords: Glioma, magnetic resonance imaging, morphometry, radiomics, radiotherapy

EVALUATION OF CLINICOPATHOLOGICAL FEATURES ASSOCIATED WITH DNA MISMATCH REPAIR DEFICIENCY IN A COHORT OF COLORECTAL CANCER PATIENTS IN SRI LANKA

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Abstract

Colorectal cancer (CRC) is the third commonest cancer worldwide with a global rise in incidence specially in developing countries. A significant increasing trend has also been reported in Sri Lanka recently. DNA mismatch repair deficient (dMMR) CRC, which shows microsatellite instability (MSI), occurs in Lynch syndrome and around 15% of sporadic CRCs. The detection of these patients is important for prediction of prognosis and therapeutic decision making. Universal screening for MSI status is mandatory in many countries though not done in Sri Lanka due to the lack of resources. This study evaluates the demographic and clinicopathological data of a cohort of patients with CRC with a view to assessing the need for such assessment. This study includes 76 patients with 42 (55.3%) women recruited from four selected tertiary care centres in Sri Lanka. Most tumours (77.6%) were left-sided, and the highest number of patients were observed in the 60-69 years age group (38.2%) with a median age of 63 years, while 26% had early onset CRC defined as occurring at or below 50 years of age. The commonest type was adenocarcinoma NOS (86.8%), followed by mucinous carcinoma (10.5%) and adenocarcinoma with a mucinous component (2.6%). Of the tumours, 89.4% were moderately differentiated, 54.5% were stage T3 and 25.7% had distant metastasis. Three patients had a family history of CRC, eight a family history of Lynch syndrome-related tumours and 20 (26.3%) fulfilled the revised Bethesda criteria for Lynch syndrome. Of this cohort, only one patient had been tested for MSI status and was microsatellite stable. Hence, most patients who fulfilled clinicopathological criteria for dMMR CRC had not been screened for MSI status. This highlights the possible requirement of establishing screening for the same in Sri Lanka. In our further studies, we expect to investigate a larger multicentre cohort for dMMR CRC.

Keywords: Colorectal cancer, cancer demographic data, DNA mismatch repair deficiency, microsatellite instability, lynch syndrome

IMPACT OF ANTHROPOMETRIC PARAMETERS ON SUCCESS RATE OF INTRA UTERINE INSEMINATION

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Abstract

Intrauterine insemination (IUI) is an assisted reproductive technology commonly used to treat subfertility. The impact of anthropometric parameters on the success rate of Intra Uterine Insemination (IUI) is studied with inconclusive results. Even though subfertility is a common health concern among Sri Lankan couples, the anthropometric factors that impact the success rate of IUI are not well reported. The purpose of the investigation is to study the impact of anthropometric parameters on the success rate of IUI. This cross-sectional analytical study was conducted in a selected private fertility clinic in Colombo District from May 2022 to September 2022. A total of 70 couples were selected via the convenience sampling method as per the sample size calculated. Anthropometric parameters of the consented couples were measured and recorded before undergoing IUI and the success of pregnancy was confirmed by beta HCG concentration 14 days post insemination. The ethical approval for the study was obtained from the Faculty of Medical Sciences, University of Sri Jayewardenepura (MLS/9/2022). Data were statistically analysed using Statistical Package for Social Sciences (SPSS) version 26. Independent sample t test was used to compare two groups. The success rate of IUI among the selected couples was 12.85%. The majority of study participants [men (87.1%) and women (81.4%)] were overweight or obese. The mean BMI, waist circumference, waist : hip ratio and mid upper arm circumference of women who were successful in IUI were 24.9±4.6 kg m^{-2}, 79.5±6.6 cm, 0.8±0.04, 34.4±4.3 cm, and among men the parameters were 27.0±3.6 kg m^{-2}, 87.3±8.1 cm, 0.9±0.04 and 38.86±3.5 cm respectively. The mean BMI of the women and men who were not successful in IUI were 26.25±4.6 kg m^{-2} and 27.0±3.8 kg m^{-2} respectively. BMI of women who succeeded in IUI was significantly low compared to the unsuccessful group ($p<0.05$). Other anthropometric parameters were not significant even though they were noticeably low among the successful group. According to the current study, BMI is a significant parameter that impact on the success rate of IUI among women.

Keywords: Intrauterine insemination, anthropometric parameters, IUI success rate, reproductive technology, couple

CONTAMINATION STATUS OF *Escherichia coli* IN RAW AND COOKED POULTRY MEAT

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Abstract

Foodborne infections have been determined as an emerging health problem in many countries. The poultry industry is the fastest growing livestock industry in Sri Lanka. Many studies have recorded on contamination of poultry meat by pathogens. Chicken is a popular type of poultry meat consumed in Sri Lanka. *Escherichia coli* (*E.coli)* is considered as one of the most common causes of food-poisoning outbreaks all over the world. This study aimed to determine the contamination of *E.coli* in raw meat from two different strata in the market; butcher shops and supermarkets and in cooked meat which is cooked in three different cooking methods from five similar households and collected soon after cooking. All the collected samples were transferred directly to the laboratory in an ice box. Isolation and identification of *E.coli* in meat were carried out by the conventional culture methods and confirmatory tests. The presence of *E.coli* was confirmed by Polymer Chain Reaction (PCR) technique with the primers of phoA gene. The antibiotic resistance of isolated *E.coli* was analyzed by Antibiotic Sensitivity Tests (AST). The highest incident rate of *E.coli* among inoculated samples was in raw chicken from butcher shops compared to those from supermarkets. The incident rate of *E.coli* in chicken samples from butcher shops was 80% and 20% in supermarkets. In cooked meat samples, grilled chicken indicated the highest incident rate of *E.coli* (12%) and fried chicken showed no growth. The results indicate the need of applying proper hygienic practices in food outlets to reduce the incidence of food diseases. The different cooking methods apply different effects on the growth of *E.coli.* The antibiotic sensitivity shows the existence of antibiotic-resistant *E.coli* strains in both raw and cooked meat, which is a major health issue due to the failure of medical treatments. PCR confirmed the results of the conventional methods and it is more specific and rapid if directly used.

Keywords: *Escherichia coli*, foodborne infections, PCR, AST, poultry

PARENTS' VIEWS ON THE IMPACT OF ONLINE EDUCATION AT A SELECTED PRIMARY EDUCATION CENTER DURING THE COVID-19 PANDEMIC

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Abstract

Learning is a complex cognitive process that can be improved with motivation. Primary education plays a foundational role and serves as the gateway to secondary education and other levels of education. The traditional classroom education method has been changed into a newer platform of education due to the COVID-19 crisis while causing a major effect on the primary education level. The objective of the study assesses the parents' views on the impact of online education at selected primary education centers during the COVID-19 pandemic. A cross-sectional study was conducted among 137 parents by using the convenient sampling method. Data was collected by using a self-administered web-based questionnaire that was developed by the researchers. Ethical clearance was obtained from the Ethics Review Committee of KIU (KIU/ERC/22/017). The majority were females (77.4%, n=106) and the mean age was 33.21(SD+5.41) years while most of them (38%, n=52) were educated up to a degree level, (67.2%, n=92) of participants belonged to the nuclear family. Most children (46%, n=63) were under the age of 4 years. The majority (59.9%, n=82) were attending nursery and (55.5%, n=76) of them were male. The majority (71.5%) of parents believe that technology support at the child's education center is courteous while 70.8% of teachers adequately measure the progress of the child through an online platform to parents. Most participants (65.7%) agreed that teacher is available to assist their children when needed. The majority reported limited e-learning equipment, and poor internet facilities as are main barriers of 60.6%, and 67.2% respectively. Most of the parents (62%) were overall satisfied with their child's experience in online education during the pandemic but 32.1% were dissatisfied with administrative support. Parents' view of the online learning experience was positive. Mainly limited e-learning equipment and weak internet facilities were barriers.

Keywords: Parents' views, online, primary education, COVID-19, pandemic

HUMANITIES & SOCIAL SCIENCES

EFFECTIVENESS OF SOCIAL SECURITY POLICIES FOR FISHERIES COMMUNITY IN SRI LANKA

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Abstract

The systematic study of public policy is a relatively recent discipline, while studying politics has a long history. However, different definitions attempt to explain the shape of the public policy. According to Dye (2005), "public policy is whatever the government chooses to do or not to do." In the current civil society, citizens' expectations from the government increase the importance of implementing policies for their citizens. Furthermore, Dye (2005) emphasized the importance of implementing social security policies to assist citizens when they face a risk. Due to that reason, in recent decades, there have been various social security policies introduced by various countries, as well as Sri Lanka. However, currently there is a massive discourse among the fisheries community regarding the practice of fisheries social security policies in Sri Lanka. Based on that, the primary objective of this study is to determine whether the social security policies in Sri Lanka for the fisheries sector are effectively implemented to address the issues of the fisheries community. This is a qualitative research based on both primary and secondary data. Purposive sampling method used on selecting Kalpitiya islands as per the research area and primary data collected through conducting in-depth interviews with thirty respondents, including fishermen and women, as well as officers from government and non-government organizations. Secondary data is gathered from books, articles, reports, websites, and other publications. The gathered data analysed using grounded analysis techniques. The study reveals that, social security policies in Sri Lanka for the fisheries sector are not being effectively implemented to address the issues of the fisheries community. Finally, the study suggests, when developing a social security policy for the fishing industry, the government should consider the demands and other opinions of the fishing community.

Keywords: Public policy, fisheries, community, government, social security

SHIFTING CHILDREARING TO SINGLE FATHERS (WITH SPECIAL REFERENCE TO RATMALANA DS DIVISION, SRI LANKA)

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Abstract

Children are expected to grow up in a family setting where both the mother and father play their respective roles in the child's growth and development. In recent years, there has been an increase in the phenomenon of single father families who attempt to ensure their family's sociocultural and economic survival as the head of the household. Males within culture have little opportunity to develop the parenting skills that will aid them in being effective parents. Therefore, the study intends to investigate the challenges faced by single fathers in rearing children. Hence, this study objectives attempt to fulfil the requirement of anthropological approach to study the ability to provide the physical care, academic assistance, household management and meeting emotional needs of children with balancing the personal lives of single fathers. This study is based on 12 single parent fathers and 08 teachers of Ratmalana DS division, Colombo district, Sri Lanka. The qualitative methods and techniques have been applied to collect data including interviews, case studies, focus group discussions and observation methods. Single-parent fathers' involvement in child rearing was, for most of the part (66.66%), limited to a small amount of physical care including playing with children, and leading children to do sports at school. Only (16.66%) of single-parent fathers visit medical officers for children's issues while others (83.33%) send their children with a female member of their kindred. According to the teachers, 100% of positive compliments were identified in children's health, in addition, it was stated that children from single-father-headed households have a more significant amount of participation in sports at school. These children's academic performances were poor according to the teacher's statements. But, according to the registration document analysis, the percentage of regular daily attendance of the children belonging to single-father parents was in a sound stage. In view of the results of the study, few recommendations can be made as follows: Schools must establish guidance and counselling platforms to assist children from single- father households in coping with academic work and completing on an equal footing with children from intact families. Furthermore, single fathers should be counselled so that they can confidently assume their responsibilities to raising children as a single parent.

Keywords: Child rearing, education, personality, single father, socialization

SMALL MACROECONOMIC MODEL FOR THE SRI LANKAN ECONOMY

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Abstract
Today Sri Lanka is facing a severe economic crisis after its independence in 1948. Therefore, the central bank believes that cautious macroeconomic policies focused on domestic economic stability, along with IMF participation, enhanced monetary and fiscal policy coordination, and planned reforms, will accelerate growth in the medium term. Economic policies have various effects on macroeconomic variables, which in turn have several effects on overall economic development. This study aims to develop a small macroeconomic model for the Sri Lankan economy based on the Keynesian national income identity to assess the alternative economic policies, specifically fiscal and monetary policies and predicting their effects on the Sri Lankan economy as a whole, by running different policy scenarios based on the different simulation experiments. The research utilizes Autoregressive Distributed Lag with the Two-stage Least Squares method to estimate the simulation model. The econometric model contains five single equations, six endogenous variables, and three exogenous variables and the study uses time series data from 1991 to 2019. Mean absolute percentage error is used for model validation and the majority of the endogenous variables evaluated have minimal mean absolute percentage errors. Based on the developed model, the study analysed different economic policies to forecast Sri Lankan economic performance from 2020 to 2025. The baseline simulations are evaluated against three policy shocks to assess the model's performance, a 15% increase in government expenditure, a 15% increase in money supply, and mix policy as a 15% rise in government spending and a 15% reduction in the money supply. The results of this study show a positive relationship between fiscal policy implications with economic growth compared with monetary policy implications. In addition, a historical data-based forecasting procedure was adopted over the 2010-2025 period to explore the different behavioral scenarios of government expenditure and money supply. The exercise's outcomes closely indicated Sri Lankan economic performance.

Keywords: Income identity, macroeconomic growth, forecast, modeling, simultaneous equations model

AN ANTHROPOLOGICAL STUDY ON SUBCULTURE IN SRI LANKAN CONTEMPORARY AGRARIAN COMMUNITY (WITH SPECIAL REFERENCE TO *UHANA* AND *DEHIATHTHAKANDIYA* DIVISIONAL SECRETARIAT DIVISIONS IN *AMPARA* DISTRICT)

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Abstract

Agriculture has traditionally been the mainstay of Sri Lanka. A basic feature of farming is that they maintain their own culture and thus the subculture associated with farming. It is a system of customs related to agriculture, and religious beliefs and usage of special vocabulary, etc. are the peculiarities of agricultural subculture. The social, economic, and cultural problems of the contemporary agricultural community have been taken as the research problem of this study. The main objective is to identify the unique features and trends of the contemporary agricultural community. The Applied Anthropological study used 50 farmers as primary data contributors. From judgmental sampling method, *Uhana* and *Dehiaththakandiya* Divisional Secretariats in *Ampara* district were selected. In the religious and social context of the peasantry, beliefs and rituals dominate. These historical individuals may still communicate a unique dialect related to agriculture. It was known as *Kamath Bashawa*. Paddy cultivation can be stated as the main plantation crop, and the quantity of families that cultivate residual plantation crops in addition to it is 69%. It shows that contemporary farmers are gradually moving away from the self-sufficient lifestyle. In their contemporary economic situation, it appears that they are living a problematic life. The reason given by the farmers is the lack of proper income from agriculture. It can be mentioned that they have preserved their own subculture in terms of social, economic, and cultural structures from past to present. Poverty has permeated their culture as a result of severe financial crises, and this community illustrates the characteristics of the culture of poverty.

Keywords: Agriculture, applied anthropology, culture, culture of poverty, subculture

FACTORS AND PREVENTION STRATEGIES BEHIND GENDER - BASED VIOLENCE: A REVIEW OF LITERATURE

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Abstract

Gender-based violence (GBV) is an offense that generally occurs against humanity. This has become an unhidden social problem with several impacts in contemporary Sri Lanka. Even though punishment-based prevention strategies introduced to reduce the offense, it has not effectively worked toward the prevention of GBV. Hence, the identification of prevention strategies for GBV is vital as they might use in contemporary society. This study aims to identify the gendered theoretical underpinning and its prevention strategies of GBV and make recommendations that would be applicable in the Sri Lankan context. Bibliometric analysis has been utilized to find the published literature using the keywords "GBV", and "Prevention of GBV", in the Scopus database. Accordingly, there are 27 literature materials like journal articles and book chapters published in the English language under the Social Science discipline. As per the literature analysis, feminist scholars have discussed the reasons for women's subordination and GBV. Liberal feminists view "all forms of oppression are extensions of male supremacy" while Marxist feminists see women's subordination and oppression as a systemic failure of capitalism. Scholars have also argued that GBV is not a result of subcultural violence or deranged men but is related to normal patterns of male behaviour. Radical feminists argue that interacting male violence with the patriarchal structure has crucial effects on this setting. As per the prevention of GBV, Scholars have suggested in-depth evaluations of programs promoting gender equity, Social and Emotional Learning, and community-level changes in attitudes regarding gender norms. Organizational-level changes in the integration would be beneficiary in advance. In the Sri Lanka context, Community-level changes in attitudes regarding gender norms and organizational-level changes can be applied to Primary, Secondary, and higher education curricula. Further, adhering to gender norms and prevention strategies for GBV would be more effective than punitive methods.

Keywords: Gender-based violence, feminists, prevention strategies, literature, Sri Lanka

PROTECTION OF SRI LANKAN WORLD CULTURAL HERITAGE SITES; LEGAL CONTRIBUTION THROUGH ANTIQUITIES ORDINANCE NO.9 OF 1940 AND CENTRAL CULTURAL FUND ACT NO.57 OF 1980

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Abstract

UNESCO World Heritage Convention (WHC) came into being in 1972 in Paris after a lengthy discussion process, to protect thousands of world heritages spread across the world. UNESCO world heritage list has declared six world cultural heritage sites in Sri Lanka. Sri Lankan government signed WHC in 1980. The main principle of the WHC is that once a heritage site is recognized thereunder, such heritage site becomes a world heritage and its protection becomes a duty of the international community as a whole. Antiquities Ordinance (AO) No.9 of 1940 and Central Cultural Fund Act (CCFA) No.57 of 1980 can identify as a major local legislation for the protection of cultural heritages in Sri Lankan legal framework. Once a site is identified as a world heritage site by UNESCO, a duty is cast on the state where the site is located to protect and maintain the site, not only for the citizens of that state, but also for the entire world and for the future generations to come. The objective of this research is to analyse, whether adequate measures have been taken by Sri Lanka as a state party to WHC for the protection and maintenance of the world cultural heritage sites. In order to do so, the current legal frame work consisting the above legislation and their strengths and weaknesses will be evaluated. The research methodology is qualitative and comparative in nature. The measures taken by the state, including the local legislation for the protection and management of world cultural heritage sites will be analysed and compared with the standards set out in WHC. The study will adopt an analytical descriptive methodology, with the focus on legal aspects. As the outcome, it will be seen that there have been certain recent developments in this area of law, such as declaring the offences under AO as non bailable offenses, and establishing the central cultural fund through the CCFA, which can be considered as progressive steps. However, the study will demonstrate that in general, the present legislation in Sri Lanka does not contain a satisfactory, up to date and comprehensive approach towards the protection of cultural property, beyond the protection of antiquities, and therefore will require more in depth reforms which are in line with the present international standards.

Keywords: World cultural heritages, Sri Lanka, protection, antiquities ordinance, central cultural fund act

LAKSHMI PLAQUES IN SRI LANKA; WITH SPECIAL REFERENCE TO NUMISMATIC SOURCES

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Abstract

This research aims to study, especially the diversity, and the religious pantheon of Lakshmi plaques. The numismatic sources found through archaeological excavations provide evidence of metallic rectangular-shaped coin, which is designated as Lakshmi plaques. These can be dated back to the 2nd century BC (Before Christ) and had a wide distribution within Sri Lanka, especially centred around the monasteries and Southern province of Sri Lanka. Even though coins and currencies have been subjected to the archaeological research field in Sri Lanka, a few writings were found on Lakshmi plaques. A literature-based secondary analysis was carried out to gather data on Lakshmi plaques; especially the numismatic sources and excavation reports (published during the past 5 years) were used. The establishment of the diversity of the Lakshmi Plaques was done based on the size and weight (ranges from large to small sizes), technology and the metal type. These can be distinguished into two categories as; engraved symbols and moulded symbols on copper alloys. Also, these are catalogued according to their dimensions. The Lakshmi plaques were rectangular in shape and differ from other forms of coins circulated in Sri Lanka. It represents two different angles of the goddess Lakshmi as in standing or seated on the obverse of the coin. The coin with the standing image has two elephants on either side of the goddess and is titled *Gaja Lakshmi* coin and the other coin with the seated image is generally called the *Sri Lakshmi* coin. The reverse of the coin is mainly engraved with a railed swastika which has turned to the right side of the coin. The Lakshmi stands for prosperity and wealth combined with the concept of 'fortune', which is also responsible for merchants, especially in the South Asian region. The Lakshmi plaques found in Sri Lanka have their own origin and are not Indian based given the fact that the railed swastika is a symbol of the local dynasty. Apart from very few specimens, considering the pierced outer appearance, most of the coins of the Lakshmi series are in worn condition. Archaeologists assumed that people had indeed worn it as a piece of jewellery given the fact of visible crucial features including bent and folded pieces. These bent and halved goddess plaques occur in all layers from the 1st century BC to the 7th century and the reason for this treatment of plaques has to be sought in the sphere of Hindu or Buddhist ritual action, practised unchanged for centuries. It is highly unlikely that the plaques would have been treated based on a religious pantheon if they were not used as money. Therefore, it has been assumed that the Lakshmi plaques as non-monetary functions given the fact on unrecognizability of circulation and non-visible weight standard of these specimens.

Keywords: Lakshmi plaques, coins, archaeology, religious pantheon, numismatics

MEDITATION WALK-WAYS IN RAJAGALA MONASTERY

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Abstract

Rajagala is an ancient cave-dwelling Buddhist monastery complex in the eastern province of the country, constructed by King Lajjitissa (119–109 BC), which was inhabited by more than a hundred monks during the Anuradhapura period. According to the evidence, the monks predominantly had been practicing meditation in cave dwellings, and there was enough uninhibited space to practice meditation outside of the premises aligned with the code of discipline (Vinaya). Also, on the west side of the monastery, which is identified as an abandoned area where rock outcrop can be seen without forest cover, can see more than fifteen walking pathways (Chankamana) associated with unidentified buildings, arranged as a separate areas for some practices for the monks. This study set out to answer the questions "why they used the restricted area to practice walking meditation and had Buddhist discipline has been used to construct the walking meditation pathway" Furthermore, the main objective is to identify the location and characteristics of a walking meditation pathway in line with the code of discipline (Vinaya). Combining quantitative and qualitative approaches, systematic survey methods were used to gather primary data, and based on Vinaya Pitaka and other secondary sources, they define traditional construction methods used in ancient times. For the analysis of the data, the detailed scale drawing of each pathway and relevant literary sources were cross-referenced. The results of the analysis define each walking meditation pathway in a solitary complex as used in the open walking method, and it had been constructed in three types: the high (30m), medium (20m), and low (15m) in length and width generally seen at 3m, with disclosed evidence, the concept of design and measurement are aligned with the code of discipline as well as traditional Buddhist architecture. The meditative monks have prioritized walking meditation to achieve their purpose and have carefully observed the Vinaya in carrying out the necessary constructions to implement the related practices.

Keywords: Buddhist monastery, Chankamana, meditation pathway, Rajagala, solitary complex

AN ANTHROPOLOGICAL COMPARATIVE STUDY ON THE MALE AND FEMALE TEEN VIDEO GAMERS (BASED ON KOTTAWA/SOUTH GRAMA NILADHARI DIVISION)

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Abstract

Many explanations can be identified for feminism and masculinism. Most of the past philosophical perspectives have been posited about the difference of gender, not only among humans but also among animals. Although the present scientific pieces of evidence have indicated the importance of both males and females for the existence of human life as well as animal life and there can be both negative and positive viewpoints regarding the so-called gender differences. There are many discoveries have been invented to make daily human tasks easier. Since there are both benefits as well as damages to human life, people have to adjust to the present changing world. Video gaming has been identified as one of the most popular activities among present teenagers. The history of video gaming started in 1940 when Edward Condon designed a computer that could play a game called "Nim" with one player (History of Video Games - Four Decades of Video Entertainment, 2010). The first home video game, "Space Odyssey", was created in 1972 and in 1993, the release of "Mortal Combat" forced the US Government to start rating the games based on their violence level (History of Video Games - Four Decades of Video Entertainment, 2010). The first game with a female protagonist appeared in 1996 known as "Tomb Raider" and it became one of the most popular games in video game history afterward, Will Wright created a game called "The Sims" in 2000 which has been the most popular game among the female players at that era (Kondrat, 2015). However, the study elaborated more on the comparison of male and female teen video gamers in the Kottawa/South Grama Niladhari Division. The intentions of playing video games and their features were basically focused on here.

Keywords: Addiction, gender differences, teenagers in Sri Lanka, video gaming, video gamers

DOES ORGANIZATIONAL CULTURE IMPACT ON EMPLOYEE LOYALTY IN PRIVATE BANKING SECTOR: A STUDY BASED IN WESTERN PROVINCE

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Abstract

Organizations now recognize the need of investing in their people if they want to continue providing value to its' clients. This research set out to quantify the effect organizational culture has on loyalty of the private bank employees in Sri Lanka's Western Province. Employee loyalty was used as the dependent variable, while the organization's culture was examined as the independent variable along four dimensions: managerial culture, open working environment, incentives and perks, and training and development. Data was gathered by self-administered questionnaires on a 5-point Likert scale from 374 bank employees chosen via simple random sampling. The effect was evaluated by a multiple-regression model. Regression results shows that model and all independent variables are significant at 95 % confidence level. Based on the findings, improving the openness of management choices; providing value to a person's professional development; the positive culture with opportunities will help the bank's decision-making and planning; associated with people-centred ideas, which guide managers and to act in the best employees' interests of stakeholders. Schedule job-related training to satisfy the employer's and workers' goals. According to the findings, banking sector ought to offer a lot of specialize in their training and development and policymakers should recognized, develop a strong policy firework to facilitate developing organizational culture that facilitate increasing employee loyalty. Management of the banking sector can use these findings to introduce systems to increase the collaboration among staff to straighten the relationships.

Keywords: Banking sector, employee loyalty, organizational culture, reward, benefits

AN INVESTIGATIVE STUDY OF THE ENVIRONMENTAL PROBLEMS AND BUDDHIST METHODS IN SOLVING IT

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Abstract

Environment means anything that compasses us and it is included every living and non-living things. Human is the fundamental responsible person of the destruction and also protection of the environment. There are disastrous environmental issues that can lead to loss of human life. Air pollution, water pollution, land pollution, global warming, climate change, ozone subscale depletion are among them. This research investigates the environmental problems of society and the Buddhist methods in solving it. Source study was mainly used to obtain information for this research. Information was obtained using primary and secondary sources, journals, encyclopaedias, and used a qualitative data analysis method using above sources. The main objective is studying the Buddhist methods useful in solving the environmental problems. Investigating the environment and its importance, Study of environmental destruction, Buddhist view towards the environment and the methods of Buddhism to prevent environmental destruction are sub objectives of this research. Buddha is the most brilliant environment scientist. Buddha's life and his teachings had a strong bond with environment as it is revealed in Tripitaka and other Buddhist literary sources. Utmost Buddhists believe that man need to live and admire the cycle and balance in nature. These can continue for unborn generations. Buddhism explains the idea of inter- relatedness of all phenomena. Accordingly, humans depend on nature while nature depends on humans. In the world, the total of the environmental aspects are well profit. So, Buddhist teachings can be used to find out a result to the environmental problems. Fundamental teachings that Buddhism includes: Eightfold path, Five precepts, and Karma etc. are important here. Thus, by not acting thoughtlessly Buddhists can defend the environment from destruction.

Keywords: Buddhism, destruction, environment, problems, solutions

THE IMPACT OF POLITICAL SYSTEM ON FOREIGN POLICY DECISION MAKING IN SRI LANKA

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Abstract

Internal and external factors have a very special place in the formulation of the foreign policy of a state. Among internal factors, the political system, religion, political parties, pressure groups, and public opinion are important. Among these internal factors, the political apparatus is unique because it has official ownership of foreign policy decisions. Accordingly, the political mechanism has a special place among the factors influencing the decision of foreign policy in Sri Lanka. Therefore, this research is practically important in the Sri Lankan context. The main objective of this research is to study the impact of the political system and its performance as a major domestic variable affecting Sri Lanka's foreign policy decision-making. As the methodology of this research, secondary data had been used. In order to collect secondary data, Books, journals, newspaper articles, Sri Lankan government reports, data bases, Parliamentary reports, Party Constitutions, election manifestos, previous research publications, opinion papers and web sites have been used. The Ministry of Foreign Affairs, the President, and the Cabinet are the main institutions of Sri Lanka's foreign policy decision-making mechanism. But a standard, accurate and unanimous process is not used in Sri Lanka to take foreign policy decisions. Therefore, although the government machinery is engaged in the foreign policy decision-making work of Sri Lanka, the foreign policy decisions end up being based on common consensus after bargaining rather than logical methods. Since there is no system to measure the progress of the decision reached in that agreement, it has directly affected the future of the country. Due to the lack of a proper decision-making mechanism, Sri Lanka's foreign policy decision-making process has become unstable and conflicting in nature. In order to take foreign policy decisions with proper direction in Sri Lanka, an official hierarchy of field experts and a proper procedural bureaucracy should be formed, and it should be made an institution accountable to the Legislative Assembly.

Keywords: Decision making, foreign policy, internal factors, political system, Sri Lanka

A STUDY ON UNIVERSITY STUDENTS' ATTITUDES TOWARD INFORMATION AND COMMUNICATION TECHNOLOGY BASED ON GENDER

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Abstract

This research examined the attitudes of university students toward information and communication technology based on gender. Accordingly, the primary objective of this study was to find out whether there is a significant difference in the attitudes of university students toward information and communication technology based on gender. To fulfill the research objective, a group of 100 undergraduates of the Faculty of Humanities and Social Sciences of the University of Sri Jayewardenepura was selected as the sample. The sample consisted of 50 females and 50 males. The sample was selected using the convenience sampling technique. A structured questionnaire was used to collect the relevant data. The second part of the questionnaire examined the attitudes of students toward information and communication technology by using the Likert Scale. SPSS Version - 26 has been used to analyze the collected data. Accordingly, an Independent Sample T-test was conducted to find out whether there is a difference in the attitudes of university students towards information and communication technology based on their gender and it recorded a value of ($0.001 < 0.05$) which lead to rejecting the null hypothesis. Accordingly, the alternative hypothesis was accepted by concluding there is a significant difference in the attitudes of undergraduates toward information and communication technology by gender. This study discovered that there are differences between university students' attitudes about information and communication technologies depending on their gender. Accordingly, the university should make necessary arrangements to develop an interest in the information and communication technology of undergraduates to carry out educational activities more effectively and efficiently. Furthermore, as views differ based on gender, it is important to take measures to reduce gender disparities. The researcher recommends suggests holding programs and lectures for students to disseminate basic knowledge in information and communication technology. This study is important for those in charge of creating university curricula to enhance undergraduate students' knowledge and skills in information and communication technology in Sri Lanka.

Keywords: Attitudes, gender, information communication technology, university students, COVID-19

THE IMPACT OF SPIRITUAL INTELLIGENCE ON JOB SATISFACTION OF IT PROFESSIONALS IN SRI LANKAN IT COMPANIES

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Abstract

Job satisfaction has been identified as one of the most researched yet one of the key issues managers face in contemporary organizations. A number of critical factors influence an employee's satisfaction with his or her job in an organization. The growing concern of finding the meaning of life and work for an employee with recent fast-paced intensifying work-life models and the limited number of studies in both local and international IT contexts paved the way to lay emphasis on the role of Spiritual Intelligence (SI) as a concept started gaining prominence in the recent era with relating to Job Satisfaction (JS). Measurements of the present study were made using the four dimensions of SI as developed by King (2008) and the three dimensions of JS as developed by Schmidt (2004). Gender was taken as the moderating variable since the studies examined the gender differences in the above relationship found to be even less. A cross-sectional survey including a self-administered electronic questionnaire was adopted as the research instrument to gather data from a sample of 383 IT professionals. Based on the evidence of Lonska et al. (2021) snowball sampling was used as the sampling method. As the collected data gathered through the questionnaire is converted into a numerical platform, the quantitative method is applied. The Pearson correlation coefficient, and simple linear regression were performed by using SPSS version 26. Evidence from this study reveals that spiritual intelligence is a significant determinant of job satisfaction. In addition, a positive moderate correlation with a linear relationship resulted between these variables yet no significant difference between males and females was found. Accordingly, this study's findings bring attention to making aware the managers to increase their efforts in supporting the development of employee spirituality in building a value-oriented organization where SI plays a major role in individual value formation to promote employee job satisfaction.

Keywords: Gender, IT companies, IT professionals, job satisfaction, spiritual intelligence

SYMBOLIC REPRECENTATION OF *SAPU* FLOWER IN SIGIRI FRESCOES

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Abstract
Flowers are spectacular creations of the universe, which are used closely in art and literature. Artists use flowers to embellish and enhance the concept portray in paintings. In Sri Lankan traditional paintings, commonly used flowers were Lotus, *Sal*, *Kadupul*, *Sapu*, *Wetakeiya* and *piccha*. Sigiri frescoes are one of the oldest evident art traditions in Sri Lanka. Symbolic representation of *Sapu* flower in Sigiri Frescoes is investigated in this research. The study is conducted with reference to sigiri frescos paintings. As secondary source material, Sigiri Graffiti will be investigated. Objective of this research is to identify the symbolic representation of *Sapu* flower and analyze the concept of visual manifestation in terms of perception and emphasis given to it. Manifestation of *Sapu* can be identified with its delicate and seductive fragrance, soothing yellow hues with subdued texture, which holds a sacred place specially in Hinduism and Buddhism.

Keywords: Sapu, Sigiri frescoes, Sigiri graffiti, symbolic representation, visual manifestation

PROTECTION OF THE RIGHTS OF SURROGATE MOTHERS IN SRI LANKA: A LEGAL PERSPECTIVE

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Abstract

Infertility among married couples is a major problem that affects their marital and social life. As per the World Health Organisation's (WHO) data, the situation has changed radically during the last two decades due to the consolidation of Assisted Human Reproduction Techniques (AHRTs). Among them, surrogacy is arguably the most controversial Assisted Human Reproduction Technique, which is a contractual undertaking whereby the surrogate mother impregnates by assisted conception, carries the resulting fetus, and relinquishes all parental rights of the child at birth. According to the reported information on the internet, throughout the last years, Sri Lanka has been experiencing a high rate of increasing incidents regarding the surrogacy practice. The country's existing legal framework neither expressly recognizes nor prohibits surrogacy arrangements, making Sri Lanka as a favourite destination for commercial surrogacy, even for foreign couples in the near future. The Penal Code of Sri Lanka indirectly addresses and allows the altruistic surrogacy arrangements through the amendment made to the penal code in 1995, under sexual offences and human trafficking. However, due to the lack of specific legislation, the judiciary has to decide the cases based on traditional contract law, criminal law, and other laws in the country. Although the Sri Lanka Medical Council established a provincial code of practice in 2005 to regulate Assisted Reproductive technologies, it does not provide legal protection for the parties involved in such practices. It has been identified that the surrogate mother is the most vulnerable party whose rights are consistently violated in the surrogacy practice, among other parties involved in the surrogacy agreement. Therefore, adopting the qualitative research methodology, which involves two methodological approaches; black letter methodological approach of research and international and comparative research methodology, this study discusses the problem of protecting the rights of surrogate mothers by exploring the inadequacy of available laws in terms of domestic and international obligations. Enacting special legislation for the regulation of Assisted Reproductive Technologies based on human rights perspective, particularly highlighting the rights of the parties involved in the surrogacy arrangement, is the primary recommendation on this matter. Finally, this research makes suggestions to enhance the domestic legal regime through the transparent lens of human rights and progressive developments of Indian Jurisdiction.

Keywords: Human rights, law reform, Sri Lanka, surrogate motherhood, penal code

A GIS ANALYSIS OF EVALUATION OF URBAN LAND IN MATARA MUNICIPAL COUNCIL AREA

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Abstract

The assessment of land value and its spatial variation with other factors in urban areas is the emphasis of urban land evaluation, which also supports the identification of various land value zones in urban areas. The degree to which various factors affect the value of land is revealed by the land evaluation model. Planners and decision-makers need to consider these spatial variances. Due to its complexity, urban land cannot be evaluated similarly to rural land. Spatial variations of urban land value is significantly determined by proximity and density factors. When applying weights for each factor, those might be arranged according to their relative importance. Multi-criteria evaluation combined with geographic information systems (GIS) is used for land evaluation and the pairwise comparison method is used to give weights while expert opinions are used to calculate weights. This study aims to evaluate urban land using MCE and GIS based methodologies. The case study area is the Matara Municipal Council Area. Five 1:10,000 base maps are used for developing criterion maps after reviewing the literature. Based on socioeconomic, physical, and environmental factors, 13 criterion maps were developed using base maps. The weights in each factor were determined using the pairwise comparison approach based on expert judgments. To develop a land evaluation model, Arc GIS weighted overlay analysis tool, and Model Builder were used. Different land value zones, including most valuable, more valuable, less valuable, and least valued, were identified using the final land evaluation map. This final map shows spatial variation of land value categories thus making it immensely useful for planners and decision-makers to make decisions in urban planning.

Keywords**:** Urban land value**,** land evaluation, multi-criteria evaluation, pairwise comparison, weighted overlay

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[1]අපරාධ විද්‍යා හා අපරාධ යුක්ති අධ්‍යයනාංශය,
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සාරසංක්ෂේපය

පුද්ගලයාට එරෙහිව සිදු වන අපරාධ අතරින් එක් අපරාධයක් ලෙස ළමා අපයෝජනය හඳුනාගත හැකි ය. දෙමාපියන් හෝ වෙනත් වැඩිහිටියන් විසින් ළමයින්ට අඩත්තේට්ටම් කිරීම හා ලිංගික වශයෙන් පීඩාවට පත් කිරීම ළමා අපයෝජනය ලෙස හඳුන්වයි. විවිධ හේතු මත වර්තමානය වන විට ළමා අපයෝජනය ලොව පුරා වර්ධනය වෙමින් පවතී. ශ්‍රී ලාංකේය සමාජය තුළ ද ළමා අපයෝජනය සැලකිය යුතු මට්ටමකින් වර්ධනය වෙමින් පවතී. 2020 පළමු දින 60 තුළ ජාතික ළමා ආරක්ෂක අධිකාරියට ළමා අපයෝජන සිද්ධි 2500කට අධික සංඛ්‍යාවක් ලැබී ඇති අතර 2021 වර්ෂයේ පළමු දින 60 තුළ වාර්තා වී ඇති සිද්ධි සංඛ්‍යාව 3660කි. ජනාධිපති ලේකම් කාර්යාලය මඟින් පිහිටුවා ඇති 'ප්‍රතිපත්ති පර්යේෂණ හා තොරතුරු ඒකකය' මඟින් පෙන්වා දෙන පරිදි ගැහැනු ළමුන්ගෙන් (20%)ක් ද, පිරිමි ළමුන්ගෙන් (10%)ක් ද, ළා-බාල වයස්වල දී ලිංගික අපයෝජනයන්ට ගොදුරු වන අතර දුප්පත්කම හා විසිරී ගිය පවුල් පසුබිම හේතුවෙන් දරුවන් වීදි දරුවන් බවට පත් වේ. මේ අනුව ළමා අපයෝජනය කෙරෙහි විවිධ සමාජීය, ආර්ථික හා සංස්කෘතික හේතු බලපාන අතර එයින් එක් හේතු සාධකයක් ලෙස මව්වරුන්ගේ විදේශගත වීම හඳුන්වා දිය හැකි ය. මෙම අධ්‍යයනයේ ප්‍රධාන අරමුණ වූයේ මව්වරුන්ගේ විදේශගත වීම හා ළමා අපයෝජනය අතර ඇති අන්තර්-සම්බන්ධතාව හඳුනාගැනීම ය. මෙම අරමුණු අනුව අධ්‍යයන ක්ෂේත්‍රය ලෙස වයඹ පළාතේ කුරුණෑගල දිස්ත්‍රික්කයේ පන්නල පොලිස් බල ප්‍රදේශය තෝරාගත් අතර මව්වරුන් විදේශගතව සිටිය දී අපයෝජනයට පත් ළමයින් 30ක් පරමාර්ථගත නියැදි ක්‍රමය යටතේ තෝරා ගන්නා ලදි. ආකෘතිමය සම්මුඛ සාකච්ඡා ක්‍රමය මඟින් දත්ත ලබාගත් අතර ගුණාත්මක හා ප්‍රමාණාත්මක යන දෙයාකාරයෙන් ම දත්ත විග්‍රහය සිදු කරන ලදි. අධ්‍යයන ප්‍රතිඵල අනුව මව විදේශගතවීමෙන් පසු ව අපයෝජනයට පත් ගැහැනු ළමුන්ගේ ප්‍රතිශතය 87%(26)ක් වන අතර අපයෝජනයට පත් පිරිමි ළමුන් සංඛ්‍යාව 13%(4)කි. පිරිමි ළමුන් සිව් දෙනා ම ශාරීරක අපයෝජනයට ලක් ව ඇත. නියැදිගත ළමුන් අතුරින් 84%(25)ක් ලිංගික අපයෝජනයට ලක් ව ඇත. මේ යටතට ස්ත්‍රී දූෂණය හා බරපතල ලිංගික අපයෝජනය අයත් වේ. අපයෝජනයට පත් දරුවන් සියලු දෙනාගේ කායික හා මානසික බිඳවැටීම වඩාත් සැලකිය යුතු මට්ටමක පවතී. වයස අවුරුදු 10-13 කාණ්ඩයට අයත් අපයෝජනයට පත් දරුවන්ගේ ප්‍රතිශතය 70%(21)කි. අධ්‍යයන ප්‍රතිඵලවලට අනුව දරුවන් මෙලෙස අපයෝජනයට ලක්වන්නේ පවුල තුළ පවතින අනාරක්ෂිත බව හේතුවෙනි. ළමා අපයෝජය කෙරෙහි මව විදේශගත වීම හේතු සාධකයක් වී ඇති බව අධ්‍යයන ප්‍රතිඵල අනුව පැහැදිලි වේ. කුඩා දරුවන් සිටින මව්වරුන් විදේශගතවීමේ දී පවතින විධි විධාන ශක්තිමත් කිරීම මෙහි පළමු පියවර වේ. දරුවන්ගේ සුරක්ෂිතභාවය හා ළමා අයිතිවාසිකම් පිළිබඳව දරුවන් තුළ අවබෝධයක් ඇති කිරීම සඳහා ඒ හා සම්බන්ධ නීති-රීති පාසල් විෂය නිර්දේශය තුළට ඇතුළත් කිරීම වැදගත් වේ.

ප්‍රමුඛ පද: ළමා අපයෝජන, වින්දිතභාවය, විදේශගත වීම, ආනාරක්ෂිත බව, ළමා අයිතිවාසිකම්

හින්දී භාෂාවේ උභය ලිංග නාම පදවල අර්ථ භේදය පිළිබඳ විමර්ශනාත්මක අධ්‍යයනයක්

ප්‍රේමතිලක එච්.අයි.

හින්දී අධ්‍යයන අංශය, මානව ශාස්ත්‍ර පීඨය, කැලණිය විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
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සාරසංක්ෂේපය

නාම පදයක ලිංග භේදය දැකිය හැකි ය. හින්දී භාෂාවේ ලිංග භේදය දෙවැදෑරුම් ය. එනම්, පුරුෂ ලිංගය හා ස්ත්‍රී ලිංගය වේ. පුරුෂ භාවය හඟවන වචන පුරුෂ ලිංගයට අයත් වන අතර ස්ත්‍රී ලිංගය හඟවන වචන ස්ත්‍රී ලිංගයට අයත් වේ. මීට අමතරව අචේතනවාචී අර්ථ පද ද හින්දියේ ස්ත්‍රී ලිංග සහ පුරුෂ ලිංග ගණයට අයත් වේ. එනම්, හින්දියේ පවතින්නේ ව්‍යාකරණික ලිංග භේදයකි. අධ්‍යයනයේ පහසුව සඳහා අචේතනවාචී නාම පදවල ලිංග නිර්ණය විවිධ සාධක යටතේ සිදු කරනු ලබයි. හින්දී භාෂාවේ ඇතැම් නාම පද පුරුෂ ලිංග හා ස්ත්‍රී ලිංග රූප ද්විත්වය ම ගනු ලබයි. එවැනි උභය ලිංග නාම පදවල රූපීය වෙනස් වීමක් නොමැතිව අර්ථය අනුව ලිංගය වෙනස් වන්නේ කෙසේ ද සහ ඉන් හින්දී වාක්‍ය සංස්තිථියට සිදු කරනු ලබන අර්ථමය බලපෑම කවරේ ද යන්න අධ්‍යයනය කිරීම මෙම පර්යේෂණයේ අරමුණ විය. මෙම පර්යේෂණයේ ගැටලුව වන්නේ හින්දී උභය ලිංග නාම පදවල අර්ථය අනුව ලිංගය වෙනස් වීමට ලක් වන්නේ ද යන්නයි. මෙම අධ්‍යයනය සඳහා හින්දී භාෂාවේ උභය ලිංග නාම පද පර්යේෂණ නියැදිය වශයෙන් තෝරා ගනු ලැබී ය. මෙහිදී ප්‍රධාන වශයෙන් ශබ්ද කෝෂ සහ පොත්පත් ආශ්‍රයෙන් තොරතුරු රැස් කර ගන්නා ලද අතර ස්වභාෂකයන් ලවා එම දත්ත තහවුරු කර ගන්නා ලදී. දත්ත විශ්ලේෂණය හින්දී භාෂාවේ ලිංග භේද නිර්ධාරණය අනුව සිදු කරන ලදී. මෙම අධ්‍යයනය මඟින් හඳුනාගත් ප්‍රධාන කරුණ වන්නේ හින්දියේ උභය ලිංග නාම පදවල ලිංග භේදය හටගන්නා විට එහි අර්ථ භේදය ද සිදුවන බවයි. ඒ අනුව හින්දී භාෂාවේ උභය ලිංග පද පවතින බවත්, ඒවායේ ලිංගය සන්දර්භයට අනුකූලව වෙනස් වන බවත්, එමගින් වාක්‍ය සංස්තිථියේ ප්‍රස්තුතයට සහ ආඛ්‍යානයට ව්‍යාකරණාත්මක බලපෑම් ඇති කරන බවත් නිගමනය කළ හැකි ය.

ප්‍රමුඛ පද: අචේතනවාචී වචන, අර්ථ භේදය, උභය ලිංග පද, ලිංග භේදය, හින්දී භාෂාව

දේශීය ශාන්තිකර්මයන්හි නිරූපිත ඊශ්වර දේව වන්දනය පිළිබඳ අධ්‍යයනයක්

රණවීර ඩබ්ලිව්.වී.පී.එච්.

භාෂා, සංස්කෘතික අධ්‍යයන හා ප්‍රාසංගික කලා අධ්‍යයනාංශය,
මානවශාස්ත්‍ර හා සමාජීයවිද්‍යා පීඨය, ශ්‍රී ජයවර්ධනපුර විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
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සාරසංක්ෂේපය

හින්දු සමයෙහි මහා දෙවියා වන ශිව හෙවත් ඊශ්වර, දේශීය ශාන්තිකර්මයන්හි පුද ලබන ආකාරය හඳුනා ගැනීම මෙම පර්යේෂණයේ මුඛ්‍ය අරමුණ විය. ඊශ්වර දෙවියන් ශාන්තිකර්මයන්හිදී මූලික හින්දු ලක්ෂණ සහිතව ම පුද ලබන්නේ ද නැතහොත් දේශීයකරණයට ලක්වූයේ ද යන්න අධ්‍යයන ගැටලුව විය. මෙය ගැමි ආගමික විඤ්ඤාණය අනාවරණය කෙරෙන මානවවංශ පර්යේෂණයකි. දත්ත රැස් කිරීමේදී හිමබෝල නියැදි ක්‍රමය යොදා ගනිමින් ශාන්තිකර්ම ඇදුරන් සමග සම්මුඛ සාකච්ඡා පැවැත්වීමත්, තෝරාගත් ශාන්තිකර්ම නිරීක්ෂණය කිරීමත්, සාහිත්‍යයික මූලාශ්‍රය පරිශීලනය කිරීමත් සිදුකරන ලදී. දත්ත විශ්ලේෂණය තේමාත්මක විශ්ලේෂණය යටතේ ගුණාත්මක ක්‍රමවේදයට සිදු කෙරිණි. හින්දු ත්‍රිමූර්තිගත දෙවිවරුන් අතර නාශක දෙවියා වූ ශිව, සිංහල ගැමි සංස්කෘතිය තුළ ඊශ්වර, ඉසිවර හෝ ඉසුරු යන නම්වලින් ප්‍රකට ය. ශාන්තිකර්මයන්හි පුද ලබන සෑම දෙවි කෙනෙකු ම ගැමි ආගමික විඤ්ඤාණයේ උපරි තලයෙහි සිටින බුදුරජාණන්වහන්සේට යටත් වූ දේව ධුරාවලියට අයත් සමාජිකයකු බවට පත් වෙයි. ඊශ්වර දෙවියන් ද ශාන්තිකර්මයන්හි පුද ලබන්නේ එපරිද්දෙනි. ඇතැම් හින්දු දෙවිවරුන් ගැමි ආගමට සම්බන්ධ කිරීමේදී දේශීය ලක්ෂණ අරෝපණය කර ඇත. එහෙත් ශිව දෙවියන් ශාන්තිකර්මවල පුද ලබන්නේ හින්දු ශෛව සම්ප්‍රදායානුගත මහා දෙවියාගේ භෞතික හා අභෞතික ලක්ෂණ ඒ අයුරින් ම පිළිගනිමිනි. ශිව දේව සංකල්පයට අනන්‍ය වූ මූලික ලක්ෂණ, රූපාකෘති මෙන් ම හින්දු ආගමික පුරාණෝක්ති ද ශාන්තිකර්ම පුද පෙළපාලිවල යෙදේ. බලි යාගය හැරුණු කොට යක්ෂ හෝ දේව ශාන්තිකර්ම කිසිවක් ඊශ්වර දෙවියන් අරමුණු කොට නොපවත්වයි. උඩරට හා සබරගමු සම්ප්‍රදායන්ට අයත් ඊශ්වර කල්‍යාණය, නීලකණ්ඨ රාක්ෂ හා සියවටුක වැනි බලි ශාන්තිකර්ම කිහිපයක් ඒ අතර විශේෂ වේ. ඒවායෙහි බලි ඇඹුම්කරණය හින්දු ප්‍රතිමා ලක්ෂණයන්ට සමාන වේ. හින්දු ආගම බෞද්ධ සම්ප්‍රදායට යටත් කොට දැක්වීමත්, ඇතැම් දෙවිවරුන්ගේ ආනුභාවය තීව්‍ර කිරීමත් අපේක්ෂාවෙන් ඊශ්වරයන්ගේ බලය හීනකරවන අවස්ථා කිහිපයක් යක්ෂ හා දේව ශාන්තිකර්මයන්හි හමු වේ. කොහොඹායක්කංකාරි උපත් කථාව, භස්මාසුර පුවත හා අසුර යක්කම ඊට නිදසුන් කිහිපයකි. ගැමි ආගමේ මූලික ලක්ෂණවලට අනුගත වෙමින් බුදුරජාණන්වහන්සේට යටත් දේව ගණයට ඇතුළත් වූ ඊශ්වර දෙවියන් මූලික හින්දු සාම්ප්‍රදායික ලක්ෂණ සහිත ව ම දේශීය ශාන්තිකර්මයන්හි පුද ලබන බව අධ්‍යයනයෙන් තහවුරු විය.

ප්‍රමුඛ පද: ශිව, ඉසුරු, පුරාණෝක්ති, ගැමි ආගම, බලි යාගය

මිනිස්-රිලා අන්තර්ක්‍රියා සහ වගා හානි අවම කිරීමේ ක්‍රියාමාර්ග තුළින් තිරසර කෘෂිකාර්මික පද්ධතියක් නිර්මාණය කිරීම පිළිබඳ මානව විද්‍යාත්මක අධ්‍යයනයක්

ජයරත්න එස්.ඩී.වයි.[1*] නහල්ලගේ සී.ඒ.ඩී.[2] හෆ්මන් එම්.ඒ.[3]

[1]පශ්චාද් උපාධි අධ්‍යයන පීඨය, ශ්‍රී ජයවර්ධනපුර විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
[2]මානව විද්‍යා අධ්‍යයනාංශය, ශ්‍රී ජයවර්ධනපුර විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
[3]සමාජ පද්ධති පරිණාමීය අංශය, ප්‍රිමාටා පර්යේෂණ ආයතනය,
කියෝතෝ විශ්වවිද්‍යාලය, ජපානය
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සාරසංක්ෂේපය

ප්‍රිමාටාවන් යනු ක්ෂීරපායී වර්ගයේ එක් ගෝත්‍රයක් වන අතර පොදුවේ රිලවුන්, වඳුරන්, වානරයන් හා උණහපුළුවන් මේ ගණයට අයත් වෙති. මිනිසා අයත් වන්නේද ප්‍රිමාටා ගෝත්‍රයට වන අතර අවශේෂ ප්‍රිමාටාවන් මිනිස් නොවන ප්‍රිමාටාවන් ලෙස හඳුන්වයි. රිලවුන්ගෙන් සිදු වන වගා හානි පාලනය කිරීම පිණිස මිනිසා භාවිත කරනු ලබන උපක්‍රම මොනවාද යන්න අධ්‍යයනය කිරීම මෙම පර්යේෂණයේ එක් ප්‍රධාන අරමුණක් වෙයි. කුලියාපිටිය ප්‍රාදේශිය ලේකම් කොට්ඨාසය අධ්‍යයනය සඳහා යොදා ගනු ලැබූ අතර සම්මුඛ සාකච්ඡා, නාභිගත කණ්ඩායම් සාකච්ඡා සහ සහභාගීත්ව නිරීක්ෂණ මඟින් දත්ත එකතු කිරීම සිදු කරන ලදි. ප්‍රදේශයේ තෝරාගත් ගොවීන් සහ ගම්වාසීන් 875 දෙනෙකුගෙන් දත්ත රැස්කරන ලදි. දත්තදායක වගාකරුවන්ට අනුව යන්ත්‍ර-මන්ත්‍ර, කෙම් ක්‍රම භාවිතය, ආදී සාම්ප්‍රදායික උපක්‍රමයන්ද රිලවුන්ගේ පැමිණීම වැළැක්වීම උදෙසා භාවිත කරනු ලබයි. කාලානුරූපීව මෙකී ක්‍රම භාවිතයේ අඩු-වැඩි වීමක් වාර්තා විය. මීට අමතරව වායු තුවක්කු, වෙස් මුහුණු ආදී නවීන උපක්‍රමද මොවුහු භාවිත කරති. එහෙත් මෙම එකඳු ක්‍රමයක්වත් දිගු කාලීනව සාර්ථක නොවන බව පසක් විය. ඊට හේතුව නම් රිලවුන් ඉතා ඉක්මනින් එම උපක්‍රම සඳහා අනුගත වීමයි. සාම්ප්‍රදායික උපක්‍රමවල ඇති වැදගත්කම වන්නේ ඒවා රිලවුන්ට හානිදායක නොවීමයි. රිලවුන් වගාහානි පමණක් නොව දේපළ හානිද සිදු කිරීමෙන් නිගමනය කළ හැකි වන්නේ ඔවුහු ආහාර සඳහා පමණක් ගම්වැදීම සිදු නොකරන බවත් මානව ජනාවස අසල සැරිසැරීමට වඩාත් වැඩි කැමැත්තක් දක්වන බවත් ය. කෘමීන් වැනි කුඩා ප්‍රමාණයේ පළිබෝධකයන් මර්දනය කිරීමට රිලවුන් විසින් සුවිශේෂී කාර්යභාරයක් සිදු කරනු ලැබූවද රිලවුන් විසින් සිදුකරනු ලබන වගා හානිය ඊට වඩා සුවිසල් ගැටුම් නිර්මාණය කරයි. එමෙන්ම රිලවාට අමතරව වෙනත් සතුන්ද වගාහානි සඳහා හේතු වුවද එම වගාහානිද රිලවුන් විසින් සිදු කරන ලද වගාහානි ගණයටම අදාළ සේ සැලකීම නිසා වගාකරුවන්ගේ ප්‍රධාන සතුරා ලෙස රිලවුන් ප්‍රචලිත වී ඇත. එපමණක් නොව රිලවුන්ගේ වර්ධනය මර්දනය කිරීම සඳහා භාවිත කරනු ලබන උපක්‍රම බොහෝමයක්ද රිලවුන්ට හානිකර ඒවා වේ. විශේෂයෙන් ම වායු තුවක්කු භාවිතයෙන් මරා දැමීම ආදිය ඒ යටතට අයත් වේ. කෙම් හේතුවෙන් එම සතුන් පීඩාවට පත්වීම අනුමත කළ නොහැකිය. පරම්පරානුගතව පැවත ආ කෙම් ක්‍රම, මන්ත්‍ර ආදිය ජන විඥානය මුසු අස්පර්ශනීය සංස්කෘතික අංගයන් ලෙස තිරසර පරිසර ජෛව සංරක්ෂණය සඳහා ද උපකාරී වේ. රිලවුන් පාලනය කිරීමට භාවිත කරනු ලබන උපක්‍රම අතුරින් දත්තදායකයන් වඩාත් ප්‍රිය කරන උපක්‍රමය පිළිබඳව විමසීමේ දී දත්තදායකයන් අතුරින් 48% (n= 420)ක ප්‍රතිශතයකගේ අදහස වූයේ නවීන උපක්‍රම ඔවුන් විසින් වැඩි වශයෙන් භාවිත කරනු ලබන බවයි. 24% (n= 210)ක ප්‍රතිශතයක් සාම්ප්‍රදායික උපක්‍රම වැඩි වශයෙන් භාවිත කරනු ලබන අතර 28% (n= 245)ක ප්‍රතිශතයක් උපක්‍රම වර්ග ද්විත්වය ම භාවිත කරනු ලබයි. පොදුවේ ඔවුන් භාවිත කරනු ලබන උපක්‍රමවල සාර්ථක අසාර්ථකභාවය පිළිබඳව විග්‍රහ කිරීමේ දී දත්තදායකයන් 65% (n= 569)ක ප්‍රතිශතයක් පවසා සිටියේ එම උපක්‍රම කෙටි කාලීනව සාර්ථක වන බවයි. එමෙන් ම එකී උපක්‍රම යාවත්කාලීන කිරීම හා විද්‍යාත්මක පර්යේෂණය මඟින් ගවේෂණය කිරීම මිනිස්-රිලා ගැටුම සඳහා ප්‍රයෝගික වේ දැයි විමසා බැලිය යුතු ය.

ප්‍රමුඛ පද: රිලා-මිනිස් ගැටුම, හේතු සාධක, ගෙන ඇති ක්‍රියාමාර්ග, අභියෝග, නව ක්‍රමවේද

ජලය හා තදනුබද්ධ පහතරට ඇදහිලි විශ්වාස පිළිබඳ විමසුමක්

පීරිස් ඩී.පී.ආර්.[1*], විතාරණ ඩබ්ලිව්.බී.ඒ.[2]

[1]පහතරට නර්තන අධ්‍යයනාංශය, නර්තන හා නාට්‍යකලා පීඨය,
සෞන්දර්ය කලා විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
[2]භාෂා, සංස්කෘතික අධ්‍යයන හා ප්‍රාසංගික කලා අධ්‍යයනාංශය,
මානවශාස්ත්‍ර හා සමාජීය විද්‍යා පීඨය, ශ්‍රී ජයවර්ධනපුර විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
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සාරසංක්ෂේපය

මානව ශිෂ්ටාචාර ආරම්භයේ සිට මිනිසා හා ජලය අතර ඒකාත්මික බැඳීමක් පැවති බව පිළිගත යුත්තකි. ඒ අතර ජලය වන්දනීයත්වයෙන් සලකා ඇති බව පැහැදිලිය. අතීත මානවයාගේ පරිසර කේන්ද්‍රීය ජීවිතය අනෝමියත්වය මත දූරස්ථව ඇත. ඒ කෙරෙහි බලපෑ අද්‍යතන පුද්ගලවාදී ආර්ථික බලාධිකාරිය විසින් ආගමික හා සංස්කෘතික හරණය මෙරට පරිසර පද්ධති විනාශයටද බලපාන්නට විය. ඊට විසඳුම් සෙවීමේ දී ලාංකේය සංස්කෘතියේ ජන විඤ්ඤාණගත ප්‍රකාශන රැසක් හඳුනාගැනිණි. ඒ අතුරින් පහතරට ශාන්තිකර්ම වත්පිළිවෙත් මඟින් ජලය සංරක්ෂණයට උපස්තම්භක වන්නේ දැයි මෙහි පර්යේෂණ ගැටලුව ලෙස සැලකීය. එහි දී පුද-පූජා, අභිචාරයන්හි ආගමික, සංස්කෘතික සබැඳියාව විමසුම මූලික අරමුණ වන්නට විය. මානවවංශ පර්යේෂණයක් වන මෙම අධ්‍යයනයට, ගුණාත්මක පර්යේෂණ ක්‍රමවේදය භාවිත විණි. ඒ අනුව ප්‍රාථමික මූලාශ්‍රය වශයෙන් පහතරට සූනියම, රිද්දියාගය හා මඩු ශාන්තිකර්ම නිරීක්ෂණයද, ද්විතීයික මූලාශ්‍රය ලෙස ඒ හා බැඳි සාහිත්‍ය පරිශීලනයද, කෙරිණි. ප්‍රස්තුත ශාන්තිකර්මයන්හි අන්තර්ගත ජලය හා බැඳුණු පුද-පූජා විමසීමේ දී ඊට වන්දනීයත්වය ආරෝපණය එය ආරක්ෂා කිරීමේ උපක්‍රමයක් ලෙස භාවිත කොට ඇති බව පැහැදිලිය. එම වත්පිළිවෙත් අතර තොටමෙටයාම, කහදියර කන්නලව්ව, නානුමුරය, දියකැපීම, දියකෙළි සමයම ආදිය මඟින් ආගමික සංස්කෘතික හා මානව විද්‍යාත්මක සාධක රැසක් ගම්‍යමාන කෙරේ. ජලය හා බැඳි උපත්කථා හා පුරාකථා අධ්‍යයනයේ දී සප්තමහා සාගර, විල් හත, පොකුණු හත, නේරංජනාව, සීතගඟුල, ආභරණ ඇල්ල, කරදිය, මිරිදිය, කිවුල්දිය, උල්දිය, කසපැන්, පිනිදිය, කහදිය, සඳුන් කිරිපැන්, නානු ආදිය ඉන් කිහිපයකි. ඒවායෙහි ඓතිහාසික, සාහිත්‍ය, ඖෂධ හා සෞන්දර්යාත්මක සබැඳියාව මැනවින් හඳුනාගත හැකිය. ඒ අතර ශාන්තිකර්ම පද්ධතියේ ජලය පරිහරණය ආතුර සහ ඇදුරු දෙපාර්ශ්වයේ ම පවිත්‍රතාව, කිලි හරණය, රෝග නිවාරණ ලෙසද, ගායන හා නර්තන සුවිශේෂතාද, අධ්‍යයනය කෙරිණි. ඒ කෙරෙහි ගොඩනැගුණු ආධ්‍යාත්මය මෙරට ජලය හා බැඳුණු සංස්කෘතියට පාදක වී ඇති බව නිරීක්ෂණය විය. ඒ අනුව උක්ත වත්පිළිවෙත් මඟින් මානවවාදී ආකල්ප හා ධර්මතා සංයුක්ත දර්ශනයක් වෙත ළඟාවීම ජලය සංරක්ෂණයට සහනදායී බලපෑමක් ඇති කරන බව මෙම අධ්‍යයනයෙන් අනාවරණය කෙරේ.

ප්‍රමුඛ පද: සංස්කෘතිය, ශාන්තිකර්ම, ජලය, වත්පිළිවෙත්, නානුමුරය

සීගිරි ගීවල චූල කාව්‍ය ලක්ෂණ පිළිබඳ විශ්ලේෂණාත්මක අධ්‍යයනයක්

විරංග ජී.ඒ.එච්.[1], රණසිංහ ආර්.එම්.එස්.කේ.[2*]

[1]භාෂා අධ්‍යයනාංශය, සමාජීය විද්‍යා හා භාෂා පීඨය,
ශ්‍රී ලංකා සබරගමුව විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
[2]ඉංග්‍රීසි ඉගැන්වීමේ අධ්‍යයනාංශය, මානවශාස්ත්‍ර හා සමාජීයවිද්‍යා පීඨය,
ශ්‍රී ජයවර්ධනපුර විශ්වවිද්‍යාලය, ශ්‍රී ලංකාව
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සාරසංක්ෂේපය

සීගිරි කැටපත් පවුරේ ක්‍රි. ව. 7, 8, 9, යන සියවස්වල ලියැවුණු කාව්‍ය සමූහයක් වන සීගිරි ගී 685ක් සෙනරත් පරණවිතාන විසින් "සීගිරි ග්‍රැෆිටි" (1956) කෘතියේ සංග්‍රහ කර තිබේ. මෙම ගී සංක්ෂිප්ත ස්වරූපයක් සහිත කාව්‍යාත්මක බවින් ඉහළ නිර්මාණ වේ. මෙම පර්යේෂණයේ අරමුණ වන්නේ සීගිරි ගීවල පවතින චූල කාව්‍ය ලක්ෂණ විමර්ශනය කිරීමයි. ගුණාත්මක පර්යේෂණයක් වන මෙහි පර්යේෂණ ගැටලුව වන්නේ සීගිරි ගී චූල කාව්‍ය සම්ප්‍රදායක් ද යන්න විමර්ශනය කිරීමය. පර්යේෂණ ක්‍රමවේදය වශයෙන් විශ්ලේෂණාත්මක ක්‍රමවේදය යොදා ගන්නා ලදි. ප්‍රාථමික මූලාශ්‍රය වශයෙන් සෙනරත් පරණවිතානගේ "Sigiri Graffiti" (1956) කෘතිය යොදාගන්නා ලද අතර ද්විතීයික මූලාශ්‍රය වශයෙන් පර්යේෂණ කෘති, පර්යේෂණ පත්‍රිකා, ශාස්ත්‍රීය ග්‍රන්ථ හා ශාස්ත්‍රීය ලිපි ද පුවත්පත් සඟරා ලිපි ද අන්තර්ජාල මූලාශ්‍රය ද යොදා ගන්නා ලදි. සීගිරි ගීවල ආකෘතිය වන්නේ ගී විරිත්වලට ආසන්නව ලියැවුණු කාව්‍ය ආකෘතියක් වශයෙනි. කාව්‍ය පාද වශයෙන් ගත් කල කාව්‍ය පාද එකේ සිට කාව්‍ය පාද 12 දක්වා පරාසයක එම කවීන් මෙම ගී ලියා තිබේ. කාව්‍ය ලිවීමේ දී යොදා ගන්නා රිද්මානුකූල භාෂා ව්‍යාපාරයක් මෙම ගී සතු වේ. තව ද උපමා රූපක මෙන්ම කාව්‍යාත්මක අනුභූතීන්ගෙන් පොහොසත් කාව්‍ය ව්‍යාපාරයක් වශයෙන් මනා නිමාවකින් යුක්ත කාව්‍ය සීගිරි ගී අතර වේ. සිංහල සම්භාව්‍ය කාව්‍ය සාහිත්‍යයේ වැඩිම කවීන් ප්‍රමාණයකගේ කාව්‍ය දක්නට ලැබෙන්නේ සීගිරි ගීවල ය. චූල කාව්‍ය ක්‍රමයක දක්නට ලැබෙන සංක්ෂිප්ත ස්වරූපය සීගිරි ගීවල බහුලව දක්නට ලැබේ. කවියේ කාව්‍යාත්මක බව විස්තරාර්ථ වශයෙන් දීර්ඝව ලිවීම එහි දක්නට නොලැබේ. කවීන් විශාල ප්‍රමාණයකගේ කාව්‍ය එකතුවක් වශයෙන් එල වීම චූල කාව්‍ය ව්‍යාපාරය පිළිබඳ පැහැදිලි කරන ටී. එස්. එලියට් දක්වන ප්‍රධාන නිර්ණායකයයි. සම්භාව්‍ය කාව්‍ය තත්ත්වයෙන් දූරස්ථ වූ මෙම කාව්‍ය ස්වරූපය සීගිරි ගීවල ද වේ. ඒ අනුව සීගිරි ගී චූල කාව්‍ය ස්වරූපයක් වන බව මෙම පර්යේෂණයෙන් පැහැදිලි විය.

ප්‍රමුඛ පද: සීගිරි ගී, චූල කාව්‍ය, සිංහල සම්භාව්‍ය කාව්‍ය, හයිකු කාව්‍ය, සීගිරි කැටපත් පවුර

MANAGEMENT, COMMERCE & INDUSTRY DEVELOPMENT

FACTORS AFFECTING MACHINE DOWNTIME IN THE PLASTIC MANUFACTURING INDUSTRY IN SRI LANKA

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Abstract

Machine downtime is critical in manufacturing owing to the association between organizational productivity and profitability. Reduced downtime in manufacturing processes, such as those utilized by plastics manufacturers, has become crucial, since it also increases machine utilization. In Sri Lanka's plastic manufacturing business, machine downtime is one of the most prominent difficulties. Machine downtime is primarily affected by the availability of machine operators, machine breakdowns, and changeovers. The purpose of this research is to investigate the link between influencing variables and machine downtime. This is a quantitative research, data were acquired from machine operators using a Likert scale questionnaire. Results revealed that all three factors: availability of operators, machine downtime, and changeovers—impacted machine downtime. The findings of this study enrich the present literature and have given implications that help to improve the plastic manufacturing industry in Sri Lanka.

Keywords: Machine downtime, machine breakdowns, changeovers, operators, plastic manufacturing industry

THE IMPACT OF GREEN ENTREPRENEURIAL ORIENTATION ON GREEN PERFORMANCE OF CONSTRUCTION INDUSTRY IN SRI LANKA

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Abstract

Environmental sustainability has become a major concern of the entire world. According to studies in literature there is a considerable impact of construction activities on the environment in Sri Lanka. Green entrepreneurship is the activity of consciously addressing environmental and social problems and coming up with innovative ideas that will bring solutions to these problems. The main purpose of this research is to investigate the impact of Green Entrepreneurial Orientation on the Green Performance of Sri Lankan construction industry. The green risk-taking propensity, green innovativeness and green proactiveness were taken as dimensions of green entrepreneurship. In order to evaluate the Green Performance, selected dimensions of international rating schemes such as Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM) were used. Five leading construction companies were selected. The list of permanent employees, maintained by the company was used as the sampling frame and 260 employees in these five leading construction companies were used to collect data for the research. Unit of analysis was the organization. The data was analyzed using multiple regression using SPSS software. Green entrepreneurship i.e. green risk-taking propensity, green innovativeness and green proactiveness has a significant positive relationship with the green performance of construction industry in Sri Lanka. This research also examined the moderating effect of transformational leadership on the relationship between green entrepreneurial orientation and green performance. It found that transformational leadership moderates the relationship between green entrepreneurship and green performance. This research provides valuable insights for the policymakers and managers to overcome the barriers of high initial cost of implementing green building principle and support Sri Lankan construction industry to improve the sustainability in future.

Keywords: Green performance, green entrepreneurial orientation, green risk-taking propensity, green innovativeness, construction industry

ELEMENTS THAT IMPACT CONSUMER ENGAGEMENT OF SRI LANKAN CLOTHING BRANDS: EVIDENCE FROM INSTAGRAM

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Abstract

Modern-day consumers have more awareness, knowledge, choices, and low switching cost which has created a challenging environment for businesses in the fashion industry to develop and maintain customer loyalty. Fashion and clothing manufacturers are increasingly aware of the connection between brand recognition and prospective purchasing behaviour. The main objective is to identify the factors and investigate the impact of the factors affecting the effectiveness of consumer engagement with clothing brands on Instagram. Consumer engagement on Instagram was examined in this study, along with the factors of media richness, verbal interactivity, informative and entertaining content, publication day, and post length, which will be the study's independent variables. These independent variables were measured by observing the engagements of consumers in each post through likes and comments, which were manually coded and analysed using the STATA software. For the study, researchers used a sample of 384 employing purposive sampling techniques and the sample includes pages from 14 distinct brands with more than 50k followers. The hypothesis was tested using a multi-nominal logistic regression model. According to the results, verbal interactivity and post length have the biggest impact among the factors considered due to the high significance level after stepwise regression. Therefore, this study investigates Sri Lanka's more active consumer engagement with clothing brands. In this study, researchers have only investigated the consumer engagement of Sri Lankan clothing companies. However, in the future, researchers intend to contrast these findings with those of some international clothing brands.

Keywords: Consumer engagement, social media interactivity, content, social media engagement, instagram posts

IMPACT OF THE CHARACTERISTICS OF SOCIAL MEDIA INFLUENCER MARKERS ON CONSUMER ENGAGEMENT: A STUDY ON COSMETIC CONSUMERS IN SRI LANKA

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Abstract

Social media influencer marketing is one of the most common and efficient ways for businesses to deliver marketing messages to their customers. This study discussed the impact of Social media influencer marketing on consumer engagement in the context of the cosmetic industry in Sri Lanka. The quantitative data collection and the analysis were done using regression analysis to measure how consumer engagement in local and foreign cosmetic brands acts under the influence of Social media influencer marketing in Sri Lanka. Data were analyzed using SPSS software, important information helped this study to be successful. To collect data, an online survey was prepared and passed to 385 cosmetic users in Sri Lanka. This includes demographic information about the customers and some common questions relevant to the study. The results showed that men also have a better interest in cosmetics, but women act vital when it comes to cosmetics. It also showed that women have a higher ability to be impacted by social media influencers which leads to buying cosmetic products. According to engagement and usage, those aged 18-30 years are using more social media and interacting with social media influencers. The majority of cosmetic consumers use Instagram out of other social media platforms. The researchers were able to prove that the selected independent variables such as attractiveness, expertise, trustworthiness, and authenticity have affected the dependent variable, which is consumer engagement. The findings forecasted the facts on how consumer engagement has been affected and how the engagement depends on the influence of Social media influencer marketing on these social media platforms. Social media influencer marketing is developing day by day with the new technological advancements. This study will provide the necessary knowledge to future researchers who are willing to carry out their research in this area.

Keywords: Social media influencer marketing, social media influencer, social media, consumer engagement, cosmetic brands, consumer decision-making process

IMPACT OF SUPPLY CHAIN MANAGEMENT PRACTICES ON COMPETITIVE ADVANTAGE AND ORGANIZATIONAL PERFORMANCE IN THE TEXTILE AND APPAREL INDUSTRY IN SRI LANKA

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Abstract

Many global and local studies have been conducted on the impact of supply chain management practices on competitive advantage and organizational performance. The main objective of this study is to examine the impact of supply chain management practices on competitive advantage and organizational performance of the textile and apparel industry in Sri Lanka. Additionally, the study examines the mediating role of competitive advantage in the relationship between supply chain management practices and organizational performance. In this study, the SCM practices would be measured on the parameters of strategic Supplier Partnership, Customer Relationship, Level of Information Sharing, Quality of Information Sharing and postponement and the competitive advantage would be measured on price/cost, quality, delivery dependability, product innovation and time to market while organizational performance will be measured in terms of market performance and financial performance. The data required in the study was collected for analysis from top managers in the Sri Lankan textile and apparel industry. The hypotheses were developed based on the constructed conceptual framework derived from the literature. The overall population for the research was 1,200 and the sample size of the study was determined using the sample determination criteria of the Morgan table. According to the Morgan table sample size criterion, the sample size would be 291 people in total. Moreover, multiple regression analysis in the SPSS was used for data analysis. The results of the analysis indicated that all SCM variables have a positive impact on competitive advantages and organizational performance of the textile and apparel industry in Sri Lanka. Also, it was revealed that competitive advantage has a direct positive effect on organizational performance. The results demonstrate that supply chain practices directly impact the competitive advantage and organizational performance of the textile and apparel industry also the findings show that increased SCM practice may boost competitive advantage and boost organizational performance. Additionally, competitive advantage may directly and favourably affect how well a company performs.

Keywords: Competitive Advantage, Organization Performance**,** Supply Chain management practices, Sri Lanka, Textile and Apparel Industry

NATURAL & LIFE SCIENCES

AGAR EXTRACTION FROM *Gracilaria verrucosa* AND DEVELOPMENT OF FOOD JELLIES

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Abstract

Seaweeds have been used throughout the world for various applications (in food and non-food areas). However, seaweed is an underutilized and abundant natural resource in Sri Lanka. Large quantities of red seaweeds, such as *Gracilaria* species, are found in Kalpitiya, Trincomalee, and Mannar. Furthermore, *Gracilaria edulis* and *Gracilaria verrucosa* known as "Ceylon moss," are rich in agar-agar. In the present study, agar was extracted from red seaweed *Gracilaria verrucosa,* harvested from Trincomalee, Sri Lanka, and that agar was used to develop gelatine-free food jellies because there is a high potential to develop novel functional food products utilizing available red seaweed, *Gracilaria verrucosa,* in Sri Lanka. Agar was extracted using the hot water extraction method at 90 °C for 1 hour, and food jellies were developed with different agar weights (4 g, 8 g, and 12 g) after conducting preliminary trials. To select the best sample among three jelly samples, sensory evaluation was carried out. According to the sensory analysis, for taste, texture, and overall acceptability, 12 g of agar added jellies were ranked as having the highest average value on the 5-points hedonic scale. Therefore, 12 g of agar added jellies were selected as the best sample. The nutritional composition of the developed jellies was investigated by comparing them with the control sample (gelatine-added jellies). All experiments were conducted in triplicate, and the collected data were analyzed using the MINITAB 17 package. According to the proximate analysis, the moisture, total lipid, total carbohydrate, total ash and crude fibre percentages of developed agar added jellies were 80.09±0.28, 0.33±0.03, 8.54±0.48, 1.03±0.01, 1.00±0.06 while control sample percentages were 77.69±0.56, 0.16±0.02, 12.42±0.40, 2.16±0.11, 0.20±0.03 respectively. Hence, *Gracilaria verrucosa* collected from Trincomalee, is a good source of agar-agar and gives acceptable gel properties to extract agar for applications in the local food jelly industry.

Keywords: Agar-agar***,*** *Gracilaria verrucosa,* red seaweeds, food jellies, industry

CHARACTERIZATION OF FISH-BASED COLLAGEN FROM *Decapterus macarellus* (PERCIFORMES: CARANGIDAE)

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Abstract

Marine fishes serve as a good candidate for collagen, which has a high demand in the food and cosmeceutical industries due to their attractive physiochemical properties and biocompatibility. The occurrence of collagen in *Decapterus macarellus* was reported by the authors previously. The present study is an extension aiming at the characterization, and evaluation of the *in-vivo* toxicity of collagen from *D. macarellus,* a commonly available food fish species in Sri Lanka. The fish samples were obtained from a local fish market, and the Acid Soluble Collagen (ASC) extraction method was optimized to obtain dry collagen powder. Physio-chemical properties of collagen were characterized; pH, moisture content, ash content, protein concentration, and solubility, while *in vivo* toxicity was evaluated by the *Artemia salina* toxicity assay and the results were analysed by probit analysis. The ASC extraction yielded 6.57% (w/w) of dry collagen, while proximate analysis showed an acidic pH (5.20±0.05), low ash (1.79±0.09%) and low moisture (2.147±0.17%) content. High protein content was resulted with Bradford assay (88.28±2.26%) and Lowry's assay (52.74±1.9%) whereas the highest relative solubility was recorded at pH 3. The collagen was non-toxic with respect to *in vivo Artemia salina* toxicity assay ($P<0.05$). The reported physical and chemical properties and the results of the assays further warrant the use of these in many disciplines. Further analyses are underway to establish data related to amino acid analysis and other bioactivities of extracted collagen.

Keywords: Marine collagen, decapterus macarellus, mackerel scad, acid soluble collagen, proximate analysis

WATER UPTAKE CAPACITY OF DIFFERENT PADDY VARIETIES IN SRI LANKA DURING HOT SOAKING STAGE AT PADDY PARBOILING PROCESS

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Abstract

This study was conducted to determine the water absorption capacity of 5 Sri Lankan traditional paddy varieties (Kaluheenati, Suwandel, Ma wee, Pachchaperumal, Pokkali) and 12 most popular improved paddy varieties [three Long Slender rice varieties (At 306, At 405, At 311), three Long Medium varieties (Bg 94-1, Bg 357, At 362), three Intermediate Bold varieties (Bg 352, Bg 300, Bg 366), three Short Round varieties (Bg 358, Bg 360, At 308)] during hot soaking stage at paddy parboiling process. The water absorption capacities were investigated by immersing the paddy samples in hot water, at 70 °C for 5 h. Respective samples were drawn at 30 min intervals and weight gain due to water absorption was determined. During soaking period all paddy varieties absorb moisture in to the grain in a similar pattern. Rapid water absorption was observed at the initial stages. Highest water absorption rate was observed during the first 30min for all the paddy varieties. Percentage water uptake increases with the soaking time but the rate of absorption was declined with time leading to no significant difference at later stages. Water uptake capacity of the selected paddy varieties were ranged from 20.27 ± 0.45% to 39.51 ± 0.87% after 5 h. The highest percentage of water uptake was recorded by At 405 and the minimum was recorded by At 308. It was clear that water uptake capacity of paddy is significantly influenced by the varietal difference and its composition. In the same variety it is significantly influenced by the duration of soaking. Water uptake capacity of paddy is an important parameter to decide optimum parboiling conditions and to design processing equipment for parboiling. In addition, these findings can be used to determine time, duration conditions for rice fortification and enrichment treatments during paddy parboiling.

Keywords: Water uptake, paddy, parboiling, hot soaking, moisture absorption

EVALUATION OF PHYSICOCHEMICAL PROPERTIES OF VIRGIN COCONUT OILS MANUFACTURED IN SRI LANKA

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Abstract

Virgin coconut oil (VCO) is an emerging functional food produced from fresh, mature coconut kernels through natural mechanical methods. The physicochemical properties of 16 VCO samples in Sri Lanka were evaluated. The samples were detected with peroxides (0.2, 0.4, and 0.4 meq O_2/kg), though the resulting values were below the SLS 32:2017 standard requirements. Free fatty acids (FFAs) are naturally present in edible oils and may increase in value due to moisture and processing temperature. The current study showed a significant difference ($P<0.05$) in the FFA values of the VCO samples, and the results ranged from 0.04±0.00% to 0.26±0.02%. The recommended FFA value (max) according to SLS 32:2017 is 0.2% and almost all samples except one resulted in below 0.2%. VCOs are expressed as almost colourless oils. The Lovibond tintometer was used to detect the colour of the VCO samples and expressed them with the Lovibond colour scale (Y + 5R). The colour of the oil samples ranged below 1, while one sample evidenced a higher value (1.7). It is assumed that the producer may have incorporated coconut testa as an ingredient for a particular sample; therefore, a value below 2 resulted. The fatty acid profile of the oil is an important factor, and VCO samples indicated the presence of caproic (0.42 - 0.59%), caprylic (6.71 - 8.45%), capric (5.12 - 6.12%), lauric (45.87 - 50.45%), myristic (19.18 - 20.44%), palmitic (7.34 - 9.30%), stearic (2.88 - 3.41%), oleic (4.16 - 6.94%) and linoleic (0.68 – 1.76%) acids. The results also indicated that most of the fatty acids present in the samples are medium-chain fatty acids. The present study suggests that majority of VCO samples are good in quality. However, further studies are required concerning the adulteration of the oils.

Keywords: Virgin coconut oil, fatty acid profile, quality, coconut kernels, free fatty acids

ASSESSING THE ASSEMBLAGE AND ACTIVITY PATTERNS OF MESO-MAMMALS IN BADDAGANA WETLAND PARK USING CAMERA TRAPS

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Abstract

Wetlands in Colombo, Sri Lanka, covering approximately 20 km^2 of the district, consist of marshes, man-made lakes, and abandoned paddy fields. Baddagana Wetland Park (BWP) in Colombo, declared the first wetland park in Sri Lanka, is an urbanized wetland park located near the Diyawannawa lake. This research was conducted to assess the meso-mammal species assemblage and activity patterns in BWP. It was conducted by carrying out a camera trap survey in an area of 0.15 km^2 from June 2021 to January 2022. Browning Dark OPS HD Pro cameras were deployed in 08 camera trap stations with a sampling effort of 475 trap days. Camera trap stations were selected, maintaining a minimum distance of 200 m between two cameras, and were activated for 24 hours a day. Time stamp data on captured videos obtained from camera traps was used to investigate the activity patterns, denoting the nocturnality and diurnality of a meso mammal, and the activity level, which denotes the proportion of the day a meso mammal is active. The most abundant species was the Indian porcupine *(Hystrix indica)* with 365 independent events, while the Eurasian otter *(Lutra lutra)* was the rarest species recorded with 06 independent events in BWP. The Brown mongoose (*Urva fuscus)* displayed both diurnal and nocturnal activity patterns with the highest activity level (0.63±0.06). The lowest activity level (0.17±0.06) was recorded by the Common palm civet (*Paradoxurus hermaphoditus)* due to the absence of any diurnal behavior. A special finding of this research was the detection of otters in areas away from water, such as grasslands, and the highly nocturnal behavior of the brown mongoose, which cannot be observed in the pristine forest habitats. This study suggests the coexistence and temporal variations in activity patterns of different species of meso-mammals in BWP and further concludes that BWP successfully acts as a habitat that maintains the sustainability of meso-mammals within Colombo wetlands.

Keywords: Activity patterns, biodiversity, camera trapping, carnivores, temporal variations

USE OF RAPD-PCR FOR CATTLE IDENTIFICATION AND TRACEABILITY

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Abstract

Identification and traceability of livestock animals are crucial for genetic improvement, disease control, conservation, and forensic applications. The drawbacks of available strategies and their effects on health and food safety policies have been challenged at both domestic and industrial levels. Therefore, novel approaches are essential to overcome current limitations. In order to introduce a reliable molecular method, DNA based techniques have shown to be effective in distinctly identifying animals. The genetic profiles of regional cattle in North Central Province were examined using two RAPD markers. As per published protocols, DNA extracted from whole blood of 22 cattle was amplified using primers OPA 18 and OPA 16 which have the sequences of 5'AGG TGA CCG 3' and 5' AGC CAG CGA A 3' respectively. PCR products were visualized on 1.5% agarose gels, and the images were analyzed by *NTSYS*-PC 2.2 Software based on the presence and absence of bands. The genetic diversity among the population was further investigated by the unweighted pair group method with arithmetic averages (UPGMA) analysis. OPA-18 resulted in a total of 8 loci with sizes ranging from 500-1500 bp, and 80 % of the individuals shared fragment sizes of 800, 900, and 1500 bp. OPA-16 resulted in 2 loci having sizes of 1000 and 1500 bp. With OPA -18, the samples had dissimilarity coefficients ranging from 0.0000-0.9730, whereas OPA-16 indicated dissimilarity coefficients of 0.0000 and 0.3466. OPA-18 distinguished 15 samples as unique within 22 samples and produced 8 phylogenic sub-clusters. OPA-16 identified only a single sample as unique. Comparatively, OPA-18 effectively discriminated samples over OPA-16. According to this study, OPA-18 is more likely to be used for cattle traceability compared to OPA-16. A cattle DNA fingerprinting database was established for future applications. The findings of this study can offer fundamental molecular knowledge for further marker-based investigations on local cattle.

Keywords: RAPD, PCR, traceability, cattle, Sri Lanka

NODULARIN-INDUCED CYTOTOXICITY AND APOPTOSIS *IN VERO* RENAL CELL LINE

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Abstract

Cyanobacterial toxins are being increasingly reported in reservoirs, ponds, and even dug wells in different parts of the world. Nodularins (NOD) are a type of cyanotoxin and a potent hepatotoxin produced by the filamentous species *Nodularia spumigena,* which was recorded in Sri Lankan water bodies. NOD is a potent hepatotoxin, inducing liver hemorrhage and promote liver carcinogenesis with chronic exposure. The purpose of the present study was to evaluate cytotoxic effects on the Vero renal cell line. After cells were exposed to pure NOD at different concentrations (0.5, 1.0, 5.0, 10.0, 50.0, 100.0, and 200.0 µM) for 24 hours, cell viability was evaluated using 3-(4,5-dimethylthiazol-2yl)-2,5-diphenyltetrazolium bromide (MTT) and sulphorhodamine B (SRB) assays. The maximum cell mortality percentage was observed when cells were exposed to 200 µM concentrations of NOD. There was considerable dose-dependent cytotoxicity of NOD on Vero renal cells ($p<0.05$). The analysis of the IC_{50} value for MTT was 109.02 and the SRB was 72.35, respectively. Phase-contrast microscopy observations, revealed decreased confluence in NOD-treated Vero cells in a dose-dependent manner. Cell apoptosis was evidenced under the fluorescence microscopic observations using the acridine orange-ethidium bromide (AO/EB) staining after cells exposed to NOD for 24 hours. Thus, the findings of the study showed that NOD has cytotoxic effects on renal cells.

Keywords: (Vero) renal cells, NOD, MTT assay, SRB assay, IC_{50}

PHYSICOCHEMICAL CHARACTERIZATION OF THE NATURAL TENDER COCONUT (*Cocos nucifera* L. var. *Nana*) WATER COLLECTED FROM DIFFERENT DISTRICTS IN SRI LANKA

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Abstract

Tender coconut (*Cocos nucifera* L. var. *Nana*) water is an underutilized product in Sri Lanka, despite having a distinct flavor and rich nutritional profile. Its nutritional profile is still totally unknown. Therefore, the present study examines the physicochemical and nutritional properties of dwarf tender coconut water (maturity stage 6–8 months), collected from six different districts in Sri Lanka: Colombo, Kurunegala, Jaffna, Kilinochchi, Vavuniya, and Mullaitivu. Fifteen coconuts from each district were used to measure pH, Total soluble solids (TSS), Titratable acidity (TA), turbidity, total protein, Total phenolic content (TPC), total sugar, and simple sugars (glucose, and fructose), following the standard AOAC methods. The samples collected from different regions showed a significant difference (p<0.05) only in the mean values of pH, total sugar, glucose, and fructose contents. The nutrition profile of coconut water varies between districts as pH 4.87±0.09 - 5.14±0.05, TSS 5.2±0.2 - 5.6±0.2 (°Brix), TA 0.072±0.002 - 0.088±0.006 (% of malic acid), turbidity 5.73±0.55 - 6.30±0.44 (related to distilled water transmittance), protein 0.030±0.010 - 0.047±0.006 (mg mL^{-1}), TPC 55.76±0.72 - 57.77±4.54 (mg GAE L^{-1}), total sugar content 49.50±4.34 – 98.80±5.06 (mg mL^{-1}), fructose 23.25±5.58 - 55.88±7.12 (mg mL^{-1}), and glucose 25.23±5.89 – 60.24±10.10 (mg mL^{-1}) respectively. Furthermore, the coconut samples collected from the Kurunegala area showed the highest total sugar content (98.80±5.06 mg mL^{-1}), glucose (60.24±10.10 mg mL^{-1}), and fructose (55.88±7.12 mg mL^{-1}) content, which significantly differed from other districts' results, especially the lowest values observed in Colombo samples - glucose (25.23±5.89 mg mL^{-1}), fructose (23.25±5.58 mg mL^{-1}), and total sugar content (49.50±4.34 mg mL^{-1}). According to the findings about the biochemical profile of tender coconut water, the sugar content varied by the district might be due to their growing conditions. Further, tender coconut water contains a significant amount of simple sugars that could aid to produce a fermented beverage, opening up a new avenue for Sri Lankans to explore refreshing coconut water-based beverages.

Keywords: Beverage, chemical composition, Sri Lanka, sugar content, tender coconut water

YOGHURT PRODUCTION POTENTIAL OF *Lactobacillus delbrueckii* SUBSP. INDICUS-ISOLATED FROM TRADITIONAL BUFFALO CURD IN SRI LANKA

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Abstract

Lactic acid bacteria (LAB) play a vital role as starters in yoghurt production. The present study was carried out to investigate the yoghurt production potential and characterization of yoghurt produced using monocultures of *Lactobacillus delbrueckii* subsp. *indicus*, a wild type of LAB strain isolated from traditional buffalo curd in Sri Lanka. Forty five bacterial isolates from buffalo curd samples were screened based on morphological, physiological, and biochemical characteristics, namely, Gram's staining, catalase, oxidase, indole, methyl red, Voges-Proskauer, citrate utilization, and lactose fermentation tests. The characterization of the yoghurt produced using the isolated monocultures was carried out by measuring pH, spontaneous syneresis, and texture profile analysis, followed by viability testing of bacteria during cold storage of the yoghurt. The pH of all yoghurt samples remained in the range of pH 4.2– 4.8 during the storage period of 21 days at 4°C with no significant difference between the samples. The lowest syneresis percentage was observed in the yoghurts produced using *L. delbrueckii* subsp. *indicus* ANU_IN-91 and *L. delbrueckii* subsp. *indicus* THS_IN-36. The textural parameters, namely hardness, adhesiveness, springiness, and stringiness, showed significant changes between the yoghurt samples over time. According to the obtained results, the survival rate of all the bacterial strains gradually decreased during the test period. Overall, findings suggest that *L. delbrueckii* subsp. *indicus* strains can be used in combination with other suitable LAB as starter cultures in the production of yoghurts with low syneresis and good textural properties.

Keywords: Buffalo curd, lactic acid bacteria, *Lactobacillus delbrueckii* subsp. *indicus*, indigenous, fermentation characterization

PHYSICAL, CHEMICAL, AND MICROBIOLOGICAL PARAMETERS OF WELL-WATER SOURCES IN THE PADUKKA AREA, SRI LANKA

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Abstract

Groundwater quality is stressed due to the quick changes brought about by buildings, urbanization, and agricultural activities in emerging regions. This study aimed to assess the physical, chemical, and biological characteristics of well water in the Padukka region. In April 2022, ten water samples were collected from ten different wells using standard sampling methods. Chloride(Cl^-) concentration, total alkalinity, and total hardness were determined using titrimetric methods, while concentrations of free-ammonia, nitrate(as NO_3^-), nitrite(as NO_2^-), total phosphate(as PO_4^{3-}), and total iron were measured using a UV-VIS spectrophotometer, following the APHA(American Public Health Association) *standard methods* for the examination of water and wastewater. *Escherichia coli* and total coliform counts were obtained by following the standard membrane filtration method. The findings of the study showed that the pH values ranged between 4.47±0.01 and 6.00±0.01, while all the sampling points were below the standard guideline range of pH 6.5 to 8.5. The low pH of the lateritic aquifer and the characteristics of the soil can be considered as the reasons for the low pH value of well water in this area. The conductivity of the well water ranged from 28.2±0.1 µS cm^{-1} to 280.0 µS cm^{-1}, while the total phosphate (as PO_4^{3-}) and nitrate(as NO_3^-) ion concentration ranges were <0.00–0.41±0.01 mg l^{-1} and <0.0–29.7±0.0 mg l^{-1}, respectively. The total phosphate, nitrate, nitrite, chloride, total alkalinity, and hardness of all the sampling points were below the SLS 614: 2013 specification for potable water guideline values, while thirty percent of the well-water sampling points surpassed the concentration of potable water guideline value of ammonia. In addition, sixty percent of the sampling points exceeded the SLS 614:2013 specification for potable water guideline values for both *Escherichia coli* and total coliform thus the direct consumption of well water from contaminated wells is not recommended.

Keywords: *E.coli*, well water, water quality, ammonia, pH

COMPARITIVE EVALUATION OF ESSENTIAL OIL AND OLEORESIN EXTRACTION FROM *Cinnamomum zeylanicum, Zingiber officinale, Syzygium aromaticum*

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Abstract

The true essences of the spices are captured as essential oils (EOs) and oleoresins (ORs) using various extraction methods, and the selection of the proper extraction method is crucial in plant-based research for both academics and industry professionals. Therefore, it is focused on doing a comparative study of obtaining both EOs and ORs using the most applicable methods by evaluating the extraction yield and the analysis of the main chemical compounds of EOs and ORs from locally-important, economical spices: cinnamon, ginger, and clove bud. In EOs, hydro-distillation (HD) and steam distillation (SD) are compared while soxhlet extraction (SE) and reflux extraction (RE) are compared, in ORs based on the extraction yield, GCMS, and HPLC analysis. The study revealed that SD (1.46±1.28%) of ginger has a significantly higher extraction yield over the HD and there was no significant difference between the extraction yields of HD and SD in EOs of cinnamon and clove bud. The significant extraction yields and main bioactive components of ORs were given by SE using acetone and ethyl acetate (50:50) in cinnamon (yield of 3.13±0.09% and cinnamaldehyde content of 42.20±0.85%), RE with ethyl acetate in ginger (yield of 7.11±0.14 and gingerol and shogaol content of 16.43±0.37%) and RE with acetone and ethyl acetate (25:75) in clove bud (yield of 29.77±0.39). The overall study revealed that the effective, efficient and economical distillation or extraction method vary with plant type and usage of solvent combinations are effective in increasing the extraction yields with higher content of main active compounds. Further, it demonstrated that ethyl acetate is a promising solvent for extracting oleoresins.

Keywords: Distillation, solvent extraction, cinnamon, ginger, clove bud

ANTIBACTERIAL PROPERTY OF PINEAPPLE (*Ananas comosus*) PEEL OIL AGAINST TWO FISH PATHOGENIC BACTERIA

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Abstract

Recently, great emphasis has been placed on utilizing plant-based wastes for generating value-added products like phytobiotics, which can be used as an alternative to antibiotics in aquaculture systems. Pineapple peels are reported as one of the abundant wastes generated (30–42% (w/w), which are rich in bioactive compounds, and possess medicinal values. The objective of the study is the extraction of Pineapple peel oil, identification of antibacterial compounds and to demonstrate the antibacterial activity of crude pineapple peel oil against common bacterial pathogens that affect ornamental fish, such as *Aeromonas hydrophila* and *Pseudomonas* spp. The extraction of pineapple peel oil was performed by Soxhlet extraction using hexane as the solvent followed by rotary evaporation. The extracted oil was identified using Gas Chromatography – Mass Spectrometry (GC-MS). The antibacterial activity of crude pineapple peel oil for both tested pathogens was compared using the disc-diffusion method, and the disc-diffusion assay for each tested bacterial strain was triplicated. Five major fatty acid compounds were detected by GC-MS analysis and the most abundant chemical constituent was oleic acid followed by palmitic, linoleic, stearic and arachidic acids respectively. The inhibition zone observed for both tested pathogenic bacterial strains; *A. hydrophila* and *Pseudomonas* spp: were 2.37± 0.13 cm and 2.06 ± 0.08 cm, respectively. The antibacterial activity of extracted pineapple peel oil could be attributed to the presence of fatty acids, phenolic compounds which are responsible for antimicrobial effects. Conclusively, the present study recommends that Pineapple peel oil can be used as an antibacterial agent against the bacterial pathogens that affect ornamental fish.

Keywords: Pineapple peel oil, *Aeromonas hydrophila*, *Pseudomonas* spp, antibacterial, disc-diffusion

IN VITRO ANTI-INFLAMMATORY ACTIVITY OF POLYPHENOL-RICH METHANOL EXTRACT AND ITS FRACTIONS OF SRI LANKAN EDIBLE MARINE ALGAE *Chnoospora minima*

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Abstract

Marine seaweeds are rich in bioactive metabolites that can be used as an alternative source for treating inflammatory conditions. The current study highlights the anti-inflammatory activity of polyphenol-rich extract and fractions of *Choonospora minima* for the first time, as there were no studies reported relevant to the anti-inflammatory activity of polyphenol-rich methanol extract and its fractions. De-polysaccharide polyphenol-rich methanol extract of *C.minima* was sequentially partitioned with hexane, chloroform, and ethyl acetate to determine the anti-inflammatory activity using proteinase inhibition and protein denaturation inhibition bioassays *in vitro*. The effects of protein denaturation and proteinase inhibitory activity were measured using bovine serum albumin and trypsin, respectively. Results showed that the hexane fraction (IC_{50}:0.46±0.001 mg/mL) of *C.minima* exhibited a moderate level of inhibitory activity of protein denaturation in a concentration-dependent manner compared to the standard drug Aspirin (IC_{50}:0.15±0.001 mg/mL). The ability of extracts to inhibit protein denaturation was expressed as hexane fraction> ethyl acetate fraction>aqueous fraction> crude methanol extract> chloroform fraction. Further, the hexane fraction (IC_{50}: 1.43±0.03 mg/mL) of *C.minima* exhibited moderate proteinase inhibitory activity compared to the standard drug Aspirin (IC50:0.69±0.02 mg/mL) in a dose-dependent manner. Similarly, the percentage inhibition of proteinase activity was within the range of 10-60%. The results of the present study concluded that the hexane fraction of *C.minima* exhibited a moderately high level of anti-inflammatory activity compared to other fractions, which may be due to the presence of nonpolar compounds

Keywords: *Choonospora minima*, anti-inflammatory, methanol extract, fractions, marine algae

COMPARATIVE MORPHOANATOMY, PHYCOCHEMICAL SCREENING, OF THREE SELECTED GRACILARIA (RHODOPHYTA) SPECIES FROM SRI LANKA

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Abstract

The present study reports comparative morphoanatomy, phycochemical analysis and carotenoid and chlorophyll contents of three selected species of *Gracilaria* from Sri Lanka. *G. hikkaduwensis* which is endemic to Sri Lanka, *G. corticata*, and *G. canaliculata* were collected from shallow sea water at Koggala, Sri Lanka by hand picking. A comparative morphoanatomical study was performed and extracts of each species were prepared by incubating in methanol: dichloromethane (1:1 v/v), for 72 hours, followed by rota-evaporation. Qualitative and quantitative phycochemical screening was carried out, chlorophyll a and carotenoids were extracted and quantified. The results of the quantitative analysis were statistically analysed using Minitab 17 statistical software. According to the results, the identity of *G hikkaduwensis* was confirmed with the toothed apices, *G. corticata* and *G. canaliculata* with rounded apices in vegetative thalli. *G. corticata* contained markedly compressed axes and 1–3 layers of pigmented outer cortical cells while *G. canaliculata* contained *cylindrical* axes with 1–2 layers of cortical cells. Phycochemical analysis indicated the presence of alkaloids, carbohydrates, glycosides, saponins, amino acids, phenols, tannins, steroids and flavonoids in all three extracts with exception of terpenoides. The highest total phenolic content (2.02 ± 0.11 mg GAE g^{-1} dry weight) in *G. corticated* and lowest phenolic content (1.36 ± 0.08 mg GAE g^{-1} dry weight) in *G. hikkaduwensis*. Highest total flavonoid content (1.52 ± 0.01mg QUE g^{-1} dry weight) was reported in *G. hikkaduwensis* while lowest (1.02 ± 0.01mg QUE g^{-1} dry weight) was reported in *G. corticata*. The highest and the lowest chlorophyll contents (6.2 μg g^{-1} &1.9 μg g^{-1} sample) were evidenced in *G. canaliculata* and in *G. hikkaduwensis* respectively. The highest total carotenoids content (0.8 μmol g^{-1} sample) was reported in *G. corticata* while the lowest in (0.3 μmol g^{-1} sample) in *G. canaliculata* extracts. The present study revealed for the first time the presence of phycochemicals, carotenoids and flavonoid contents in *G. hikkaduensis*. The results of the present study can be used as baseline data in further research on these species.

Keywords: Carotenoids, flavonoids, *Gracilaria*, phycochemicals, Sri Lanka

COMPARISON OF ULTRASOUND-ASSISTED AND CONVENTIONAL METHODS ON THE EXTRACTABILITY OF POLYPHENOLS AND ALKALOIDS OF ARECA NUT

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Abstract

Areca nut is a masticatory substance considered to generate group 1 carcinogens for humans. Its toxicity is mainly associated with its alkaloids; mainly arecoline. High antioxidant potential of the nut increase the prevention of alkaloids from nitrosation and oxidative stress resulting from auto-oxidation of polyphenols (catechin and epicatechin). The study aims to optimize extraction conditions to maximize the extraction of beneficial polyphenols, and toxic alkaloids co-extracted with them, yet resulting highest antioxidant capacity. The fresh areca nuts (indigenous) were purchased from three different locations in the Colombo district. The dry powder samples of areca nut (moisture < 9%; 10% w/v) were extracted using different solvents (water, ethanol, methanol, and acetone) using Cold Maceration (CM; 60˚C, 3h), Soxhlet Extraction (SE; 60˚C, 3h), and Ultrasound-Assisted Extraction (UAE; 80% intensity; pulse 5s/5s; 30 min.). The values vary significantly ($p<0.05$) for each solvent. Among the polar and non-polar solvents used, acetone (CM) resulted in the highest Total Polyphenol Content (TPC) (370.14 ± 10.65 mg GAE g^{-1}) followed by methanol (135.3 ± 26.7 mg GAE g^{-1}), ethanol (124.92 ± 1.61mg GAE g^{-1}), and water (106.68 ± 2.09 mg GAE g^{-1}). Methanol extract (CM) resulted in the highest alkaloid content (11.58 ± 4.63mg g^{-1}) followed by ethanol (8.97 ± 0.92 mg $^{g-1}$), water (5.43 ± 0.31 mg g^{-1}), and acetone (2.16 ± 0.76mg g^{-1}). The ratio of TPC to alkaloids was 19:1, 11:1, 13:1, and 171:1 for water, methanol, ethanol, and acetone respectively. Antioxidant capacity exhibited by methanol extract (317.14 ± 42.16 mg GAE g^{-1}) was only lowered to acetone. The ultrasound-assisted methanol extract exhibited the highest TPC (278.87 ± 3.51 mg GAE g^{-1}), alkaloids value (18.27 ± 0.02 mg GAE g^{-1}), and antioxidant capacity (230.13 ± 38.80 mg GAE g^{-1}) followed by maceration and soxhlet extraction.

Keywords: Areca nut, polyphenols, alkaloids, antioxidants, ultrasound-assisted

EVALUATION OF *IN VITRO* PAPAIN INHIBITORY ACTIVITY IN SEEDS OF CULTIVAR BOMBAY; A LOCAL CULTIVAR OF *Vigna unguiculate* (COWPEA)

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Abstract

Although cysteine proteases are important for the survival of living organisms, it may lead to adverse conditions if the activity is dysregulated. Legumes with high protein contents have been recognized as a rich source of protease inhibitors. The discovery of cysteine protease inhibitors may lead to the development of novel therapeutic agents. The present study aimed to evaluate and analyse the cysteine inhibitory activity (CIA) of a seed extract from a local cultivar of *Vigna unguiculate* known as Bombay, which was released from the field crops research and development institute of Sri Lanka and pooled together. A series of concentrations (20%, 10%, 5%, 2.5%, and 1.25%) of water extract of seeds was first evaluated for papain inhibitory activity in the presence of casein. Then the effect of temperature (0 ℃, 20 ℃, 37 ℃, 60 ℃, 80 ℃,100 ℃) and pH (5.8, 6.4, 7.0, 7.4, 8.0) as well as the presence of metal ions (Ba^{2+}, Fe^{3+}, Zn^{2+}, Cu^{2+}, Na^{+}), detergents (Triton X 100, Tween-80), an oxidizing and a reducing agent (DMSO, β-mercaptoethanol) was evaluated. Among the tested concentrations, 10% crude extract of the seed sample (67.59±0.01%) exhibited the highest CIA. Hence, it was used for further analysis. The maximum CIA was recorded at 37°C (65.26±0.06%), which gradually decreased with the increment of the temperature. According to the results, the highest CIA was indicated at 6.4 pH (76.19±0.04%). Among metal ions, the maximum CIA was exerted in the presence of Na^{+} (88.4±0.1%). The CIA was increased ($p<0.05$) in the presence of the Triton X 80 (69.90±0.06%) while it was decreased in the present of Triton X 100 (65.34±0.03%), DMSO 50±0.01% and β-mercaptoethanol (58.50±0.007%). The results of the present study emphasized that the tested local cultivars of *V. unguiculate* exert considerable cysteine inhibitory activity, and the analysis data will be useful in the isolation of active agents.

Keywords: Proteases, cysteine inhibitors, legumes, *Vigna unguiculate,* Bombay

EVALUATION OF THE IMPACT OF PROBIOTICS ADDITION ON WATER QUALITY AND GROWTH PERFORMANCE OF *Catla catla*

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Abstract

In Sri Lanka, the aquaculture industry plays the most important role in fulfilling consumers' protein requirements. Nevertheless, currently, this industry is threatened by issues of water quality and pathogenic diseases. As a result, *Catla catla* farming at the National Aquaculture Development Authority (NAQDA)-Udawalawa is associated with a high rate of disease and issues with water quality, which may facilitate the use of antibiotics and other chemicals as well as a low fry survival rate. Hence, the purpose of the present study was to evaluate the impact of probiotic strains as a water additive to enhance the water quality and *C. catla* growth performance. The field trial was conducted for 60 days. Furthermore, around 360 *C. catla* fry were randomly stocked into 12 cemented tanks to increase the reliability of the measurements. The experiment tanks were provided with the following additions of the commercial probiotic mixture "Profs": T_C (no probiotic added), T_1 ($0.012gm^{-2}$ weekly), and T_2 ($0.03gm^{-2}$ weekly). The fish in each group were fed the standard commercial feed three times a day for eight weeks. After a comparison of the results, it was revealed that the level of dissolved oxygen (DO) in the water of the treatment tank had gradually improved at the end of the experiment. ($P< 0.05$). In contrast, total ammonia nitrogen ($N\text{-}NH_4$) concentrations in probiotic tanks were dramatically reduced ($P<0.05$) by the probiotic supplements. Additionally, it has been observed that an overdose of microbial supplementation ($0.03gm^{-2}$) boosts the survivability of the host organism ($P <0.05$; the highest survival percentage was observed in probiotic-treated ponds; 92%). However, compared to the reference tanks, the direct addition of a microbial supplement has not revealed any noticeable variations in growth parameters (final body weight, feed conservation ratio, weight gain, specific growth rate, and condition factor). As a result of these experiments, it was found that the direct administration of probiotic supplements helped to decrease nitrogen compounds, enhance the DO level in rearing water, and increase host species survival rates.

Keywords: *Catla catla*, water quality, growth performance, probiotic, bioremediation

EFFECT OF SELECTED PROBIOTIC STRAINS IN FERMENTATION STAGE ON THE TOTAL PHENOLIC CONTENT, TOTAL FLAVONOID CONTENT AND ANTIOXIDANT CONTENT OF MID COUNTRY BLACK TEA

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Abstract

Fermentation is used as a preservation technique in many sectors of the food industry. Microbially fermented tea is ~~a~~ popular among consumers due to its unique sensory properties and higher nutritional and bioactive content. Acetic acid bacteria, lactic acid bacteria, yeast, and fungi are commonly found microbes used in fermented tea production. Kombucha, Pu-erh tea, Fu brick tea, and Miang tea are some of the fermented tea varieties. This study was conducted to investigate the effect of selected probiotic strains on the bioactive compounds of mid country black tea. For the study, yeast (*Saccharomyces cerevisiae*), thermophilic lactic acid bacteria (*Lactobacillus bulgaricus* and *Streptococcus thermophiles*), and a 1:1 mix of two of above cultures were used as the microbial cultures, and their fermentation was allowed at mesophilic (25˚C) and thermophilic (43˚C) conditions separately. Experiments were designed and analysed using 3*2 multilevel factorial design. Fermented tea samples were tested for Total Phenolic Content (TPC), Total Flavonoid Content (TFC) and Antioxidant content alone with a control black tea samples (without microbial fermentation). Results from the above tests showed that the TPC, TFC and antioxidant content of fermented tea are higher compared to black tea. They also revealed that fermentation temperature and the interaction of culture and temperature have a significant effect ($p<0.05$) on TPC, TFC and antioxidant content. But fermentation culture has only a significant effect on TPC and antioxidant content. Tea fermented with yeast ~~in~~ at 25˚C shows the highest antioxidant content (2591.45±88.00 mg AAE/L). Mix culture tea sample fermented at 43˚C is highest in TPC (325.97±14.70 mg GAE/L) and TFC (227.41±11.45 mg QE/L). Findings of this study can summarized as the microbial fermentation significantly effect on the TPC, TFC and Antioxidant content of tea and the degree of effect vary with fermentation culture in different temperatures.

Keywords: Antioxidants, fermented tea, flavonoids, lactic acid bacteria, mid country tea, polyphenols, Yeast

METABOLIC DIVERSITY OF MICROBIAL COMMUNITY IN HOT SPRINGS IN SRI LANKA

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Abstract

Microbes and microbial products are being used in multiple applications in industrial processes, and microbial metabolic pathways play a significant role in industries viz; paper and pulp, food and beverage, textiles, detergents , pharmaceuticals, bioethanol production, personal care, animal feed, and other. The utilization of microbial metabolic pathways in industries has been identified as an eco-friendly and cost-effective alternative for the chemical transformation of substrates. Therefore, this study aimed at the identification of industrially important metabolic pathways in the hot spring microbial community in Sri Lanka. In this study, water samples were collected from the bottom and surface of four hot springs (Madunagala, Mahaoya, Wahava, and Kivlegama) in the southern and eastern provinces of Sri Lanka. Temperature, conductivity, pH, and Dissolved Oxygen (DO) levels were measured at the site itself using portable standard meters. The genomic DNA was extracted from collected water samples using the MoBio Power Water DNA Extraction Kit and subjected to 16s rDNA amplicon sequencing on the Illumina MiSeq platform at Omega BioServices, USA. Resulted sequencing data was analysed using the METAGENassist web server tool and predicted the metabolic inferences of hot spring microbial communities. The temperature of the springs ranged from 33.7℃ to 55.4℃ where conductivity, pH, and DO levels were recorded from 801 to 1507 µS/cm, 7.20 to 8.27 and 1.05 – 3.5 mg/L respectively. According to the metabolic inference analysis, hot springs were mainly comprised of metabolic pathways of nitrogen fixation, iron oxidation, pollutant degradation, methane oxidation, sulphur reduction, streptomycin production, cellulose degradation, selenite reduction, sugar fermentation, propionate metabolism, xylan degradation, nitrite reduction, and sulfide oxidation. The results revealed that Sri Lankan hot springs are comprised of the microbes having industrially important metabolic pathways. Consequently, these metabolic pathways can be successfully used in industrial processes.

Keywords: Hot spring, microbes, metabolic pathways, industrial applications, DNA

SPECIES DIVERSITY AND ABUNDANCE OF AQUATIC AVIFAUNA IN KIMBULAWALA WETLAND, COLOMBO RAMSAR WETLAND CITY

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Abstract

Colombo, Sri Lanka is the first capital in the world declared as a Ramsar Wetland City. Approximately 20km^2 area of Colombo is covered with wetlands. Wetlands in urban areas play a major role in the assemblage and conservation of water birds. Aquatic avifauna use wetland habitats throughout their lives or during a certain part of their lives and support to maintain the ecological balance of this delicate ecosystem. The aquatic avifaunal diversity and abundance in Kimbulawala wetland, located in the Colombo Ramsar Wetland City was studied from May 2021 to April 2022. Aquatic avifauna was surveyed using line transect method. Habitats present within the Kimbulawala wetland were categorized as open water body, trees, grassland, shrubs and bare land. Sampling was done in three time slots of the day, morning, mid-day, and evening. The Shannon-Weiner diversity index was used to determine the species diversity. In the present study, total of 16,659 aquatic avifauna belonging to thirteen species, eight families and four orders were recorded from the study site. The order Ciconiiformes was found to be the most dominant. Most abundant aquatic avifauna species is the Black-headed ibis (*Threskiornis melanocephalus*) (39.13%). Of the total bird species recorded one species belong to nationally Near Threatened category (NT); Black crowned night heron (*Nycticorax nycticorax*) and four species belong to globally NT category namely, Oriental Darter (Anhinga melanogaster), Spot Billed Pelican (*Pelicans philippensis*), Painted Stork (*Mycteria leucocephala*) and Black Headed Ibis (*Threskiornis melanocephalus*). Species diversity and abundance of aquatic avifauna in Kimbulawala wetland varied greatly during the study period. Since Kimbulawala wetland act as important breeding and nesting grounds for Black headed ibises, Little cormorants, Intermediate egrets and Little egrets, higher abundance of aquatic avifauna was recorded during the breeding season. The results of this research indicate that Kimbulwala wetland act as a prime habitat for the aquatic avifauna and account for rich aquatic avifaunal diversity.

Keywords: Abundance, aquatic avifauna, Kimbulawala, species diversity, wetlands

KNOWLEDGE, ATTITUDE AND ADVERSE EFFECTS RELATED TO HAND SANITIZER USAGE DURING THE COVID-19 PANDEMIC AMONG A SELECTED GROUP OF PROFESSIONALS IN WESTERN, SOUTHERN, CENTRAL AND UVA PROVINCES OF SRI LANKA

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Abstract

COVID-19 is a highly transmissible viral infection caused by the SARS-CoV-2 virus, and the WHO has recommended the use of hand sanitizers as a preventive measure. Several studies have reported adverse effects that occur due to the use of hand sanitizers. Hence, this study aims to analyze knowledge and attitudes related to the usage of hand sanitizers, and possible adverse effects among selected healthcare professionals and bank/office staff in four selected provinces of Sri Lanka. A descriptive cross-sectional study was carried out among conveniently selected 366 healthcare professionals and bank/office staff using a pretested questionnaire distributed physically in conveniently selected banks and hospitals of the Western, Southern, Central, and Uva provinces of Sri Lanka, as they are more vulnerable to COVID-19 infection and it is recommended to use hand sanitizers often. The most commonly used form of hand sanitizer was assessed using the pretested questionnaire. The descriptive statistics were used to analyze the data using the SPSS 25 package. Among the total population, 54.6% (n=200) were bank/office staff followed by 45.4% (n=166) of healthcare professionals. The majority of healthcare professionals had poor knowledge (40.96%) and a moderate attitude (40.96%). The majority of bank/office staff had a good attitude (36.5%) and moderate knowledge (43%) related to hand sanitizers. This highlights the need to overcome the knowledge gaps in the community. The majority preferred liquid over gel hand sanitizers that has given most of the adverse effects. Adverse effects such as flaky skin (30.1%), callous formation (19.7%), swelling in hands/palms (16.7%), followed by dry skin (63.1%), redness in skin (44.8%), burning sensation (39.1%), damaged skin (38.5%), irritation in skin (36.6%), itchy skin (30.3%), wrinkles and cracks (27.0%),which significantly associated with the form of hand sanitizer and presence of previously diagnosed skin diseases were identified during the study. Hence, the findings of this study, allow the community to select the most suitable form of hand sanitizer according to its adverse effects.

Keywords: COVID-19, hand sanitizers, adverse effects, knowledge, attitude

EVALUATION OF THE COMPOSITION AND ABUNDANCE OF ALGAE AND CYANOBACTERIA IN THREE RESERVOIRS IN AMPARA DISTRICT. (DRY ZONE), SRI LANKA

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Abstract

Algae and cyanobacteria are two types of photosynthetic phytoplankton present in many different water bodies worldwide. Agricultural activities that contribute to the nutrient enrichment of water bodies cause eutrophic conditions that produce algae and cyanobacteria blooms. Some cyanobacteria, algae species produce toxins, taste and odour-producing compounds, and clog filters, among other negative effects. Therefore, the objective of the present study was to assess the species composition and abundance of cyanobacteria and algae in three reservoirs in the dry zone: Ampara District Konduwattuwan, Himidurawa, and Rambakan Oya from November 2021 to March 2022. Algae and cyanobacteria were enumerated using the natural sedimentation method, and physicochemical parameters were evaluated using standard methods (APHA 4500). The results of the study showed a clear positive relationship between temperature, pH, Total Phosphate level, Electrical Conductivity, color, and algal abundance. Fourteen phytoplankton genera belonging to the phylum, Chrolophyta, Cyanophyta, Euglenophyta, and Crysophyta, were identified morphologically. In all the tested water bodies, Cylindrospermopsis sp. was the dominant cyanobacterium, and Microcystis sp. were the co-dominant species. According to the Shannon Diversity Index, the Himidurawa tank had the highest diversity (H = 1.124), while the Konduwattuwan had the lowest (H = 0.46). The physicochemical parameters were within safe limits for drinking water (SLS 614: 2013), except for the turbidity. Temperature (r= 0.668, P=0.007, pH (r= 0.591, P=0.020), Total Phosphate level (r= 0.796, P=0.000), Electrical Conductivity (r= 0.635, P-value = 0.011), and colour (r= 0.734, P-value = 0.002) had substantial positive associations with algal abundance. According to the Canadian Water Quality Index, the Himidurawa tank (69.37) and the Rambakan Oya (70.03) were acceptable for drinking. In contrast, the Konduwattuwan tank had a Water Quality Index of 54.02, suggesting that it was at the marginal level.

Keywords: Algae, cyanobacteria, cyanotoxins, physico-chemical parameters, algal blooms.

CYTOTOXICITY OF WATER COLLECTED FROM ANGUNUKOLAPELESSA, GALNEWA AND PADAVIYA IN SRI LANKA ON MONKEY KIDNEY CELL LINE (VERO)

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Abstract

The synergistic effect of fluoride and hardness could cause Chronic Kidney Disease of Unknown aetiology (CKDu) in Sri Lanka since there is a correlation between the areas with high CKDu prevalence and the areas with high fluoride and hardness concentrations in drinking water. The objective of the present study was to apply a Vero; monkey kidney epithelial cell line to determine the cytotoxicity of fluoride and the hardness of drinking water collected from Angunukolapelessa, Galnewa, and Padaviya. Cell viability was assessed using the Sulforhodamine-B (SRB) assay. Four dilution series of water samples (1:1000, 1:100, 1:10, and 1:1 V/V; water sample: Dulbecco's Modified Eagle's Medium) collected from drinking water wells in the areas of Angunukolapelessa (CKDu non-prevalent), Galnewa (CKDu low-prevalent), and Padaviya (CKDu high-prevalent) were exposed to Vero; monkey kidney epithelial cells ($5x10^3$ cells/well). CC_{50} values and non-viable cell percentages were determined. Fluoride, hardness, and other water quality parameters were tested using the industry-standard methodology. The water quality parameters remained within the SLSI drinking water standards, whereas the fluoride and hardness concentrations in the water from Angunukolapelessa, Galnewa, and Padaviya were 0.281, 92; 1.53, 216; and 1.91, 280 mgL^{-1}, respectively. The percentages of non-viable cells in the cells exposed to the water samples from Angunukolapelessa, Galnewa, and Padaviya ranged from 1.37 to 8.04%, 4.71 to 15.15 %, and 5.31 to 18.95 %, respectively while the corresponding CC_{50} values for the cells were 24.43, 15.62 and 12.18 mgL^{-1} respectively. Significantly lower non-viable cell percentages were recorded in the cells exposed to Angunukolapelessa water than in the cells exposed to Galnewa water ($p<0.05$), and Padaviya water ($p<0.05$). Furthermore, the CC_{50} values for Padaviya and Galnewa water were lower than those for Angunukolapelessa water. The findings of the present study indicate that drinking water from Padaviya with high fluoride and hardness reduces the cell viability of Vero cells.

Keywords: CKDu, flouride, hardness, synergistic effect, Vero cell

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