



# Uni - In Alliance 2023

“Building a Sustainable Future through Inspiring  
Innovation and Entrepreneurship”



**Uni - In  
Alliance  
2023**

Building a Sustainable Future  
through Inspiring Innovation and  
Entrepreneurship

## 9<sup>th</sup> Undergraduate Research Symposium

Organized by B.Sc. (Hons) Degree  
in Applied Sciences

PROCEEDINGS OF  
**UNI - IN ALLIANCE SYMPOSIUM**

# **Proceedings of the 9<sup>th</sup> Undergraduate Research Symposium**

**“UNI-IN ALLIANCE 2023”**

Faculty of Applied Sciences

University of Sri Jayewardenepura, Nugegoda, Sri Lanka

23<sup>rd</sup> June 2023



Organized by

B.Sc. (Honours) Degree in Applied Sciences

**Proceedings of the 9<sup>th</sup> Undergraduate Research Symposium  
Organized by the Students of B.Sc. (Honours) Degree in  
Applied Sciences, University of Sri Jayewardenepura**

23<sup>rd</sup> June 2023

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**Faculty of Applied Sciences**

University of Sri Jayewardenepura

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**Message from Prof. Upul Subasinghe**  
**Acting Vice Chancellor & Dean of the Faculty of Applied Sciences**  
**University of Sri Jayewardenepura**



I would like to offer my heartfelt congratulations to the organizers of the 9<sup>th</sup> Uni-in Alliance Symposium. It brings me immense joy to witness this significant event once again, showcasing your unwavering commitment to advancing education at the Faculty of Applied Sciences, University of Sri Jayewardenepura.

In line with the motto of the University of Sri Jayewardenepura, "Vijja Uppathathan Setta", the Faculty of Applied Sciences remains dedicated to enriching the academic experience of our students. Through our Honours Degree Program in Applied Sciences, we strive to equip our students with critical thinking and problem-solving skills, fostering a culture of innovation and practical application. The papers presented at the Uni-in Alliance Symposium reflect the invaluable findings derived from the students' project period, highlighting their ability to analyse real-world problems and propose viable solutions.

This year's theme, "**Building a Sustainable Future through inspiring innovation and Entrepreneurship**" holds critical importance and is timely. As our nation faces numerous challenges, the selected papers, totalling around 100 across ten different disciplines, will address not only the issues faced by our country but also those faced by others. I am confident they will provide valuable insights and methods for overcoming the present obstacles and paving the way forward. I am happy to see past "Uni-In-Alliance" symposium participants have not only excelled in their respective fields but have also added significant value through their contributions as academics, researchers, and a plethora of executive positions. Their experiences and expertise gained from participating in the symposium have played a pivotal role in shaping their professional journeys and making a positive impact in their areas of specialization.

Finally, I extend my sincere well wishes for the success of the 9<sup>th</sup> Uni-In Alliance Symposium. May this event serve as a catalyst for inspiring innovation, fostering collaboration, and propelling our students towards a brighter future.

**Prof. Upul Subasinghe**  
**Acting Vice Chancellor and Dean of the Faculty of Applied Sciences**  
**University of Sri Jayewardenepura**

**Message from Prof. Pahan Godakumbura**

**Coordinator**

**B.Sc. (Honours) Degree in Applied Sciences**

**Faculty of Applied Sciences**

**University of Sri Jayewardenepura**



I am delighted to extend my heartfelt congratulations on the successful organization of the 9<sup>th</sup> Annual “Uni-In Alliance Symposium 2023” in B.Sc. (Honours) Degree in Applied Sciences program of University of Sri Jayewardenepura. This event serves as a testament to your unwavering commitment to fostering the professional growth of students and developing their soft skills. By focusing on areas such as leadership, report writing, presentation, public speaking, event organizing, and teamwork, you are equipping yourselves with essential competencies that will undoubtedly benefit for your future endeavours.

The B.Sc. (Honours) Degree in Applied Sciences program offered to you is truly commendable for its multidisciplinary nature. With a primary objective of producing highly competent and employable graduates, this program equips students with practical knowledge that aligns with the demands of the industrial sector in various fields. The fact that students in this program have consistently excelled in their academic pursuits, earning research awards, and competing successfully with undergraduates from other state universities, reflects the quality and dedication of the program.

I am particularly impressed by the industrious efforts of the 119 students who form the 9<sup>th</sup> batch of this program. Their commitment to conducting industrial-based research over the past six months is truly admirable. This symposium provides an invaluable platform for students to share their experiences and disseminate the knowledge they have acquired during their research internships. I am confident that the B.Sc. (Honours) Degree in Applied Sciences program will prove to be an excellent opportunity for new graduates, opening doors to a multitude of job prospects in academia as well as in industrial sector. The practical skills and theoretical foundation they have acquired through this program will undoubtedly set them apart as highly sought-after professionals in their respective fields.

Once again, congratulations on the successful organization of this symposium. Your dedication to nurturing the next generation of professionals is truly admirable, and I applaud your unwavering commitment to the success.

I wish you all the best in your future endeavours.

**Prof. Pahan Godakumbura,**

**Coordinator**

**B.Sc. (Honours) Degree in Applied Sciences**

**Faculty of Applied Sciences**

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<b>Aquatic Resource Management</b>	Dr. I. Senanayake
<b>Electronic and Embedded System</b>	Dr. W. K. I. L. Wanniarachchi

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**AGENDA**

**UNI-IN ALLIANCE 2023**

**23<sup>rd</sup> June 2023**

**Venue: Senate Boardroom, University of Sri Jayewardenepura**

- 08:00-08:30 Registration
- 08:30-08:40 Lighting the Oil Lamp and University Anthem
- 08:40-08:45 Welcome Address by Mr. Yasitha Kudahetty, Chairperson of the Symposium
- 08:45-08:55 Speech by Prof. Upul Subasinghe, Acting Vice Chancellor & Dean of the Faculty of Applied Sciences, University of Sri Jayewardenepura
- 08:55-09:05 Video Presentation (Introduction to Symposium)
- 09:05-09:55 Keynote Speech by Dr. Sisira Ranathunga, Director of Manufacturing, Global Rubber Industries Pvt. Ltd.
- 09:55-10:30 Tea Break
- 10:30-12:30 Session 1: Oral and Poster Presentations (at Faculty Premises)
- 12:30-13:15 Lunch Break
- 13:15-15:15 Session 2: Oral and Poster Presentations (at Faculty Premises)
- 15:15-15:30 Tea Break
- 15:30-15:40 Address by Prof. Pahan Godakumbura, Course Coordinator, BSc. (Honours) Degree in Applied Sciences
- 15:40-16:40 Entertainment Item
- 16:40-17:35 Awarding Ceremony
- 17:35-17:40 Concluding Remarks and Vote of Thanks by the Secretary of the Symposium
- 17:40-17:45 National Anthem



<b>Time</b>	<b>Oral Presentations: Morning Session</b>				
	<b>AST</b>	<b>AMT</b>	<b>CHE</b>	<b>BSC</b>	<b>PST</b>
<b>10:30-10:50</b>	<b>ID 33</b> Analysis of Factors Affecting Employee Turnover in Telecommunication Industry: A Survival Analysis.  <b>Waduge D. D. D.</b>	<b>ID 32</b> A Survey on the Strongly J-Cleanness Property on Various Ring Structures.  <b>Abeyrathne S. M. D. R.</b>	<b>ID 23</b> Aboveground Biomass Estimation of Selected Home Garden Trees.  <b>Hansamali A. P. U.</b>	<b>ID 30</b> Optimization of Culture Media for <i>In Vitro</i> Propagation of <i>Valeriana mooni</i> from Different Explants.  <b>Sudusinghe A. A. M.</b>	<b>ID 39</b> Investigation of Optimum Dispersing Technique for Various Glove Dispersion Formulations.  <b>Kumarasiri H. P. K. H. P.</b>
<b>10:50-11:10</b>	<b>ID 51</b> Analysis of Weight Variability of Handmade Chocolates: A Case Study in Sri Lanka.  <b>Rajapaksha R. M. M. N. S.</b>	<b>ID 37</b> Forecasting Sri Lankan Stock Market Indices Using Discrete Fourier Transforms.  <b>Rajapaksha R. W. K. T.</b>	<b>ID 24</b> Evaluation of Curing Characteristics and Reinforcing Behavior of Cinnamon Wood Bio Char as a Filler Material for Natural Rubber Composites.  <b>Gunathilaka K. P. M. P.</b>	<b>ID 34</b> Effect of Ascorbic Acid on Rheological Properties of Wheat Flour Dough and Bread Quality.  <b>Subasinghe S. R.</b>	<b>ID 52</b> Investigating the Effectiveness of LiCl-Treated Banana Fibers in Enhancing Electrical Conductivity and Non-Marking Properties in Tires.  <b>Polgampala D. N.</b>
<b>11:10-11:30</b>	<b>ID 78</b> Modeling Time Series Analysis to Forecast Embellishment Capacities in Apparel Industry.  <b>Dissanayake D. M. D. M.</b>	<b>ID 60</b> Development of A Data Base Management System for Monitoring Embellishment Operations.  <b>Harischandra G. J. B.</b>	<b>ID 69</b> Evaluating the Stability of the Polyurethane Coating Emulsion Applied on the Inner Surface of Synthetic Poly-Isoprene Surgical Gloves.  <b>Balasuriya B. L. C. J.</b>	<b>ID 41</b> Association of Covid-19 Vaccination and Relapse in Children with Nephrotic Syndrome.  <b>Gunathunga A.</b>	<b>ID 84</b> The Study of the Effect of Incorporating an Eco-Friendly Filler on the Cost and Properties of a Toothbrush Shaft.  <b>Abeyasinghe D. P.</b>

Time	AST	AMT	CHE	BSC	PST
11:30-11:50	<p><b>ID 90</b> The Impact of Finance Industry-Specific and Macro-Economic Factors on Non-Performing Loans in the Non-Banking Finance Sector in Sri Lanka.</p> <p><b>Ranaweera P. D. K. S.</b></p>		<p><b>ID 85</b> Value Addition to Rice Bran Oil in Sri Lanka Through Soap Development.</p> <p><b>Wijayaratne T. D.</b></p>	<p><b>ID 47</b> Screening of Plant Extracts Against Leaf Blight Disease in Coconut.</p> <p><b>Kaushalya D. L. V.</b></p>	<p><b>ID 86</b> Enhancement of Properties in High Temperature Grease Using Graphite and Polymer Additives.</p> <p><b>Yapa A. D. K.</b></p>
11:50-12:10	<p><b>ID 105</b> A Statistical Model to Calculate Fabric Quantity After Relaxation Process in Garment Industry.</p> <p><b>Sathsarani W. A. G.</b></p>		<p><b>ID 108</b> Assessment And Mitigation of Carbon Footprint in The Printing Industry: A Case Study of a Selected Newspaper Company in Sri Lanka.</p> <p><b>Gunawardana I. K. M.</b></p>	<p><b>ID 48</b> Molecular Identification and Serotyping of <i>Listeria monocytogenes</i> Contaminations in Raw Milk Collected from Collecting Centers in Polonnaruwa District, Sri Lanka.</p> <p><b>Perera T. K. D.</b></p>	
12:10-12:30	<p><b>ID 106</b> Relationship Between Era5 Data Set and Precipitation in Sri Lanka During the Transmission Year El Nino and La Nino.</p> <p><b>Madusha A.K. S.</b></p>			<p><b>ID 54</b> Morphological Characterization of Sri Lankan Coconut Variety Mirishena Semi Tall.</p> <p><b>Hangarapitiya H. L. S. V.</b></p>	

<b>Time</b>	<b>Oral Presentations: Evening Session</b>				
	<b>IEE</b>	<b>FSM</b>	<b>MMA</b>	<b>APH</b>	<b>RSD</b>
<b>13:15-13:35</b>	<b>ID 44</b> Socio-Economic Determinants of Energy Choice for Cooking: Evidence from Households in Sri Lanka.  <b>Rahubaddhe M.</b>	<b>ID 40</b> Development of a Yeast Spread with a New Formulation of Ingredients Targeting the Local Market.  <b>Prasadani K. A. E.</b>	<b>ID 59</b> Impact of Intrinsic and Extrinsic Rewards on Job Satisfaction of Non-Managerial Employees of Mas Active Linea Intimo.  <b>Thuduwewatte S.</b>	<b>ID 45</b> Vibration Analysis of Electrical Motors in an Air Conditioner Unit.  <b>Fernando M. N.</b>	<b>ID 46</b> An Expert System to inspect Skin Diseases in Household Dogs.  <b>Kudahetty Y.</b>
<b>13:35-13:55</b>	<b>ID 67</b> Employee Engagement and Performance of Tele sales insurance Broker Company in Sri Lanka.  <b>Manamperi R. S.</b>	<b>ID 79</b> Microbiological Quality Assessment of Selected Ceylon Spices from Small and Medium Scale Entrepreneurs.  <b>Wijegunawardana D. S.</b>	<b>ID 61</b> Factors Affecting to Women’s Career Advancement in Office Staff of ABC Hospitals, Sri Lanka.  <b>Liyanage A. R. H.</b>	<b>ID 72</b> Physical Properties of a Newly Designed Filter Cartridge to Remove Hardness in Water.  <b>Samaraweera L.</b>	<b>ID 116</b> Development of A Fully Actuated Mono-Copter Uav with Thrust Vectoring.  <b>Herath H. M. N. L. B.</b>
<b>13:55-14:15</b>		<b>ID 96</b> Test Method to Validate Thermal Inactivation of <i>Salmonella</i> Using Surrogate Microorganism <i>Enterococcus faecium</i> (ATCC 8459) in Bottled King Coconut.  <b>Weligala W. G. L. S.</b>	<b>ID 63</b> Impact of Employer Branding on Intention to Retain: With Special Reference to White-Collar Employees at ABC Private Sector Organization, Western Province, Sri Lanka.  <b>Mihirani P. K. D. S. W.</b>	<b>ID 89</b> Curing Characteristics, Mechanical Properties, and Morphology of Fiber Waste Filled Natural Rubber Composites.  <b>Fernando U. U.</b>	<b>ID 75</b> Enhancing Chatgpt Sinhala: Improving Coherence and Contextual Understanding for Conversational Agents in The Sinhala Language Using Gpt-2.  <b>Silva A. R.</b>

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<b>Time</b>		<b>FSM</b>	<b>MMA</b>	<b>APH</b>	
<b>14:15-14:35</b>		<p><b>ID 113</b> Development of Novel Symbiotic Buffalo Milk Beverage with Probiotic <i>Lactobacillus rhamnosus</i>.</p> <p><b>Dissanayaka A. N.</b></p>	<p><b>ID 80</b> Intervening Effect of Job Satisfaction of its Antecedents and Employee Job Performance: A Study of a State Financial Organization.</p> <p><b>Hettiwaththa D. D.</b></p>	<p><b>ID 92</b> Physico-Mechanical, Electrical Conductivity and Ageing Properties of Graphite Nanosheet and Micro Graphite Filled Natural Rubber Composites.</p> <p><b>Navodya I. M.</b></p>	
<b>14:35-14:55</b>			<p><b>ID 104</b> Factors Affecting Job Satisfaction: A Study of ABC Bank PLC.</p> <p><b>Chapa A.</b></p>	<p><b>ID 101</b> Industrial Power Analysis of A 3-Phase 4-Wire System.</p> <p><b>Upeksha H.</b></p>	
<b>14:55-15:15</b>				<p><b>ID 112</b> Surface Modification of Recycled Polyester Fabric by Immobilizing Agnps Using Gamma Ray Irradiation and its Antibacterial Properties.</p> <p><b>Udayangi I.</b></p>	

Time	Poster Presentations: Morning Session			
	AMT	PST	MMA	APH
10:30-10:45			<b>ID 21</b> Evaluation of The Expected Requirements of Black Tea among Buyers Before Purchasing Tea from Colombo Tea Auction.  <b>Rathnayaka I. R. M</b>	<b>ID 62</b> Performance of Portland Composite Cement with Respect to Durability, Strength, and Workability.  <b>Gunathunga J.</b>
10:45-11:00			<b>ID 22</b> The Effect of the Ongoing Economic Crisis in Sri Lanka on Migration of Youth from the Country.  <b>Yahampath T. K.</b>	<b>ID 91</b> Industrial Development of Determination of Water Vapor Transmission Rate of Different Materials.  <b>Weerasena C. J.</b>
11:00-11:15			<b>ID 57</b> Mediating Effect of Employee Engagement on its Drivers and Employee Job Performance.  <b>Wickramasinghe N. A.</b>	<b>ID 107</b> Enrich Performance of The Positive Electrode in The Lead Acid Battery Embedding Different Additives.  <b>Dissanayeka R. J.</b>
11:15-11:30			<b>ID 66</b> The Impact of Green Supply Chain Management Practices on Sustainability Performance of Export Manufacturing Companies in Western Province in Sri Lanka.  <b>Chandrasiri P. H. B. T.</b>	<b>ID 114</b> Gamma Irradiation Effects on Sapphire Gemstones: A Comparative Study of UV Vis and FTIR Spectra in Natural and Treated Gems.  <b>Ramadasa L. H.</b>

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<b>Time</b>	<b>AMT</b>	<b>PST</b>	<b>MMA</b>	<b>APH</b>
<b>11:30-11:45</b>	<b>ID 20</b> Building A Converged Campaign Plan for the Prepaid Customers. <b>Liyanage H. V.</b>		<b>ID 70</b> Factors Affecting to The Usability of Information System Project Management Software. <b>Perera J. C.</b>	
<b>11:45-12:00</b>	<b>ID 53</b> Rescheduling Construction Projects That Have Been Delayed Due to Pandemic and Economic Crisis. <b>Francis N. E.</b>	<b>ID 76</b> Development of Winter Solid Tire Tread Compound. <b>Erandika K. G. H.</b>	<b>ID 73</b> Mediating Effect of Green Orientation-A Study of a Multi-National Organization. <b>Kulasekara L. S.</b>	
<b>12:00-12:15</b>		<b>ID 77</b> Preparation of Fabric Printing Ink Using Waste Fabric Ink. <b>Bandara L.</b>	<b>ID 87</b> An Analysis of Factors Affecting Drugs Prevention and Control Training Program Effectiveness Conducted by XYZ Government Institute in Sri Lanka. <b>Rajakaruna V.</b>	
<b>12:15-12:30</b>		<b>ID 83</b> Study to Use Cotton Flock as A Replacement for Fiber-Reinforced Rubber in Solid Tire Heel Compound. <b>Karunarathna C. C.</b>	<b>ID 97</b> Mediating Effect Organizational Commitment with its Drivers and Employee Job Performance. <b>Sumanaweera N. D.</b>	
<b>12:30-12:45</b>			<b>ID 103</b> Integration of Sustainability Concept as a Marketing Strategy to Expand the Market Special Referencing to Acl Cable PLC. <b>Dickumburage C. S.</b>	

Time	Poster Presentations: Evening Session			
	AST	CHE	BSC	IEE
13:15- 13:30	<b>ID 18</b> Identifying Variables and Gaps in Covid-19 Symptoms Analysis: A Systematic Literature Review.  <b>Piyasiri N. N.</b>	<b>ID 17</b> Evaluation of the Growth and Quality of <i>Lactuca sativa</i> (Lettuce) Under IoT Based Fully Automated Controlled Environmental System.  <b>Fernando M. W. S. N.</b>	<b>ID 19</b> Molecular Identification and Antifungal Susceptibility of <i>Candida parapsilosis</i> , Isolated from Cancer Patients at Apeksha Hospital, Maharagama, Sri Lanka.  <b>Gagulie S. C.</b>	
13:30- 13:45	<b>ID 50</b> The Factors Affecting the Lead Time of The Elastic Inspection Process At Material Quality Assurance Department in Abc (Pvt) Ltd Apparels.  <b>Priyashad H. B. M.</b>	<b>ID 26</b> The Impact of Covid Pandemic Situation on Water Quality of Attanagalla Oya.  <b>Siriwardana H. C.</b>	<b>ID 56</b> Nutritional Analysis of Selected Commercially Available Canned Fish Products.  <b>Heepitiyage H. G. N. K.</b>	
13:45- 14:00	<b>ID 64</b> Impact of Non-Financial Benefits on Executive Employees' Retention at XYZ Public Service Sector Organization, Southern Province, Sri Lanka.  <b>Palliyaguru M. H.</b>	<b>ID 29</b> Bio Char- Urea Inclusion Composite: A Frugal Approach for Reducing Nitrogen Loss in Application of Urea.  <b>Senaratne G. D. H. E.</b>	<b>ID 98</b> Evaluation of the Antibacterial Activity of <i>Azadirachta indica</i> and <i>Dipterocarpus zeylanicus</i> Plants from Sri Lanka, Against Common Wound Infectious Bacteria.  <b>Priyangani K. M. N.</b>	<b>ID 49</b> Determinants of Monetary Poverty Among Households in Sri Lanka.  <b>Munasinghe K. S. K.</b>

<b>Time</b>	<b>AST</b>	<b>CHE</b>	<b>FSM</b>	<b>IEE</b>
<b>14:00-14:15</b>		<b>ID 74</b> Design and Development of Water Ionizer Machine.  <b>Senarath P. D.</b>		<b>ID 68</b> Effect of Lean Tools in Minimizing Wastes in Sri Lankan Apparel Industry.  <b>Chathumadhara D. D. P.</b>
<b>14:15-14:30</b>		<b>ID 100</b> Separation of Rhodamine B From Dye Effluent Via Adsorption to Biochar Derived Out of the Textile Sludge.  <b>Pandithage K. S.</b>	<b>ID 42</b> Developments and Evaluation of a Nutritious Coconut Milk and Star Gooseberry ( <i>Phyllanthus acidus</i> ) Enrich Ice Cream Product.  <b>Karunarathna H. P. I. W.</b>	
<b>14:30-14:45</b>		<b>ID 109</b> Determination of the Effect of Commercially Available Plastic Containers, Storage Conditions and Time on Water Quality Parameters.  <b>Weerasekara C. A.</b>	<b>ID 110</b> Microbiological Quality of Dried Fish Products of Selected Varieties from Negambo.  <b>Herath H. M. D. M.</b>	
<b>14:45-15:00</b>		<b>ID 115</b> Preparation And Characterization of a Slow-Release Potassium and Trace Elements Fertilizer Formulation Based on PVA-Alginate-Cellulose Hydrogel.  <b>Nirmal D. G. D. S.</b>	<b>ID 111</b> Development of a Fortified Set Yoghurt Product with Canistel Fruit ( <i>Pouteria campechiana</i> ).  <b>Jayawardane L. S. U.</b>	





# Applied Mathematics



"Building a Sustainable Future through Inspiring Innovation and Entrepreneurship"

**ID 20**

**BUILDING A CONVERGED CAMPAIGN PLAN FOR THE PREPAID CUSTOMERS**

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In today the customer value management is used to handle by the Artificial Intelligence (AI) driven campaign management. In telecommunication industry, customers are targeting to the AI driven campaigns, according to the subscriber types. In this study, the main purpose is to create a converged campaign plan for the prepaid customers by referring only to the customer types, prepaid MBB and prepaid airtime recharge. The objectives of the study are to being more customer centric while having an increment in the total delivered count from the target of the campaign and the total take-up for the campaign. The theory used in conducting the project is set theory to create a schedule for the campaigns by using the set intersection, set union and the definition of a subset. The campaigns have been scheduled by avoiding the overlap of the segments, lead the campaigns to an increase in the delivered count from the total target base and the total take-ups. The segment overlapping can be avoided and mapped by considering the rules that are given to target the subscribers to a campaign. And the study has concluded that, the rules that used as match all the requirements are only be considered when scheduling the campaigns and the other rules and the requirement has no effect on the segments get intersected in targeting the subscribers to a campaign. So, it concludes that the campaigns should be scheduled by considering the segments of the campaigns and the rules that have been used in targeting the audience for the campaigns.

**Keywords:** *converged plan, prepaid customers, set theory applications, delivered count, total take-ups*

**ID 32**

**A SURVEY ON THE STRONGLY J-CLEANNES PROPERTY ON VARIOUS RING STRUCTURES**

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The concept of ring cleanness has been extensively studied in the field of abstract algebra, as it provides valuable insights into the structure and properties of rings. Among the different variants of ring cleanness, the notion of strongly  $J$ -cleanness has emerged as a significant area of research. This review article explores the concept of strongly  $J$ -cleanness and its applications in various ring structures. The objectives of this theoretical study are (i) to investigate the properties of the strongly  $J$ -cleanness property, (ii) to identify this property on various ring structures like rings with involution, group rings, triangular matrix rings and matrices over local rings, and (iii) to explore associated theorems. This study is done by reviewing articles and books assembled through online, in relation to the classified subtopics under the main topic. First the main definitions and properties of the desired ring structures were observed thoroughly. Then the applicability of strongly  $J$ -cleanness property to those rings were investigated and the facts are elaborated accordingly. The main preliminary result is that, for a strongly  $J$ -clean ring  $R$  which is local, the quotient ring  $R/J(R)$  is isomorphic to a two elements field. Any Boolean ring is a precise example for a strongly  $J$ -clean ring. For a  $*$ -ring  $R$ ,  $R[i] = \{a + bi | a, b \in R, i^2 = -1\}$  and power series ring  $R[[x]]$  are strongly  $J$ - $*$ -clean if and only if  $R$  is strongly  $J$ - $*$ -clean. For a ring  $R$ , if  $T_n(R)$  is strongly  $J$ -clean for some  $n \in \mathbb{N}$ , then so is  $R$ . An element  $r \in R$  is strongly  $g(x)$ - $J$ -clean if  $r = s + w$  where  $g(s) = 0, w \in J(R)$  and  $sw = ws$ . Strongly  $J$ -clean rings are exactly strongly  $(x^2 - x)$ - $J$ -clean rings. For a ring  $R$  and a group  $G$ , if  $RG$  is strongly  $J$ -clean, then  $R$  is strongly  $J$ -clean and  $G$  is a 2-group. For a commutative local ring  $R$ ,  $M_2(R)$  is not a strongly  $J$ -clean ring. Another subclass of clean rings is discovered which called strongly  $J_n$ -clean rings. For a fixed natural number  $n$  and  $x \in R$  is strongly  $J_n$ -clean if there exists an idempotent  $e \in R$  such that  $x - e \in U(R)$ ,  $ex = xe$  and  $(ex)^n \in J(R)$ . Theories were developed in virtue of Jacobson radicals, idempotents and clean rings. This study aims to inspire researchers to delve deeper into this intriguing concept and enlighten to pursue new research areas in abstract algebra.

**Keywords:** Strongly  $J$ -clean, ring, Jacobson radical

**ID 37**

**FORECASTING SRI LANKAN STOCK MARKET INDICES USING DISCRETE  
FOURIER TRANSFORMS**

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The stock market indices are used to gauge the financial movements in the stock markets. If the index rises, the market is growing, and if it falls, the market is declining. The only stock exchange in Sri Lanka is operated by the Colombo Stock Exchange (CSE). Its two primary stock market indices are ASPI and S&P SL20. Market indices provide information to investors. So, they can predict the risks and returns of their investments. While ASPI forecasts assist investors in understanding the future direction of the entire market, S&P SL 20 forecasts help investors make investment decisions. Therefore, it is crucial to identify appropriate forecasting methods for ASPI and S&P SL20 to meet investor expectations. The process of converting a discrete signal from the time domain to the frequency domain is known as the Discrete Fourier Transform (DFT). This approach helps to decompose a complex signal into simpler components, making analysis easier. In this study, the ASPI and S&P SL20 indexes were modeled as the FFT (Fast Fourier Transform) amplitude spectrum using the daily stock values. The daily index data from the years 2017 to 2022 were used to formulate this model. The study also examined the periodic deviations of both indices during the considered period. Additionally, this research predicts the near future of both indices by modeling the daily indices values. To further verify the accuracy of the model, data from the SET (Thailand Stock Index) were employed. The findings indicate that the periodic patterns in the ASPI and S&P SL20 datasets range from 4 to 7 days, while those in the SET index datasets range from 5 to 6 days. The predicting capacity of the proposed model was evaluated by using metrics such as MSE (Mean Squared Error), MAE (Mean Absolute Error) and MAPE (Mean Absolute Percentage Error). In conclusion, it can be said that the suggested Fourier model can anticipate the ASPI and S&P SL20 indices for a short period of time equivalent to their periodicities.

**Keywords:** *Discrete Fourier Transform, Trend patterns, ASPI, S&P SL20*

**ID 53**

**RESCHEDULING CONSTRUCTION PROJECTS THAT HAVE BEEN DELAYED  
DUE TO PANDEMIC AND ECONOMIC CRISIS**

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The COVID-19 pandemic and the economic crisis have disrupted construction projects worldwide, leading to delays and budget overruns. Rescheduling these projects requires careful planning and evaluation of the impact of the delay. Construction project managers must re-evaluate the project timeline and budget, prioritize critical activities, communicate with stakeholders, and consider alternative options. They must also plan for contingencies and adapt plans and strategies as necessary to keep the project on track. This study is concerned with finding a new project completion date for an already delayed project. We considered an ongoing construction project which has three sites, that has been delayed due to the COVID- 19 pandemic and the economic crisis. Firstly, prior to the pandemic and the crisis, we studied their original schedules which were created by using Microsoft Project as well as their revised schedules that were created after holding the project due to the pandemic and the crisis. In Microsoft Project, the Critical Path Method is used to create a comprehensive project schedule. It works by establishing dependencies between activities and calculating the earliest start and finish times for each activity by considering activity durations, task dependencies, and resource availability. Our next priority was to determine the current progress of each site, as they are at different stages of completion. We reviewed the scheduled duration/days for each task of the projects and analyzed how many days have elapsed. We discovered that some tasks have already been fully completed, while others are partially completed, and some have yet to begin. We used Microsoft Excel to assess the remaining work and the completed work for each task as a percentage. The percentages of the completed work were then integrated into the Microsoft Project along with the starting dates for the remaining tasks. By doing so, we were able to generate an estimated project completion date. Then we decided to add a buffer time to keep the project on track. Rescheduling construction projects that have been delayed due to the pandemic and economic crisis is a challenging task, but by considering timeline, budget, availability of workers and materials, project managers can minimize the impact of the delay and ensure successful project completion.

**Keywords:** *Construction Projects, Schedule Plans, Covid-19, Economic Crisis, Microsoft Project*

**ID 60**

## **DEVELOPMENT OF A DATA BASE MANAGEMENT SYSTEM FOR MONITORING EMBELLISHMENT OPERATIONS**

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Production of undergarments in the Apparel industry is widely defined as the process of working collaboratively with other outsourcing suppliers to create quality Embellishments (EMB), by improving or expanding the capabilities in most of the leading garment manufacturing firms' performance in the country. In these processes, the requirement of managing the overloaded information with respect to making important decisions of the suppliers is essential. Since the prevailing system of the Brandix Apparel Limited Essentials depends on manual-checking with repeating workload, the main objective of the system development is to provide the ability to access and quickly evaluate different aspects of the listed suppliers with an all-inclusive package for performance management: to evaluate the collaboration between the company and the outsourcing suppliers, a dashboard was developed mainly based on the monthly EMB production plan from January 2023 to April 2023. The EMB production capacity details were collected from the development team database. Further, the key information of the EMB outsourcing suppliers was collected using a questionnaire distributed among the responsible employees in the development and EMB planning team. "Microsoft Power Bi" was used as a data visualization tool to design the dashboard. The system consists of the development information, suppliers' approval details and the monthly EMB plan to make the necessary decision making. It ensures the data are real-time updated. Also, the feedback obtained from the required departments states that the system helps to minimize the errors while observing and analyzing the data effectively with minimum time and cost. Developing the dashboard system concludes that the satisfaction regarding the EMB manufacturing suppliers supports the teams to identify the efficiency level of the developed tool with respect to attain the standards of the company aspects and performance.

***Keywords:*** *Outsourcing, Data-base management, Dashboard, Efficiency*



# Applied Statistics



"Building a Sustainable Future through Inspiring Innovation and Entrepreneurship"



**ID 18**

**IDENTIFYING VARIABLES AND GAPS IN COVID-19 SYMPTOMS ANALYSIS: A SYSTEMATIC LITERATURE REVIEW**

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This systematic literature review aimed to identify variables related to COVID-19 symptoms and gaps in COVID-19 symptoms analysis. The review protocol identified 24 articles using LENS.ORG, which were screened and analyzed using PRISMA guidelines. The analysis method used was bibliometric analysis with VOS viewer, which created a keyword co-occurrence network visualization. Five clusters were identified: Severe COVID-19 Symptoms, Public Health Engagement for COVID-19 Symptoms, Demographic Variables Affect COVID-19 Symptoms, Flu and Cold as COVID-19 Symptoms, and Smell and Taste Loss as COVID-19 Symptoms. Most common symptoms are flu, cold, smell, and taste loss. The study found gaps related to COVID-19 symptoms analysis in public health engagement, demographic variables, flu and cold as COVID-19 symptoms, and smell and taste loss as COVID-19 symptoms. Primary care of public health plays a vital role in COVID-19 symptoms. This study can help researchers and policymakers to identify gaps in COVID-19 symptom analysis and focus on public health engagement, demographic variables, flu and cold as COVID-19 symptoms, and smell and taste loss as COVID-19 symptoms.

***Keywords:*** COVID-19, symptoms, public health, flu, cold, smell and taste loss

**ID 33**

**ANALYSIS OF FACTORS AFFECTING EMPLOYEE TURNOVER IN  
TELECOMMUNICATION INDUSTRY: A SURVIVAL ANALYSIS**

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Employee turnover is a major challenge faced by organizations across various industries, and the telecommunication industry is no exception. Even though organizations invest significant amounts of money in hiring and training new employees, every year many firms experience a considerable loss of talent. The main objective of this study is to investigate the factors affecting employee turnover in ABC (Pvt) Ltd, which is a Small and Medium Enterprise (SME) in the telecommunications industry. Data were obtained from human resource records of 75 employees that have been recruited during the last 15 years. Survival analysis techniques were used when examining the time to turnover. The Kaplan-Meier estimator was used to estimate the survival function of employment duration, while the Cox Proportional hazards model was used to examine the risk of factors that influence employment duration. The results show that salary, promotion, age at which employees joined the company and job level significantly impact employee turnover, while gender and marital status do not. The hazard rate of executive level employees was 3.4 times higher than that of top-level employees. The concordance index of 0.793 indicates that the fitted model is a good turnover predictor. The study concludes that addressing these factors through competitive compensation packages, providing opportunities for career growth and development, and ensuring job roles are aligned with employee skills and experience can help improve employee retention in ABC (Pvt) Ltd.

**Keywords:** *kaplan-meier estimator, cox proportional hazards model, concordance index, employee turnover*

**ID 50**

**THE FACTORS AFFECTING THE LEAD TIME OF THE ELASTIC INSPECTION  
PROCESS AT MATERIAL QUALITY ASSURANCE DEPARTMENT IN ABC (PVT)  
LTD APPARELS**

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Elastic inspection is a critical process in apparel manufacturing that ensures the quality and compliance of elastic materials used in garments. This study aims to identify the significant factors that influence the lead time of elastic inspection in the Accessory section and examine their relationships. A comprehensive dataset of 5027 observations is analysed using various statistical techniques to gain insights into the characteristics of the data and develop a regression model. The dataset undergoes thorough data integrity checks to ensure completeness and minimize the impact of missing values on the model's accuracy. Descriptive statistics are employed to understand the dataset, including measures of central tendency and variability for each variable. The presence of multicollinearity is addressed using the variance inflation factor (VIF) to identify variables with high collinearity. The dataset is split into a training set (4827 observations) for model development and a validation set to evaluate the model's performance on unseen data. The findings reveal several significant factors that related the lead time of elastic inspection. The width of the elastic item and the measurement of repeat length exhibit a positive relationship with the lead time, indicating that wider and longer elastic items require more time for inspection. The type of elastic and the choice of supplier also have a significant impact on the lead time. Furthermore, the quantity and quality status of the elastic items play a role, with an increase in quantity slightly prolonging the inspection time, while various quality issues significantly affect the lead time. The regression model, developed using the backward elimination method, demonstrates a good fit and explains approximately 90.04% of the variation in the elastic inspection lead time. The adjusted R-squared value (0.8998) further supports the model's robustness. To validate the model's performance, a testing dataset is used, resulting in moderate to good prediction accuracy. The Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE) values indicate that the model's predictions are reasonably close to the actual values. The insights gained from this study provide valuable guidance for optimizing the elastic inspection process, enhancing efficiency, and allocating resources effectively in the Accessory section of apparel manufacturing.

**Keywords:** *Elastic inspection, Lead time, Apparel manufacturing, Optimization*

**ID 51**

**ANALYSIS OF WEIGHT VARIABILITY OF HANDMADE CHOCOLATES: A CASE STUDY IN SRI LANKA**

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Handmade chocolates are chocolates that are made by hand, rather than by machine. The weight variation of chocolate related handmade products is a common problem that affects the quality and consistency of the final product. To maintain weight requirements and minimize waste, manufacturers must prioritize waste reduction and process optimization. In this research, we analyze the weight variability of different chocolate products. The main objective of this study is to identify the significant factors that associate with the weight variation of chocolates and to provide insights into how these factors can be controlled to minimize weight fluctuations. The methodology involves the analysis of 10 chocolate products selected out of 65 based on large weight variations from its standard weight values. Primary data was used to the analysis. Systematic probability sampling was used for all products except chocolate eclairs, which were sampled using convenience sampling. Results revealed that the coffee truffles exhibited the least weight variation due to their unique production process, while chocolate-coated marshmallows and rocky road showed the highest variations due to a pre-processed food cutting step. Statistical hypothesis tests were conducted to compare the population mean weight with the standard weight for each chocolate product, and the results indicated significant differences between the two for all products. Brownies, rocky road, coconut bars, chocolate-coated marshmallows, and coffee truffles had population mean weights greater than the standard weight, while others had weights lower than the standard. Further investigations found a nonrandom pattern in the data, attributed to the effect of cutting order. The results of the regression analysis indicated a strong association between the cut order and a non-random distribution. In conclusion, chocolate products with high weight variations may require adjustments to their standard weight range or modifications to the production process to achieve the desired target weight. Additional factors, such as precise temperature control and employee consistency, also contribute to weight variations. The results of this research will help chocolate makers to improve their manufacturing processes, enhance the quality of their products, and ultimately satisfy customer preferences.

**Keywords:** *handmade chocolate, weight variations, consistency, quality control*

**ID 64**

**IMPACT OF NON-FINANCIAL BENEFITS ON EXECUTIVE EMPLOYEES'  
RETENTION AT XYZ PUBLIC SERVICE SECTOR ORGANIZATION, SOUTHERN  
PROVINCE, SRI LANKA**

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Employees should be known and treated as organizations' most valued assets. And also to achieve success and to gain maximum contribution, employee satisfaction and employee retention are very important. Measuring employee retention is essential to understand the effectiveness of engagement and retention strategies. This study utilized two methods, the retention rate of XYZ Organization and an employee satisfaction survey, to measure employee retention. Non-financial benefits play a vital role in enhancing organizational performance and influencing employee retention. Drawing from Maslow's Hierarchy of Needs and Herzberg's theory, this research examined the impact of non-financial benefits on employee retention, focusing on training and development, job security, and work environment. A field study conducted in the XYZ public sector service organization in Southern province, Sri Lanka, collected data through questionnaires. The study aimed to determine the impact of non-financial benefits on retention and establish relationships between training, job security, work environment, and retention. Descriptive statistics and thematic analyses were used to analyze the data. The study involved 100 randomly selected executives as research participants. Self-administered questionnaires were employed, and SPSS version 26.0 was used for data analysis. The results indicated that training and development, job security, and work environment have a positive impact on employee retention. Recommendations based on the research findings were provided to policy makers to improve retention strategies.

**Keywords:** *employee retention, non-financial benefits, training and development, job security, work environment*

**ID 78**

**MODELING TIME SERIES ANALYSIS TO FORECAST EMBELLISHMENT CAPACITIES IN APPAREL INDUSTRY**

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The apparel industry prioritizes to improve the production efficiency and profitability through the reduction of delivery lead time to give fast response for the customer. To fulfill the customer delivery date, it's important to check whether the sufficient plant capacity is available after received the order. Delivery lead time increase when embellishments which are called value additions are added to final products. If there is an accurate prediction of the future embellishment capacities it can be reserve enough space in the plant early on, promptly meeting customer's expectations. This study focused on model building of time series to forecast the embellishment capacities. It helps to reduce the delivery lead time by minimizing the last minutes difficulties when book the plant space. Monthly embellishment capacities by pieces quantities from 2017 to 2022 are readily available in well-known apparel industry in Sri Lanka was used for this study. Commonly used four embellishment types were identified in this apparel industry namely pad print, printing, embroidery, and lacer cut. These four types of embellishment capacities are forecasted separately using two forecast techniques exponential smoothing methods and Auto Regressive Integrated Moving Average method (ARIMA). Several ARIMA models were fitted for each embellishment types and the best model was selected based on the minimum AIC criteria. Box-Jenkins methodology was followed for the stochastic approach of forecasting. 80% of each sub data sets of embellishment type were taken as training set and remaining 20% was used as testing test. One of the main challenges faced in this study is the absence of continuous incremental and linear trends of embellishment capacities due to the sudden drop in capacities experienced across all embellishment types during the COVID-19 period. Time series analysis was performed for the entire data set and the post COVID-19 data set to obtain a more accurate model. It was difficult to assess the accuracy of the time series models for post COVID-19 due to the small sample size of the post COVID-19. ARIMA (1,0,0) model was selected to forecast print and embroidery capacities and ARIMA (2,0,0) model was selected to forecast pad print and laser cut capacities. Both time series techniques Holt's model and non-seasonal ARIMA provide same results in forecasting embellishment capacities.

***Keywords:*** *apparel industry, embellishment capacity, time series, ARIMA*

**ID 90**

**THE IMPACT OF FINANCE INDUSTRY-SPECIFIC AND MACRO-ECONOMIC FACTORS ON NON-PERFORMING LOANS IN THE NON-BANKING FINANCE SECTOR IN SRI LANKA**

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The Non-banking financial sector in Sri Lanka plays a pivotal role in providing financial services to individuals and companies. However, like other financial institutions, licensed finance companies (LFCs) are subject to risks, including non-performing loans (NPLs), which can negatively impact their performance and financial stability. NPLs occur when borrowers fail to repay loans according to the stipulated criteria and terms. NPLs can limit the capacity of LFCs to lend and raise money and erode the confidence of clients, investors, and stakeholders in their operations. The general objective of this study is to identify the causes of NPLs in LFCs in Sri Lanka. Specifically, the study will examine the relationship between NPLs and industry-specific factors, such as gross loans, liquidity ratio, net operating profit of LFCs, finance company's lending rate, and deposit rate, as well as macroeconomic factors, including inflation, GDP growth, interest rates, private sector credit, unemployment rate, and exchange rates. This study used data from nine LFCs in Sri Lanka and examined the causes of NPLs. The chosen variables enable the researchers to understand how internal and external factors contribute to NPL incidence of NPLs in LFCs. Panel data regression models were used in this study. Those are Pooled ordinary least square, Fixed, and Random effect models. Chow, Hausman, and Lagrange multiplier tests were used to test the robustness of the findings using data from 2012 to 2022. The test results revealed that industry-specific variables such as liquidity ratio, net operating profit of LFCs, deposit rate, and finance company's lending rate have shown significant influence on NPLs in LFCs in Sri Lanka. Among the macroeconomic factors GDP, inflation rate, private sector credit, foreign exchange reserves, and interest rate significantly influenced on NPLs in LFCs in Sri Lanka. The results of this study provide insights into the main causes of NPLs in Sri Lanka's non-banking finance industry. The findings will be useful for practitioners and policymakers to develop strategies and policies to improve the sector's financial stability. Moreover, the study results may be used to forecast and assess NPL levels in the future and guide decision-making in financial sector-related companies in Sri Lanka.

**Keywords:** *licensed finance companies, non-performing loans, macroeconomic, industry-specific variables*

**ID 105**

**A STATISTICAL MODEL TO CALCULATE FABRIC QUANTITY AFTER  
RELAXATION PROCESS IN GARMENT INDUSTRY**

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Fabric relaxation is an essential operation in the process of garment manufacturing industry. Without fabric relaxation, it is not possible to obtain the dimensional stability of the final garment. When ordering fabrics, acceptable limits for fabric shrinkage or expansion are established. Therefore, any variance beyond permissible limits is unacceptable. This unacceptable shortage will lead to stop the production process. To resume production the shortage quantity needs to be reordered, resulting in additional costs for the factory. Studying a model to calculate the exact length after relaxation allows the responsible department in garment factory to order fabric without any surplus or shortage and this will reduce the cost of the company. The aim of this study is to develop a statistical model to estimate the fabric quantity after relaxation process in garment industry. This study addresses a research gap by considering fabric suppliers, fabric quality, fabric material, and fabric shade as important factors, which were previously overlooked, in predicting fabric length deviation. In this research study data were collected for past 10 months from January to September of 2022. The most essential factors that affect to the fabric relaxation are fabric suppliers, fabric quality, and fabric material and fabric shade. The data analysis and model development were conducted using R language. The performance of different models, including multiple linear regression, support vector machine (SVM) and generalized mixed models were evaluated using statistical metrics. The analysis involved comparing the sum of squares error (SSE) values obtained from these models. The results showed that the multiple linear regression model achieved an SSE of 50523.83, SVM model yielded a SSE of 53398.94 and generalized mixed models achieved SSE values above 50000. The high SSE values obtained from the models indicate poor performance in predicting fabric length deviation. But analyzed variables have shown a significant influence on the model. Therefore, it can be assumed that there are other important factors that have been omitted from the models. These unaccounted factors may have a substantial impact on the accuracy of the predictions and should be further investigated.

**Keywords:** *fabric, shrinkage, expansion, relaxation*



**ID 106**

**RELATIONSHIP BETWEEN ERA5 DATA SET AND PRECIPITATION IN SRI LANKA DURING THE TRANSMISSION YEAR EL NINO AND LA NINA**

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The study aimed to investigate the correlation between ERA5 data and precipitation in Sri Lanka during El Nino and La Nina years. The research focused on meteorological stations in Sri Lanka and multiple regression techniques to analyze rainfall patterns and develop a rainfall forecasting model. The study area covered the three districts (Anuradhapura, Colombo, Kurunegala) in the country and highlighted the regional differences in rainfall. The ERA5 data set provides high-resolution information on meteorological variables. The study processed rainfall data from meteorological stations in Sri Lanka for three years and merged it with ERA5 data. Multiple Linear Regression analysis was used to determine the relationship between the two data sets and forecast rainfall patterns during different years. The findings reveal observations regarding rainfall patterns in different districts of Sri Lanka. The mean monthly rainfall with minimal rainfall was observed consistently in June and July in the Anuradhapura district. The results demonstrate a strong positive correlation between temperature and specific humidity. In an attempt to forecast rainfall for upcoming El Niño and La Niña years, a multiple regression model was developed. The model incorporated various variables, including temperature, specific humidity, U wind, V wind, and Vorticity downloaded from the ERA5 database at four pressure levels (100hp, 500hp, 850hp, and 1000hp). The p-value of the regression model, " $< 2.2e-16$ ," indicates an extremely low p-value. That suggests that there is a significant relationship between the predictors and the response variable. However, the model explains only a small portion (3.37%) of the variability in rainfall, with limited predictive power. The significant F-statistic suggests a relationship between predictors and rainfall, but overall explanatory power remains weak. Therefore, it is highly recommended to seek further model improvements for incorporate other important variables for more accurate rainfall forecasts.

**Keywords:** *multiple regression, ERA5 data, correlation analysis, El Nino, La Nina, rainfall*



# Biological Sciences



"Building a Sustainable Future through Inspiring Innovation and Entrepreneurship"

**ID 19**

**MOLECULAR IDENTIFICATION AND ANTIFUNGAL SUSCEPTIBILITY OF  
*CANDIDA PARAPSILOSIS*, ISOLATED FROM CANCER PATIENTS AT APEKSHA  
HOSPITAL, MAHARAGAMA, SRI LANKA**

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*Candida* species cause systemic Candidiasis in immunocompromised cancer patients, leading to significant morbidity and mortality. In recent years, experience in increased resistance of *Candida* species to antifungal agents and antifungal drug is becoming a major problem in effective management of cancer patients in Sri Lanka. At present, a large proportion of bloodstream infections are due to non-*Candida albicans* *Candida* spp. (*Candida* species of yeast other than *C. albicans*), with *Candida parapsilosis* being one of the most isolated *Candida* spp. from blood cultures in Asia, Latin America, and some European countries. If a rapid and effective methodology for *Candida parapsilosis* identification and antifungal susceptibility testing is available, it allows clinicians to use the most appropriate antifungal agent in-order to decrease the mortality and morbidity rates of their cancer patients infected with *C. parapsilosis* and thereby decrease antifungal resistance. In this study, 52 *Candida* isolates collected from cancer patient at the Apeksha Hospital, Maharagama, Sri Lanka were identified by multiplex PCR. In multiplex PCR procedure, two primer pairs specific to two strains of *C. parapsilosis* [*C. parapsilosis* I -CPPIIF41 (f)/CPPIIR122 (R) and *C. parapsilosis* II -CPPIIF41 (F)/CPPIIR69 (R) ] were used to amplify extracted DNA of *Candida* isolates from cancer patients. Furthermore, to determine the susceptibility of the identified *C. parapsilosis* isolates, antifungal susceptibility testing was conducted using the disk diffusion method on Mueller-Hinton agar medium. The testing was carried out in accordance with the CLSI guidelines (CLSI document M44-A) and the manufacturer's instructions (HiMedia Laboratories). Six antifungal drugs, including Fluconazole, Itraconazole, Clotrimazole, Miconazole, Ketoconazole, and Amphotericin B, were utilized in the susceptibility testing. There were no *C. parapsilosis* I species among the 52 isolates, and 16 samples (30.77%) were identified as *C. parapsilosis* II. According to this study Fluconazole was the most susceptible drug against *C. parapsilosis* II (100%) and Amphotericin B was the least susceptible drug against *C. parapsilosis* II (25%). Ketoconazole, Clotrimazole, Itraconazole and Miconazole showed varying degrees of susceptibility patterns. The study concludes that multiplex PCR is a better approach for the identification of *C. parapsilosis* for clinical and diagnostic purposes and Fluconazole is the best antifungal drug against *Candida parapsilosis*, while caution is advised when considering Amphotericin B as a treatment option due to low susceptible rates. Clinicians can use these findings to better manage *Candida parapsilosis* infections.

**Keywords:** *Immunocompromised, Multiplex PCR, Susceptibility, Anti-fungal susceptibility test*

**ID 30**

**OPTIMIZATION OF CULTURE MEDIA FOR *In vitro* PROPAGATION OF *Valeriana mooni* FROM DIFFERENT EXPLANTS**

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*Valeriana mooni* (Caprifoliaceae)(Lanka Thuwarala) is an endemic plant in Sri Lanka which has economical and medicinal value. Previous studies revealed, that *V.mooni* shares pharmacogenetic properties with *Nardostachys jatamansi* (Caprifoliaceae ) which is extensively utilized in Ayurveda and traditional medicine in Sri Lanka. Since the exportation of *N.jatamansi* has restricted in India, it is important to study an efficient propagation system for large scale production of *V. mooni* . The aim of this study was to establish an efficient protocol for *in vitro* micropropagation of *V.mooni* by identifying the best surface sterilization method and optimizing culture media for shoot and root induction using various growth regulators at different concentrations and ratios. This was achieved by using different explants, such as nodal/auxiliary bud, leaf, and rhizome buds. Best shoot induction (**3.13±0.35**) from axillary buds of *V.mooni* was observed in the presence of Indole-3-acetic acid (IAA )(1.0mg/L) and Kinetin (Kn) (5.0mg/L) with the maximum mean length of the shoots (**3.21±0.10cm**). Highest shoot multiplication (**5.17±0.30**) with maximum mean length of shoots resulted in MS medium supplemented with IAA (1.0mg/L) and Kn( 5.0mg/L) during first and second sub culture level. Rooting *in vitro* shoots is successful in half strength medium supplemented with 1.0mg/L IAA, resulting highest mean roots per shoot (**7.50±0.30**). Callus induction was studied *in vitro* using leaf explants. The best callus formation was achieved in MS media supplemented with 2,4-Dichlorophenoxyacetic acid (2,4-D) (3.0mg/L ) and Kn ( 1.0 mg/L ). Despite no significance was observed in callus induction from leaf explants, the findings of this study suggest that, utilizing nodal or axillary buds as explants can be a more promising approach for *in vitro* propagation of *V. mooni*. This highlights the importance of selecting the appropriate explants for optimal results in *in vitro* propagation studies, and the possibility of mass propagation of *V. mooni* through *in vitro* methods.

**Keywords:** *in vitro* propagation, explants, Indole-3-acetic acid (IAA), Kinetin(Kn), 6-Benzylaminopurine( BAP), Indole-3-butyric acid (IBA),Murashige and Skoog (MS) medium, 2,4-Dichlorophenoxyacetic acid (2,4D)

**ID 34**

## **EFFECT OF ASCORBIC ACID ON RHEOLOGICAL PROPERTIES OF WHEAT FLOUR DOUGH AND BREAD QUALITY**

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Bread is one of most famous staple foods all around the world. Only the wheat flour is capable of forming dough with correct viscoelastic properties required in bread making process. Viscous properties allow the dough to expand during the fermentation process while elastic properties give the strength. Gluten is one of major protein types present in wheat flour and gliadin and glutenin are the most responsible gluten proteins which play a vital role during dough mixing and development process. In the bakery industry, many different types of flour conditioners such as oxidative agents, reducing agents, emulsifiers etc. are used to improve the properties of the dough and finally the end product. Ascorbic acid is one of cheapest and efficient additives that commonly used in the bakery industry. The objective of this work was to study the changes of dough rheology & bread quality with addition of ascorbic acid and optimize the ascorbic acid formulation for selected 74% extraction wheat flour type. Six dough samples were prepared with the concentrations of 50 ppm, 100 ppm, 150 ppm, 200 ppm, 250 ppm, 300 ppm ascorbic acid. One sample was kept as the control without adding ascorbic acid. Then, proximate analysis (moisture, ash, and wet gluten content and acid insoluble ash content) was done to all the samples to evaluate rheological properties. Water absorption, stability and time to break down are the major parameters that can take from Farinograph. Water absorption was changed significantly when increased the ascorbic acid level. Time to breakdown was increased with the ascorbic acid level and stability was higher in 100 ppm and 150 ppm samples. Then energy, extensibility & resistance to extension are the major parameters that can take from Extensograph. When increased the ascorbic acid level, energy and resistance to extension increased and highest values showed in 100 ppm & 150 ppm samples while extensibility decreased. When amount of ascorbic acid increased, dough hardness increased. Dough temperature and dough pH were not changed significantly with the time for all the six samples. According to the results of sensory criteria, overall appearance was good in the breads with 100 ppm and 150 ppm. According to the results, 100 ppm – 150 ppm ascorbic acid level is suitable for bread making process.

**Keywords:** *bread, rheology, sensory evaluation, glutenin, gliadin*

**ID 41**

## **ASSOCIATION OF COVID-19 VACCINATION AND RELAPSE IN CHILDREN WITH NEPHROTIC SYNDROME**

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Nephrotic Syndrome (NS) is a common glomerular disease in childhood that exhibits a relapsing course and is typically triggered by T-cell activation and cytokine release. With the Pfizer-BioNTech vaccine being administered to children with active renal disease between 12 and 18 years old in Sri Lanka, concerns have arisen regarding a potential association between COVID-19 vaccination and an increased risk of relapse in children with NS. The objective of this study was to investigate the potential association between the COVID-19 vaccine and an increased risk of relapse in children with NS, with a focus on sustainable concepts in patient management. The study was conducted at the Pediatric Nephrology Clinic at Teaching Hospital Peradeniya and included all seventy-one children with steroid-sensitive disease between the ages of 12 and 18 years who received the COVID-19 vaccine. Urinary protein excretion of 3+ or more for 3 consecutive days was considered a relapse. The vaccination date was verified using the vaccination card, and the relapse frequency was noted one year before and after vaccination. The number of relapses was analyzed using a Bayesian statistical Poisson regression model. The results of the study showed a significant association between COVID-19 vaccination and an increased risk of relapse in children with NS. The incidence rate ratio (IRR) for relapse within one year of vaccination was 1.53, indicating a 53% higher relapse rate than the pre-vaccination period. The IRR for relapse within 6 months and 3 months after vaccination was even higher, with values of 3.09 and 4.57, respectively. This study highlights the importance of careful patient management and monitoring in the context of sustainable care for children with NS who have received the COVID-19 vaccine. Effective patient management strategies must be implemented to mitigate the risk of relapse following COVID-19 vaccination in children with NS, particularly in the first few months after vaccination. Healthcare providers should be aware of the potential risks associated with COVID-19 vaccination in this population and take steps to ensure that patients receive appropriate monitoring and care. Further studies are needed to better understand the underlying mechanisms and risk factors associated with relapse in children with NS after COVID-19 vaccination.

**Keywords:** *Nephrotic syndrome, COVID-19 vaccination, Relapse rate, Risk factors, Patient management*

ID 47

## SCREENING OF PLANT EXTRACTS AGAINST LEAF BLIGHT DISEASE IN COCONUT

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Leaf blight disease is one of the main fungal diseases, caused by *Pestalotiopsis palmarum* reported to be lethal to coconut causing a major impact on the economy due to the reduction of the seedling growth and yield. The pathogen has a world-wide distribution and the severity of the disease is differently reported from various climatic regions probably may due to environmental factors and the nutritional status of the palm. Currently, a number of physical and chemical methods are used to control the disease yet reported with several drawbacks; toxicity, high prices and scarcity. Therefore, use of natural fungicides which are cost-effective and environmentally friendly to control leaf blight disease is a timely need. In this study, experiments were conducted to identify the in-vitro effect of crude plant extracts to control leaf blight causing fungus under the laboratory conditions. The pure cultures of *Pestalotiopsis palmarum* were prepared on Potato Dextrose Agar (PDA) medium and the fungus was identified using the morphological characteristics. Antifungal activity of crude plant extracts of 20 plant species was preliminary screened using the food poisoning method with six replicates. The radial growth of the fungal cultures was measured for 7 days and the percentage of inhibition (PI value) was calculated to select the most effective plant extracts for further antifungal testing. Out of 20 plant varieties tested, 11 plants have shown antifungal potential as safe natural alternatives to chemical fungicides. All aqueous extracts of *Citrus aurantiifolia* (Lime), *Zingiber officinale* (Ginger), *Allium sativum* (Garlic), *Allium cepa* L. (Onion) and *Curcuma longa* (Turmeric) exhibited the maximum potential in suppressing the growth and reducing the sporulation demonstrating 100% inhibition of spore germination of the pathogen. Additionally, leaf extracts of *Alstonia scholaris* (Ruk Aththana), *Aloe vera* (Komarika) and *Helianthus annuus* (Wild Sunflower) showed high antifungal efficiency providing more than 90% inhibition of spore germination. Furthermore, the leaf extracts of *Piper nigrum* (Pepper), *Clitoria ternatea* (Katarolu) and *Tamarindus indica* (Tamarind) showed more than 75% inhibition of spore germination. The significance of the results was indicated by the p value ( $P < 0.03$ ) suggesting the observed differences are statistically significant. Further studies are underway to determine the effective minimum inhibitory concentration and to isolate and characterize the active ingredients in these plant extracts.

**Keywords:** leaf blight disease, maximum antifungal potential, *Pestalotiopsis palmarum*, plant extracts, PI value

**ID 48**

**MOLECULAR IDENTIFICATION AND SEROTYPING OF *LISTERIA MONOCYTOGENES* CONTAMINATIONS IN RAW MILK COLLECTED FROM COLLECTING CENTERS IN POLONNARUWA DISTRICT, SRI LANKA**

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The food-borne pathogen *Listeria monocytogenes* has the potential to infect humans and cause life-threatening invasive illnesses. Control of this disease is of special relevance because human listeriosis cases have historically been connected to the consumption of contaminated dairy products. The main goal of this study is to identify and determine the abundance of different serotypes of *L. monocytogenes* contamination in raw milk in Polonnaruwa District to focus on the safety of dairy products and disease prevention. Specific objectives are to identify the contamination of *L. monocytogenes* isolates found in milk samples from the Polonnaruwa District, as well as common serotypes in the dairy food industry using PCR technique, their susceptibility to antibiotics, and subtypes that correspond to DNA fingerprints produced by Pulse Field Gel Electrophoresis (PFGE). Altogether eighty samples from Polonnaruwa district were collected including twenty samples per one specific area (Bakamuna, Medirigiriya, New Town, Sangabodigama). From eighty samples ninety-eight bacterial strains were isolated using *Listeria* selective broth and agar culture media. DNA was extracted from 98 isolates using Wizard genomic DNA purification kit. A nested PCR test was conducted for molecular identification. Out of eighty, thirty-seven samples were positive for *L. monocytogenes* (46.25%). When considering serotypes, 7.5% of 1/2a, 15% of 1/2b, 10% of 1/2c and 32.5% of 4b were found. *L. monocytogenes* contamination of milk and milk products is a significant problem for the entire world, including developing nations like Sri Lanka. Since *L. monocytogenes* may grow in both ambient and frigid environments, the presence of even small amounts of this organism poses a risk. Hence it is important to take effective measures to avoid raw milk contamination by *L. monocytogenes*.

**Keywords:** *Listeria monocytogenes*, Milk, Nested PCR, Serotyping, Polonnaruwa



**ID 54**

**MORPHOLOGICAL CHARACTERIZATION OF SRI LANKAN COCONUT  
VARIETY MIRISHENA SEMI TALL**

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Coconut is one of the most important trees in the world. Food culture, traditional medical methods, economy, business opportunities and employments of millions of people of many countries depend on this palm. In Sri Lanka, coconut has been classified into three main varieties. They are *Typica* the tall variety, *Nana* the dwarf variety and *Aurantiaca* the intermediate variety. In early 90s a new coconut form “Mirishena” was identified by the Coconut Research Institute while conducting a germplasm exploration project. The seedlings of this form were conserved at the *ex-situ* field gene bank at the Lenawa estate. In this form, two sub forms were identified; one form with typical dwarf characteristics and the other form with intermediate characteristics (Semitall variety) of Talls and Dwarfs. This study was conducted to characterize the intermediate type, Mirishena Semitall, using morphological markers. In addition, the suitability of Mirishena Semitall as a variety for beverage industry was also evaluated. The morphological characterization was done by collecting the morphological data from the 22 Mirishena Semitall palms based on the IPGRI (International Plant Genetic Resource Institute) descriptors for Coconut. It includes stem morphology, inflorescence and flower morphology, leaf morphology, volume, and the Brix value of the coconut water. Collected data was analyzed by using Minitab 14. In addition to Principle component analysis, descriptive statistics and scree plot also were generated. Mean height of the Mirishena Semitall palms were brought up as 6.82 m while Minimum and maximum values are 3.746 m and 11.14 m respectively. A mean value of 114.33 cm as the leaflet length and 5.206 cm as the leaflet width has been recorded. And the mean value of the height of 10 internodes is 36.47 cm. All of those values are higher than the respective values of green dwarfs and lower than the talls. Root bole was absent in most of the palms. A scatter plot was developed using the first two principle components however, no clear groupings were identified within the semitall group. Almost all the values of morphological data of Mirishena semitall accession show in between values to the Tall palms and Dwarf palms. Hence Mirishena semitall accession is classified under intermediate or semitall variety. Because of the remarkable brix value (5.0786 °Brix) and volume of coconut water (550 ml) which is very similar to the values of king coconut, Mirishena semitall can be used as a refreshing natural beverage for commercial purposes.

**Keywords:** *Mirishena Semitall, Morphological markers, root bole, Brix value*

ID 56

## NUTRITIONAL ANALYSIS OF SELECTED COMMERCIALY AVAILABLE CANNED FISH PRODUCTS

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Fish is crucial for human nutrition and health. Fish protein is digestible and contains essential amino acids. Canned fish are a popular source of protein intake in Sri Lanka. However, the information on nutritional content of these canned fish products is marginal. The present study aims to analyze the moisture, ash, salt, protein, fat sugar, histamine and energy content of selected commercially available four canned fish species in Sri Lanka. Initially, following the survey from customers of three supermarkets and two grocery shops, canned fish products were sampled based on fish species: namely, *Auxis thazard* (Tuna product), *Decapterus macrosoma* (Mackerel product), *Thunnus albacares* (Ambulthiyal product) and *Rastrelliger kanagurta* (Fish curry product) from randomly selected three different brands. The moisture, ash, salt, protein, fat sugar, histamine and energy content of 36 homogenised samples including selected three canned fish products for all four species and composite samples were analysed using SLS, AOAC and other in-house methods. Moisture, ash, salt, protein, fat, histamine and energy contents of all tested samples ranged respectively; 56% to 69%, 2% to 4%, 0.5% to 5%, 25% to 30%, 1% to 9%, 0.01% to 0.2%, and 119.54 kcal/100g to 195.01kcal/100g. However, no Sugar was detected in any of the tested samples. And also assume that dietary fibre content is zero in fish meat. The nutritional analysis data showed that the yellow fin tuna (*Thunnus albacares*) contained higher amount of nutrients than other three species. Conclusively, canned fish process using yellow fin Tuna in Ambulthiyal product is the most suitable type for consumption hence it gives the highest mean energy (187.89 kcal/100g) than others. Study's data may enhance Sri Lankan food composition database development.

**Keywords:** Canned fish, Nutritional analysis, *Auxis thazard*, *Decapterus macrosoma*, *Thunnus albacares*, *Rastrelliger kanagurta*

**ID 98**

**EVALUATION OF THE ANTIBACTERIAL ACTIVITY OF AZADIRACHTA INDICA AND DIPTEROCARPUS ZEYLANICUS PLANTS FROM SRI LANKA, AGAINST COMMON WOUND INFECTIOUS BACTERIA**

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Antibacterial resistance has been identified as a significant public health issue worldwide. This issue has risen due to uncontrolled use and misuse of accessible antibiotics around the world and the failure to replace them with new generations of medicine. Therefore, enhancing the bactericidal activity of antimicrobial substances through invention or modification is a top priority in modern research. The purpose of the study is to evaluate the antibacterial activity of *Azadirachta indica* and *Dipterocarpus zeylanicus* plant extracts compared with Povidone Iodine solution (PVI) and Chlorhexidine Gluconate solution (CHG), against *Staphylococcus aureus* (ATCC 25923) and *Escherichia coli* (ATCC 25922). For the evaluation of the antibacterial efficacy, 96% ethanol and ethyl acetate extracts of *Azadirachta indica* (leaves) and *Dipterocarpus zeylanicus* (bark) were tested and obtained the clear zone of inhibition (ZOI) using agar well diffusion method. Qualitative phytochemical screening was done for alkaloids, saponins, terpenoids, flavonoids, phenol and tannins using standards methods. According to the triplicated results that were obtained, for *Staphylococcus aureus*, ethanol extract of *Azadirachta indica* showed the highest ZOI ( $23.50 \pm 0.50\text{mm}$ ) and for *Escherichia coli*, ethanol extract of *Dipterocarpus zeylanicus* showed the highest ZOI ( $17.08 \pm 0.17\text{mm}$ ). According to the phytochemical screening, tests for alkaloids, terpenoids, phenols and tannins were given positive results for all plant extracts and only ethanol extract of *Azadirachta indica* showed the positive reaction for saponins. According to the findings in this study suggests that, ethanol extract of *Azadirachta indica* shows higher antibacterial efficacy against *Staphylococcus aureus*. For the *Escherichia coli* ethanol extract of the *Dipterocarpus zeylanicus* shows more antibacterial effectiveness than other plant extracts.

**Keywords:** *Azadirachta indica*, *Dipterocarpus zeylanicus*, Antibacterial resistance, Wound infectious bacteria

**Acknowledgment:** Department of Research and Development, Medicom (Pvt) Ltd.



# Chemistry and Environmental Sciences



**ID 17**

**EVALUATION OF THE GROWTH AND QUALITY OF *LACTUCA SATIVA* (LETTUCE) UNDER IoT BASED FULLY AUTOMATED CONTROLLED ENVIRONMENTAL SYSTEM**

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Food is a fundamental necessity of life, holding the foremost position among basic needs. The escalating demands for food can be attributed to both population growth and economic development. In order to meet the projected demand, innovative approaches are being sought to enhance food production. Consequently, agriculture is experiencing a surge in automation, with the Internet of Things (IoT) emerging as a concept closely associated with smart farming techniques. Notably, IoT concepts have demonstrated remarkable efficacy within hydroponics systems. This present study endeavors to assess the growth and quality of *Lactuca sativa* (lettuce) under an IoT-based fully automated controlled environmental system. To achieve this, lettuce plants were subjected to three treatments. Treatment 1 involved weekly monitoring of electrical conductivity (EC) levels, with manual addition of fertilizer until reaching an EC of 2000  $\mu\text{S}/\text{cm}$ . Treatment 2 sought to maintain a constant EC of 2000  $\mu\text{S}/\text{cm}$  automatically throughout the entire cultivation period. In Treatment 3, the EC was also maintained at 2000  $\mu\text{S}/\text{cm}$  automatically, with the additional feature of activating grow lights (consisting of red and blue LEDs) when light intensity dropped below 10 kilolux, solely during daytime. The efficiency of the automated cultivation system was evaluated by analyzing various factors. Weekly measurements of growth parameters, including plant height, leaf length, leaf width, and leaf count, were systematically recorded until the harvest day. Moreover, fully grown lettuce plants were subjected to comprehensive analyses to determine their anthocyanin content, antioxidant content, and chlorophyll content. The analysis of the collected data revealed that both Treatment 2 and Treatment 3 exhibited significantly higher efficiency in terms of growth parameters when compared to Treatment 1. Notably, Treatment 3 surpassed Treatment 2 in terms of growth parameters. The determination of anthocyanin content was performed using pH differential method. Notably, plants subjected to Treatment 1 displayed higher levels of anthocyanin. Antioxidant content was assessed through the DPPH assay. The results indicated higher antioxidant content in plants treated with Treatment 1. Chlorophyll analysis was performed by extracting chlorophyll with acetone, revealing elevated chlorophyll content in plants exposed to Treatment 2 and Treatment 3. However, automating hydroponically cultivation of lettuce resulted in enhanced growth, but without significant improvements in nutrient content.

**Keywords:** *Internet of Things, Lactuca sativa, Antioxidant, Anthocyanin, Chlorophyll*

**ID 23**

## **ABOVEGROUND BIOMASS ESTIMATION OF SELECTED HOMEGARDEN TREES**

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Trees play a significant role in regulating the global climate through the removal of carbon from the atmosphere, which is stored in roots, stems, branches, and foliage as biomass. This study attempted to determine the above-ground biomass partitioning and identify the relationship between biomass and carbon of five commercially valuable, but less common tree species, viz. *Alstonia* (*Alstonia scholaris*), “Hulanhik” (*Chukrasia tabularis*), “Hurimara” (*Albizia odoratissima*), “Lunumidella” (*Melia azedarach*), and “Ketakela” (*Bridelia retusa*) growing in home gardens and roadsides. It also attempted to build allometric models to predict stem biomass of the selected tree species. Three trees of each species scatter grown in Moratenne Division in Muwankanda Estate of Lalan Agri Division Pvt. Ltd were felled for data collection. Since the age of the trees was unknown, it was replaced by diameter at breast height (DBH) and the height. Each tree stem and large branches were divided into sections and diameter and length data were collected to estimate volume using Newton’s formula. Two samples of known volume and green weight from each stem and each large branch were collected for the biomass analysis and oven dried at 105°C until a constant weight was obtained. Carbon content was analysed using Walkley Black method. The total biomasses of stems of *Alstonia*, “Hurimara”, “Hulanhik”, “Lunumidella” and “Ketakela” were 481 kg, 595 kg, 1,359 kg, 642 kg, and 404 kg and the branch biomasses were 96 kg, 78 kg, 490 kg, 201 kg, and 276 kg respectively. The highest biomass allocation in all species was observed in stems. The percentages of ratio between branch biomass to stem biomass of *Alstonia*, “Hurimara”, “Hulanhik”, “Lunumidella” and “Ketakela” were 20%, 13%, 36%, 31%, and 68% respectively. The carbon content of stems of *Alstonia*, “Hurimara”, “Hulanhik”, “Lunumidella” and “Ketakela” were 212 kg, 262 kg, 576 kg, 283 kg, and 168 kg and the carbon content of the branches were 39 kg, 36 kg, 262 kg, 87 kg, and 120 kg respectively. The carbon contents of the selected tree species varied between 40-53% when expressed in relation to its biomass. Allometric models were built using Minitab software with stem biomass as the dependent variable, height and DBH as independent variables. The best fit models for predicting stem biomass (SB) vs DBH for *Alstonia*  $SB = (0.000074 * DBH + 0.002700)^{-1.52599}$ , “Hurimara”  $SB = (0.4104 * DBH)^2$ , “Hulanhik”  $SB = (0.5015 * DBH)^2$ , “Lunumidella”  $SB = (0.3533 * DBH)^2$  and “Ketakela”  $SB = e^{0.1299 * DBH}$  respectively. All those models had high accuracy and therefore those are recommended to estimate the stem biomass of the selected trees.

**Keywords:** *biomass estimation, carbon content, allometric models, biomass partitioning*

**ID 24**

**EVALUATION OF CURING CHARACTERISTICS AND REINFORCING BEHAVIOR OF CINNAMON WOOD BIO CHAR AS A FILLER MATERIAL FOR NATURAL RUBBER COMPOSITES**

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The study was conducted for the determination of suitability of using cinnamon wood biochar (CWB) as an alternative filler material for natural rubber instead of the use of carbon black N330 (CB-N330) due to its non-renewable source and high cost. Material characterization was performed for CWB material using Fourier transform infrared spectroscopy (FTIR), thermo gravimetric analysis (TGA), particle size analysis, X-ray diffraction analysis (XRD) and scanning electron microscopy with energy dispersive X-ray analysis (SEM-EDX). Rubber compounding, Vulcanization, cure characteristics and testing of mechanical properties were done according to the international organization for standardization (ISO) standards. Two compounds were prepared with about 20 phr filler loading in each using CWB and CB-N330. Results of FTIR showed the presence of hydroxyl and carbonyl groups in CWB. Carbon content was obtained as 85.91% and the average particle size was obtained as 3.14 ( $\pm$  0.30)  $\mu$ m. The tensile strength and tear strengths were lower in CWB filled compound than the CB-N330 filler compound. Slightly reduced cure characteristics, 300% modulus, elongation at break, hardness and specific gravity were obtained with CWB filled compound compared to CB-N330 filled compound. Even though the CB-N330 filled rubber compound had superior properties than CWB filled compound, significant results of the curing and mechanical properties of studied CWB filled compound showed more cost effective, renewable filler source to use for natural rubber compounds.

**Keywords:** *Cinnamon wood bio-char, Natural rubber, Carbon black, Bio-char filled natural rubber*

ID 29

## BIO CHAR- UREA INCLUSION COMPOSITE: A FRUGAL APPROACH FOR REDUCING NITROGEN LOSS IN APPLICATION OF UREA

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Nitrogen loss of urea via ammonia volatilization, de-nitrification, leaching and run off is a tremendous issue in agricultural sector. It leads to many economic and environmental problems. In this study, slow release, bio char-urea inclusion composite (BUIC) was developed to reduce nitrogen loss via leaching, to observe the effect of above treatment on plant growth and nitrogen use efficiency. Urea was dissolved in 8% polyvinyl alcohol solution, followed by the addition of, bio char, starch and bentonite according to 'Fibonacci sequence'. 30% BUIC, 50% BUIC and urea inclusion composite without bio char (WBUIC) were produced. This synthesized BUIC and WBUIC were characterized with Fourier transform infrared spectroscopy (FTIR) and subsequently leaching experiment were carried out to test for  $\text{NH}_4^+\text{-N}$ ,  $\text{NO}_3^-\text{-N}$  and total nitrogen content. Pot experiment was carried out for 90 days by using *Capsicum frutescens* plants and the growth development was analyzed by measuring the height of each plant. Five treatments were used for both leaching and pot experiment as follows; without any fertilizer, with normal urea fertilizer, 50% BUIC, 30% BUIC and WBUIC. The percentage of total nitrogen loss via leaching of urea, 30% BUIC, 50% BUIC and WBUIC were 43.45%, 26.78%, 23.20% and 57.64% respectively. It clearly displayed that 30% and 50% BUIC had lower cumulative nitrogen loss compare to urea. WBUIC showed higher nitrogen and  $\text{NH}_4^+\text{-N}$  loss more than that of urea. It might be due to the surface binding of the composite ingredients of WBUIC into bentonite while the inclusions of dissolved urea into the porous structures of bio char in BUIC. And functional groups of bio char also play a vital role in reducing nitrogen loss. The changes of peaks associated with N-H stretching and C=O stretching mainly indicating interaction between urea, bio char, and other ingredients or sometimes bands could be overlapped by each other. A strong new peak was appeared at  $1013.45\text{ cm}^{-1}$  in BUIC but it was not in WBUIC and urea. So this newly appeared peak could be attributed to the bio char and it indicated a novel compound with related to bio char. Mean height values of *Capsicum frutescens* plants showed a significant difference between normal urea ( $16.0\pm 0.8\text{ cm}$ ,  $18.0\pm 1.3\text{ cm}$ ) and 50% BUIC ( $19.3\pm 2.4\text{ cm}$ ,  $21.8\pm 3.0\text{ cm}$ ) by 9<sup>th</sup> and 10<sup>th</sup> week after fertilizer application. According to results, nitrogen in BUIC was slowly released synchronizing the nitrogen requirements of plants and decreasing the nitrogen leaching loss effectively. Further investigations are encouraged to evaluate the effect of BUIC on yields of different crops at field scale under different environmental conditions.

**Keywords:** bentonite, de-nitrification, polyvinyl alcohol, nitrogen use efficiency, urea



**ID 69**

**EVALUATING THE STABILITY OF THE POLYURETHANE COATING EMULSION  
APPLIED ON THE INNER SURFACE OF SYNTHETIC POLY-ISOPRENE  
SURGICAL GLOVES**

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A skin-contacting coating of polyurethane bonded to a synthetic poly-isoprene rubber glove is treated by means of polyethylene wax, melamine resin, buffering agent, dispersing agent, non-ionic and anionic surfactant to improve the donning properties substantially. The objective of the research is to evaluate the factors contributing to the destabilization of polyurethane coating emulsion. A destabilized coating can't be applied on a glove surface with uniform thickness. The maximum time that the emulsion can be used without any defect is called its pot life. This study evaluates the significance of applying the uniform polyurethane coating layer by tensile, friction and donning test measurements. Imada instrument was used to measure the coefficient of friction while GIBITRE extensometer was used to measure tensile strength, elongation at break and modulus according to ASTM specifications. Unaged tensile measurements showed enhancing the tensile strength, elongation at break and modulus by introducing polyurethane polymer coating. Metal over rough test (gmf), smooth over smooth (gmf) and smooth over rubber friction test (gmf) were done for checking friction between the glove surface and the skin. Metal over rough and smooth over rough friction test values of coated and uncoated gloves are almost the same. Smooth-over-smooth friction test values of coated gloves have significantly reduced compared to uncoated gloves. Donning was very easy for coated gloves and it was difficult to don uncoated gloves. Particle size, total solid content (TSC), pH and Calcium ion concentration were monitored in the samples taken from the coating dip tank with a time interval throughout the pot life. The experimental data indicated that TSC, [Ca<sup>2+</sup>] and agglomerations of coating emulsion have increased with time. Maximum total solid content and calcium ion concentration for this polyurethane coating emulsion were found to be 2.73 and  $17.68 \times 10^{-3} \text{mol dm}^{-3}$ . The study concluded that the destabilization of the coating is due to mainly the addition of Ca<sup>2+</sup> to the coating that comes with formers and polyethylene wax in the coating formulation contributes to the destabilization of coating.

**Keywords:** *Polyurethane coating, agglomeration, pot life, polyethylene wax, Calcium ion*

**ID 85**

## **TOILET SOAP ENRICHED WITH RICE BRAN OIL IN SRI LANKA**

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Rice bran is a by-product of rice milling and is underutilized in Sri Lankan context. Oil extracted from rice bran has the potential to be utilized to produce value-added products for its various properties. In addition to product development, use of rice bran for oil production promotes sustainability, waste management and profitability of rice production. Rich fatty acid composition and high antioxidant profile in rice bran oil make it one of the most popular ingredients in cosmetic and personal care products. The aim of this study was to extract oil from red, mixed, and parboiled rice bran and formulate a toilet soap from the extracted composite rice bran oil. Rice bran oil was extracted from each bran using hexane by reflux condensation. The composited oil sample was analyzed for the physicochemical characteristics stated in Sri Lanka Standard 1592: 2018 by methods mentioned in Sri Lanka Standard 313. Three trials were carried out for the formulation of a toilet soap using NaOH as the lye by hot saponification reaction. The total fatty matter was determined for all trials according to International Organization for Standardization standard 685. Trial 3 soap comprised of rice bran oil 30%, castor oil 55%, lanolin 10% and beeswax 5% was analyzed for toilet soap requirements mentioned in Sri Lanka Standard 34: 2009 according to methods in International Organization for Standardization and its compliance with the specifications were evaluated. The highest oil yield (8.0%) was given by parboiled rice bran and composite rice bran oil showed 0.911 relative density, 1.460 refractive index, 103.122 g/100g iodine value, 196.626 saponification value, 0.08% moisture and volatile matter, 16.0% free fatty acids 5.85% unsaponifiable matter and 30.5 meq/ Kg peroxide value. The major fatty acid constituents of composite rice bran oil are oleic (18:1) 25.240%, linoleic (18:2) 17.748% and palmitic (16:0) 13.185% acids. Trial 1, Trial 2 and Trial 3 soaps showed total fatty matter as 53.12%, 66.67% and 78.23% respectively. Trial 3 formulated soap showed 78.23 % total fatty matter, 1.8% matter insoluble in ethanol, 0.05% free caustic alkali, 0.2% total free alkali and 205 mL lather. Rosin acids and chlorides were not detected in Trial 3 soap. The free fatty acid content and peroxide value of composite rice bran oil surpassed the requirements suggesting lipid oxidation and reduced quality. Trial 3 soap complies with requirements in Sri Lanka Standard 34:2009 hence regarded as a toilet soap.

**Keywords:** *Rice bran oil, toilet soap, linoleic acid, antioxidants, total fatty matter*

**ID 100**

**SEPARATION OF RHODAMINE B FROM DYE EFFLUENT VIA ADSORPTION TO BIOCHAR DERIVED OUT OF THE TEXTILE SLUDGE**

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Rhodamine B (Rh B) is a toxic dye that is primarily used in textile industries due to its unique properties. However, it has ended up in industrial effluents which could negatively affect the environment and human health. Removal of Rh B from these effluents is essential before it is released into the environment. Therefore, this research project was focused on introducing a novel, cost-effective modified Biochar (BC) to remove Rh B by incorporating waste textile dyeing sludge (TDS) which has high adsorption capacity and unique chemical nature, with tea waste (TW). The modified BC samples with 1:1 and 1:2 mass ratios of TW and TDS were synthesized by the pyrolysis method and characterized by Fourier Transform Infrared Spectroscopy (FTIR) and Thermogravimetric Analysis (TGA). The Absorbance of Rh B was evaluated after passing through the modified biochar-filled column bed using a UV-vis spectrophotometer at 554 nm. Thereby, the removal percentage was calculated using the Beer-Lambert law. According to the TGA analysis, the thermal stability of the BC increased after chemical modification. Surface functional group analysis using FTIR detected that all samples contain broad peaks between 3428 cm<sup>-1</sup> to 3451 cm<sup>-1</sup>, attributed to the -OH stretching, and the peaks between 1620 cm<sup>-1</sup> to 1646 cm<sup>-1</sup> for C=C stretching vibrations. During the column bed saturation point study, complete adsorption was observed in the beginning, however, percentage removal gradually decreased with time because of filling the vacant sites on the modified BC. The saturation point could not be observed during the considered time period because modified BC has a great exceptional adsorption capacity to remove Rh B owing to the effectiveness of the chemical treatments. Therefore, this novel modified BC can be introduced to textile industries to remove Rh B in an efficient manner at effluent treatment plants over existing removal methods.

**Keywords:** *Rhodamine B, biochar, textile dyeing sludge, tea waste*

**ID 108**

**ASSESSMENT AND MITIGATION OF CARBON FOOTPRINT IN THE PRINTING INDUSTRY: A CASE STUDY OF A SELECTED NEWSPAPER COMPANY IN SRI LANKA**

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Carbon footprint is an indicator of climate impact based on the greenhouse gas emissions from an entity's activities, measured in units of carbon dioxide equivalent (CO<sub>2</sub>e). Businesses have a lasting effect on the climate through their carbon footprints, and the printing industry is a major contributor to this environmental story. Paper-based newspapers provide current global information but also generate greenhouse gas emissions. Researchers worldwide have examined the carbon footprint of newspaper printing companies. However, there is a research gap regarding the carbon footprint of the printing industry in Sri Lanka. This study addresses this gap by estimating the carbon footprint of a Sri Lankan newspaper printing company, to contribute to the global efforts to reduce greenhouse gas emissions. The research objective is to estimate the carbon footprint of a selected newspaper company in Sri Lanka during the 2021-2022 financial year, identify its key emission hotspots, and propose feasible strategies for reducing its carbon footprint. Following the Greenhouse Gas Protocol, the company's emission sources, such as electricity consumption, employee commuting, material transport, and product distribution, were analyzed for their carbon footprint. Data for this study was collected through observations, facility visits, surveys, company records, and interviews with managers and employees. The analysis revealed a net carbon footprint of 2295.355 tonnes of carbon dioxide equivalent (t CO<sub>2</sub>e) per year, derived by subtracting the total carbon sequestration from the total carbon emissions. A comparative analysis showed that scope 3 emissions significantly contributed to the organizational carbon footprint compared to scope 1 and scope 2 emissions. A Pareto chart was used to identify the key emission hotspots, which were purchased electricity consumption, raw material transport, and employee commuting. Proposed reduction measures involve renewable energy exploration, public transportation promotion, local sourcing of materials, green logistics implementation, and carbon offset initiatives. This study is the first to estimate the carbon footprint of a newspaper printing company in Sri Lanka, filling a research gap and contributing to global efforts to reduce greenhouse gas emissions. By addressing the research gap and offering concrete mitigation measures, this study sheds light on the environmental impact of paper-based newspapers in Sri Lanka and provides valuable insights for the printing industry.

**Keywords:** *carbon footprint, greenhouse gas emissions, newspaper printing industry, emission hotspots*

**ID 109**

**DETERMINATION OF THE EFFECT OF COMMERCIALY AVAILABLE PLASTIC CONTAINERS, STORAGE CONDITIONS AND TIME ON WATER QUALITY PARAMETERS**

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Water is frequently analyzed for quality to identify the effect of changes in environmental and anthropogenic activities, as it has an impact on both humans and the environment. Proper sampling and storage are essential for accurate results. The study was designed to identify the most suitable type of container made up of polymers available in local markets and the condition for storing groundwater samples prior to analysis for short-term and long-term periods. Two water samples were collected from groundwater sources, with initial electrical conductivity values around 800  $\mu\text{S}/\text{cm}$  and 200  $\mu\text{S}/\text{cm}$ . The study was conducted using Polyethylene (PE), Polypropylene (PP), and High-Density Polyethylene (HDPE) containers available in local markets. This study evaluated the impact of filtration and low temperature with dark conditions for sample storage. Groundwater samples from two sources were stored in containers of different polymers for a period of two months and analyzed for various physical and chemical water quality parameters at different time durations. Polymer types were confirmed using FT-IR (ATR) spectrometry (ThermoScientific Nicolet iS10). Basic water quality parameters were measured using a multiparameter instrument (HQ40d multiparameter), and major inorganic ion concentrations were measured using Ion chromatography (Shimadzu, Malaysia). Electrical conductivity (EC), total dissolved solids (TDS), salinity, resistivity, alkalinity, hardness, pH, and major inorganic ion concentrations were measured in samples. The study showed that groundwater samples with low EC values had no noticeable effect due to low variations during storage time. Polyethylene containers showed the highest variation of measurements in all three conditions. Pearson correlation exhibited a negative correlation for most of the containers and conditions. Higher variations of major inorganic ion concentrations were observed, while  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ , and  $\text{SO}_4^{2-}$  ion concentrations showed a characteristic reduction. The study concluded that 4 °C is the most suitable condition for storing water samples. Based on the coefficient of variations of water quality parameters, HDPE was the most suitable storage container material to store groundwater samples at 4°C in dark conditions, and polypropylene was the most suitable container to store water at room temperature.

**Keywords:** *Electrical Conductivity, Polymers, Water Quality Parameters, Storage time, Storage condition*

**ID 115**

**PREPARATION AND CHARACTERIZATION OF A SLOW-RELEASE POTASSIUM AND TRACE ELEMENTS FERTILIZER FORMULATION BASED ON PVA-ALGINATE-CELLULOSE HYDROGEL**

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Slow-release fertilizer hydrogels (SRFHs) have a lot of potential for use in slow-release nutrient applications. However, there are still few applications of slow-release fertilizer hydrogels in agriculture. In this study, the SRFH was synthesized as a polymer bead. The SRFH contains sodium alginate (SA), carboxymethylcellulose (CMC) and polyvinyl alcohol (PVA), and  $\text{KH}_2\text{PO}_4$  as a potassium nutrient source and ZnO, CuO, MgO, and MnO as micronutrient components. The study includes the synthesis of metal oxide nanoparticles, incorporation into the polymer matrix, and the characterization of the SRFH bead. Micronutrient oxides nanoparticles (ZnO, CuO, MgO, MnO) were synthesized via the sol-gel precipitation technique. The successful synthesis of micronutrient nanoparticle oxides was confirmed by powder X-ray diffraction (PXRD) analysis. PXRD results reveal that the average diameters of MgO, ZnO, MnO, and CuO by the Scherrer equation, were 34.64, 65.39, 21.65, and 13.99 nm, respectively. The nutrient incorporated SRFH beads were characterized using Fourier transform infrared spectroscopy (FTIR). All samples contain broad peaks between  $3600\text{ cm}^{-1}$  and  $3200\text{ cm}^{-1}$  attributed to -OH stretching, and the peaks of  $1631.99\text{ cm}^{-1}$  and  $1056.78\text{ cm}^{-1}$  for -COOH and -COC vibrations, respectively. Nutrient content in SRFH was analyzed via acid digestions technique and analyzed through atomic absorption spectroscopy (AAS). The AAS analysis confirmed the presence of total K, Cu, Mg, Mn, and Zn is 3.602, 0.125, 0.0572, 0.166, and 0.348 w/w%, respectively in synthesized SRFH. The surface morphology and the of the synthesized SRFHs and micronutrient oxides were observed by scanning electron microscopy (SEM). The water absorption ability of SRFH beads was studied and compared with raw material beads. K, Mg, and Zn released about 20%, 70%, 18%, and 7% up to thirty days at 7.2 pH. The plant growth assessment was based on the height of plants and the length of the leaves of the plants using green beans as the plant type. The height of plants and length of leaves was recorded in 7-day time intervals and analyzed and compared with "ANOVA." Significant differences between the plant samples were identified according to the p values calculated by "ANOVA". It ensured an effect of the SRFH on the height of plants and length of leaves was significant. This study showcases the successful synthesis and characterization of SRFH beads, containing SA, PVA, CMC, and K, Mg, Mn, Zn, and Cu nutrients as a slow-release fertilizer formulation.

**Keywords:** *Hydrogels, Slow-release fertilizers, micronutrients, metal oxides*

**ID 119**

## **STUDYING THE FEASIBILITY OF USING THE ELECTRO-COAGULATION METHOD FOR GLOVE MANUFACTURING**

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Coagulation is a major chemical reaction taking place in the glove manufacturing process. The main target of this research is to study the feasibility of electro-coagulation instead of the conventional manufacturing procedure for the coagulation process. In the production, high amounts of acetic acid 6% (w/w) and Ca (NO<sub>3</sub>)<sub>2</sub> 12% (w/w) are used, which causes high environmental pollution. So, in this research, the coagulant concentration was reduced, and the electric pulses were introduced to the latex and former to produce gloves. Some critical set values like viscosity, foam level of latex, dipping time, dipping speed, former temperature, and coagulant level were changed, and found the best values to produce gloves as customer requirement. Robot arm and dipping tank models were designed to represent the steps of glove production. This model was used to do trials by changing several parameters like viscosity, foam level of latex, the concentration of coagulant, dipping time, dipping speed, soaking time, former temperature, coagulant level, and voltage. The negative polarization was given for the latex, and positive polarization was given to the Aluminium former. This method aimed to prepare visually, physically, and chemically good gloves which should pass all quality tests such as abrasion, cut resistance, tear, puncture, and stiffness. The initial requirement was producing visually good gloves. It means no defects can be identified by observing with the naked eye. When considering all the trials there were several set points with minimum defects and high abrasion results were obtained to produce quality gloves by doing several trials. The average abrasion result was 25,000- 26,000 rev. The concentration of acetic acid could be reduced to 5% (w/w), the optimum voltage was 30V and the optimum current was 3 A, which were the maximum range of the given DC supply. The viscosity of latex was maintained at 1300 cP, and the foam level was at 16 g. The coagulant soaking time was 0.5 s, and the coagulant drip-off time was 10 s. Latex dipping speed was 100%, and latex soaking time was 5 s. Latex drip-off time was between the 15 s. There were different reaction times after all dipping stations. Therefore all timing parameters were changed and optimized around the general manufacturing process. All these set values were very important to maintain within specific values to minimize the defects and maintain good condition as customer requirements.

**Keywords:** *Aluminium former, electro-coagulation, coagulant, latex, polarization*



# Food Science and Microbiology



"Building a Sustainable Future through Inspiring Innovation and Entrepreneurship"



**ID 40**

**DEVELOPMENT OF A YEAST SPREAD WITH A NEW FORMULATION OF INGREDIENTS TARGETING THE LOCAL MARKET**

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Yeast based spreads are basically prepared by yeast extracts which are considered the soluble fraction of yeast cells resulting in the solubilization and concentration process of ruptured yeast cells. Yeast spreads based on yeast extracts are rich sources of many nutrients such as amino acids, peptides, nucleotides, group B vitamins, and minerals. Yeast extracts are flavoring ingredients that have a combination of various flavors such as savory, meaty, umami, and salty tastes. This study aimed to develop a new spread based on both Brewer's yeast and Baker's yeast extracts by utilizing dry yeast cells without undergoing the brewing process. The study was also conducted to produce edible yeast spread through a cost-effective method enabling small-scale operation. The new yeast extracts were prepared by utilizing the combined plasmolysis-autolysis method and enriched with a vegetable broth made by adding carrot, onion, radish, peanut, soy, and dehydrated celery. Furthermore, hydrolyzed soy protein extract produced by defatted soy seed powder was also utilized as a flavor-enhancing compound to develop the yeast extract into a consumable and edible product. Sensory evaluation was carried out using thirty non-trained sensory panelists to select the most suitable yeast type from Brewer's and Baker's yeast to produce yeast extract as well as to compare the prepared spreads with commercial products. According to the results, the commercial product obtained the highest score in all sensory attributes than the prepared two products by Brewer's and Baker's yeast. Brewer's yeast spread obtained a higher score in sensory attributes compared to Baker's yeast spread. For the Brewer's yeast spread, pH, moisture, titratable acidity, and total soluble solid values were obtained as  $5.39 \pm 0.026$ ,  $19.20 \pm 1.431\%$ ,  $0.133 \pm 0.001\%$ , and  $12.30 \pm 0.337^\circ$  respectively. Moreover, the values obtained for its nutritional analysis tests for fat, protein, carbohydrates, ash, salt, and energy were  $0.77 \pm 0.004$  g/100 g,  $20.79 \pm 0.627$  g/100 g,  $41.45 \pm 0.419$  g/100 g,  $19.27 \pm 0.274$  g/100 g,  $8.13 \pm 0.100$  g/100 g, and  $260.14 \pm 1.322$  kcal/100 g respectively. In conclusion, manufacturing a yeast spread based on Brewer's yeast extract using combined plasmolysis-autolysis method is more effective and it requires small-scale operation with medium-grade technology. The prepared product is obtained with desired nutritional values and properties.

**Keywords:** acid hydrolysis, autolysis, plasmolysis, sensory evaluation, yeast extracts

**ID 42**

**DEVELOPMENT AND EVALUATION OF A NUTRITIOUS COCONUT MILK AND STAR GOOSEBERRY (*PHYLLANTHUS ACIDUS*) ENRICHED ICE CREAM PRODUCT**

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Ice cream is a widely consumed frozen food product globally. However, its high sugar content and lack of nutritional value often led to it being considered an unhealthy food option. As people seek healthier food choices, ice cream manufacturers must find better alternatives to meet these expectations. Therefore, this study aimed to develop a nutritious ice cream product enriched with coconut milk and star gooseberry (*Phyllanthus acidus*) and to evaluate its physicochemical and sensory attributes. The main ingredients utilized in this product are coconut milk, green coconut pulp, star gooseberry (*Phyllanthus acidus*), coconut water, and bee honey. Replacing cow's milk with coconut milk widens the consumer base for this product since it can be consumed by those with lactose intolerance and high cholesterol levels. Not only does the addition of star gooseberry introduce a new flavor perception to ice cream consumers that they have not experienced yet but also adds nutritional value by contributing vitamin C and antioxidants. Bee honey is used as a natural sweetener with a higher nutritional value in place of refined sugar which is used in many ice cream products available on the market. Three versions of the ice cream were produced by varying the bee honey content (15%, 20%, 25%) added of which the most acceptable ice cream, exhibiting desired sensory characteristics was the one with 20% bee honey. According to the proximate analysis, the physicochemical properties evaluated were pH ( $6.29 \pm 0.01$ ), moisture ( $61.262 \pm 0.341\%$ ), ash ( $1.617 \pm 0.144\%$ ), total solid ( $39.016 \pm 0.092\%$ ), fat ( $11.667 \pm 0.602\%$ ), and protein ( $4.175 \pm 0.019\%$ ). The total sugar content measured according to the phenol-sulfuric acid method was  $18.53 \pm 0.36$  g/100g. According to antioxidant test results sensorially accepted ice cream product (IC<sub>50</sub>=0.0909 mg/ml) showed less activity than the standard Ascorbic acid (IC<sub>50</sub> =0.02978 mg/ml). According to Atomic Absorption Spectroscopic (AAS) results, the concentration of Ca, K, and Mg in the ice cream sample was 41.801mg/100g, 456.562 mg/100g, and 42.493 mg/100g, respectively. The findings demonstrate the potential of the coconut milk and star gooseberry (*Phyllanthus acidus*) ice cream formula to meet local standards and cater to international markets, providing a nutritious, dairy-free alternative that is also tasty. This study provides valuable insights for the ice cream industry, paving the way for the production of nutritionally enriched ice cream products.

**Keywords:** ice cream, coconut milk, star gooseberry (*Phyllanthus acidus*), nutritious

**ID 79**

## **MICROBIOLOGICAL QUALITY ASSESSMENT OF SELECTED CEYLON SPICES FROM SMALL AND MEDIUM SCALE ENTREPRENEURS**

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Spices are used in different cuisines owing to their nutritional and medicinal value. However, microbiological contaminations in spices can lead to product spoilage and public health hazards. Thus, this study was carried out to evaluate the microbiological quality of some selected, commercially available, processed spices in Sri Lanka. Further, the analysis was done to observe the compliance with Sri Lankan standards (SLS) specifications for spices. A total of 36 samples from the four commonly consumed types of spices, namely, Ceylon cinnamon (n=10), chili (n=10), turmeric (n=6), and curry powder (n=10), were randomly collected from small, and medium-scale entrepreneurs. All the samples were tested for the presence and growth of yeasts and moulds, coliforms, *Escherichia coli* (*E. coli*), and *Salmonella spp.* Total aerobic mesophilic bacteria counts were tested only for the cinnamon samples due to the significant role of Ceylon cinnamon in the export market, and the highest count was  $3.3 \times 10^8$  CFU/g. All the spice samples were negative for the presence of *Salmonella spp.* Among the 36 samples, 28 were negative for *E. coli*, and only 6 were negative for coliforms. Moreover, out of 26 of chili, curry powder, and turmeric samples, only 12 met the acceptable limits specified in SLS standards for yeasts and moulds. The highest yeast and mould counts were observed in cinnamon ( $1.4 \times 10^7$  CFU/g) than in other spices. However, out of all the analyzed samples, only 50% met the existing SLS specifications for microbiological quality. This study emphasized the value of good hygienic practices, throughout the production, processing, storage, and transportation to minimize possible microbial contaminations and ensure safety for consumption.

**Keywords:** *coliforms, Escherichia coli, Salmonella spp., spices, yeasts and moulds*

**ID 88**

## **DEVELOPMENT OF CINNAMON FLAVORED INSTANT COFFEE AND EVALUATION OF PHYSICOCHEMICAL PROPERTIES**

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The majority of coffee production in Sri Lanka is commodity coffee, primarily using Robusta (*Coffea canephora*) beans that have a lower market value compared to Arabica coffee (*Coffea arabica*). This study was carried out to enhance the value of approximately 80% of existing Sri Lankan coffee production by developing an instant coffee from Robusta coffee and incorporating microencapsulated cinnamon extract powder to enhance its flavor and functional properties. The coffee and cinnamon used in the experiment were characterized. To maximize the yield of water-soluble solids in the extractions, various coffee-to-water and cinnamon-to-water ratios were tested using the maceration technique. The coffee extract was spray-dried to produce instant coffee powder, while the cinnamon extract was microencapsulated using maltodextrin as the carrier material through spray drying. Two distinct instant coffee formulations containing microencapsulated cinnamon powder, namely F<sub>1</sub> (50% instant coffee, 50% cinnamon) and F<sub>2</sub> (60% of instant coffee, 40% cinnamon) were developed and sensory evaluation was conducted to determine consumer acceptance. In addition, the color, moisture, solubility, wettability, water activity, encapsulation efficiency, bulk density, total flavonoid content, total polyphenol content, and antioxidant activity of both the instant coffee and cinnamon powders were determined. Pure instant coffee had a total phenolic content (TPC) of 57.7±0.0633 mg gallic acid equivalent (GAE)/g, a total flavonoid content (TFC) of 63.6±0.118 mg quercetin equivalent (QE)/g, and an IC<sub>50</sub> value of 0.0164±0.000831 mg/mL for DPPH radical scavenging activity. F<sub>2</sub> formulation resulted a cinnamon-flavored instant coffee with highly favorable sensory properties with significant reduction of bioactive compounds compared to pure instant coffee. It had a TPC value of 46.8±0.0475 mg (GAE)/g, TFC value of 62.5±0.0978 mg (QE)/g, and IC<sub>50</sub> for DPPH radical scavenging activity of 0.0319±0.000164 mg/mL. In conclusion, the addition of microencapsulated cinnamon extract powder to instant coffee significantly improved its sensory attributes and consumer acceptability. Through the use of microencapsulated cinnamon extract, this research creates new opportunities for raising the market value of Sri Lanka's coffee production, providing promising futures for the coffee industry.

**Keywords:** *spray-drying, microencapsulation, cinnamon, physicochemical properties, sensory properties*

**ID 96**

**TEST METHOD TO VALIDATE THERMAL INACTIVATION OF *SALMONELLA* USING SURROGATE MICROORGANISM *ENTEROCOCCUS FAECIUM* (ATCC 8459) IN BOTTLED KING COCONUT**

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*Cocos nucifera* var. *aurantica* (*King coconut*) is endemic to Sri Lanka and has received an enormous demand in the global context over years. It is one of the fastest-growing export commodities in food and beverage sector of Sri Lanka due to its unique quality and sensory attributes. King coconut water is sweet relish sterile beverage which is vulnerable to undergo rapid quality deterioration soon after exposing to external environment. Coconut water being suitable media for microbial growth, encourage the growth of enterobacteria such as *Salmonella*. Thermal treatment has been widely applied for reducing the microbial load in processed king coconut thus limits its deleterious activity during storage. Inappropriate thermal processing leads such contaminations thereby causing safety concerns and reduces product shelf life. Contamination from soil, machinery, water and personnel involved are primary risk factors associated with the product safety. Therefore, thermal process is validated through temperature monitoring mechanism to ensure product safety. Food and Drug Administration recommend using surrogate microorganism to validate the efficacy of thermal processing conditions (time-temperature combination) in terms of log reduction. Therefore, establishing a test method to validate the efficacy of thermal process is vital. The objective of this study was to develop and optimize an *in vitro* test method to validate the thermal inactivation efficacy of *Salmonella* in bottled king coconut operations using surrogate microorganism *Enterococcus faecium* (ATCC 8459). Growth kinetics and adaptability of surrogate microorganism *E. faecium* (ATCC 8459) in liquids was studied. Pre-decided concentration ( $10^8$  CFU/ml) of surrogate microorganism *E. faecium* (ATCC 8459) was inoculated aseptically to king coconut water bottles prior to heat treatments. The product allowed to undergo thermal cycles and its log reduction was observed by plating technique on selective media. Parallely, temperature distribution during thermal processing was also measured. The experiment was conducted in triplicates, repeatability and reproducibility were also tested. Above 7- $\log_{10}$  reduction of *E. faecium* (ATCC 8459) indicates an equivalent probability that no viable *Salmonella* remain in the finished product thus indicate the efficacy of tested thermal treatment.

**Keywords:** *king coconut water, surrogate microorganisms, Salmonella, thermal processing,*

**ID 110**

**MICROBIOLOGICAL QUALITY OF DRIED FISH PRODUCTS OF SELECTED VARIETIES FROM NEGOMBO**

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Local and imported dried fish is consumed throughout the country as a source of major and micronutrients. In this study the microbial quality of dried fish products from Negombo, a major dried fish processing area in Western Province, was evaluated for their microbial quality. Seventeen dried fish samples belonging to six dried fish varieties namely baby shrimp (*Penaeus* spp.), Maldive fish, queen fish (*Scomberoides* spp.), sail fish (*Istiophorus platypterus*), skipjack tuna (*Katsuwonus pelamis*) and sprats (*Stolephorus* spp.), were subjected to microbial screening using nine parameters: Aerobic Plate Count (APC), Yeast and Mold Count, Total Coliform Count and presence of *Escherichia coli*, *Salmonella* spp., *Staphylococcus aureus*, *Vibrio cholerae*, *Listeria monocytogenes* and halophilic microorganisms. Microbial screening except detection of halophiles was done using standard methods in SLS 516. Method as in SLS 643 standard was used in detection of halophilic microbes. The water activities of samples were also measured using 'LabMaster-aw neo' water activity meter. Out of tested samples 70.58 % had acceptable APC values and 17.64 % of samples had unacceptable values. Considering yeast and mold counts 47.05 % of samples were acceptable and 29.41 % were unacceptable. Although in one baby shrimp sample a total coliform count of 9.3 Colony Forming Units (CFU) per gram was detected it was acceptable according to SLS 643:2007. In any sample the tested pathogens were not detected. Halophiles were detected in 76.47 % of samples. The water activities of all samples were below the allowed maximum limit which is 0.75. All these limits are according to 'Specification for Dried Fish' standard (SLS 643:2007). Unacceptable APC values and yeast and mold counts indicate favorability of dried fish for microbes and the need to reduce contaminations, by following hygienic practices during dried fish processing. The non-detection of other tested pathogens in dried fish ensures consumer safety. Halophilic microorganisms are inherent components of dried-salted fish microbiota. The conformity of water activities to SLS standards indicates sufficient drying. However, the microbial load in dried fish must be reduced to enhance quality, consumer-safety, and shelf life. For this the use of elevated surfaces for sun-drying instead of drying on sand on gunny bags, usage of drying machines, educating the processors, standardizing drying procedure and monitoring dried fish processors can be recommended to improve the quality of dried fish products. Overall, the microbial quality of dried fish products collected from Negombo was satisfactory to some extent.

**Keywords:** *dried fish, processing, microbial quality, consumer safety, sun-dried*

**Acknowledgement:** *This research was funded by treasury grant No. 22/227, Industrial Technology Institute.*

**ID 111**

**DEVELOPMENT OF A FORTIFIED SET YOGHURT PRODUCT WITH CANISTEL FRUIT (*POUTERIA CAMPECHIANA*)**

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An underappreciated native fruit tree species in the Sapotaceae family, canistel (*Pouteria campechiana*) is widespread throughout the world, including Sri Lanka. Due to their great nutritional value and numerous health advantages for humans, *P. campechiana* fruits have significant potential as a functional food. However, the bitterness and peculiar flavour of the fruit distract many fruit enthusiasts and children. Yoghurt is a coagulated milk product that is made by *Lactobacillus bulgaricus* and *Streptococcus thermophilus* by fermenting lactose in milk. The health benefits of yoghurt can be increased by combining inexpensive nutrient sources such as native fruit pulps. This experimental study was conducted to analyze the physicochemical property of fruit pulp, as well as to develop and evaluate the rheological properties and microbial quality of the sensory-accepted fortified canistel yoghurt. For the preparation of pulp; fully ripen canistel fruits were selected which are  $263.63 \pm 16.20$  g in weight,  $26.69 \pm 0.56$ :  $26.38 \pm 0.67$  cm in size  $0.98 \pm 0.06$  kg in penetrability. Physicochemical parameters (moisture, ash, fat, protein, total carbohydrates, total soluble solids, reducing sugars beta carotene, pH, and texture profile) of the canistel fruit pulp were determined. The data interpreted canistel fruit as rich in protein, fat and beta-carotene while containing a low amount of reducing sugars. Canistel yoghurt which is incorporated with different proportions; 15% (T1), 20% (T2), and 25% (T3) from the total weight was prepared and T2 was selected as best out of them via sensory property evaluation in terms of appearance, texture, odour, taste and overall acceptability. The final product was subjected to evaluate rheological properties (Syneresis and water holding capacity) and microbial quality parameters (total plate count, total coliform count and yeast and mould). Compared to commercially available yoghurt products, the developed canistel yoghurt had a higher amount of protein and fibre and a remarkable content of beta carotene ( $2.752 \mu\text{g/g}$ ) which is the precursor of Vitamin A.

**Keywords:** *canistel fruit, canistel yoghurt, fruit pulp, physicochemical properties, microbial quality*

**ID 113**

**DEVELOPMENT OF NOVEL SYNBIOTIC BUFFALO MILK BEVERAGE WITH PROBIOTIC *LACTOBACILLUS RHAMNOSUS***

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Synbiotic foods containing probiotic cultures and prebiotics are one of the important category of the functional food market. Buffalo milk is richer in nutrients but there are only a few low buffalo milk-based products found in the local market. Thus, this study was conducted to develop a synbiotic buffalo milk-fruit smoothie incorporating locally available prebiotic sources such as pineapple (*Ananas comosus*) pulp (PA) and wood apple (*Limonia acidissima*) pulp (WA) and fermented with probiotic *Lactobacillus rhamnosus* which could deliver satisfactory level of (>10<sup>6</sup> CFU/ml-1) viable probiotics at the end of shelf life period. The control treatment was prepared without adding a prebiotic source to the smoothie. Pasteurized buffalo milk was inoculated with probiotic culture (2%) containing *L. rhamnosus*. Milk was incubated at 44 °C for 7 hours, followed by blending with PA (30%) (w/w), sugar (10%) (w/w) and WA (20%) (w/w), sugar (10%) (w/w) separately. The survivability of the probiotic organism, organoleptic properties, physical parameters, microbiological parameters, chemical parameters and shelf life of the developed products were analyzed to assess the quality. Sensory characteristics including smell, texture, fruit taste, overall taste, and overall acceptability of PA smoothie is significantly better than WA smoothie. The concentration of crude fat, crude protein, ash, moisture and initial pH, viscosity, Total soluble solid% and initial Titratable acidity of PA and WA incorporated smoothies ranged from 3.32%, 3.80% and 1.98%, 2.28% and 0.55%, 0.74% and 75.86%, 76.19% and 4.98, 4.47 and 111.23, 330.00 and 19.00, 18.00 and 0.593, 0.707 respectively. The recommended microbiological parameters by the SLSI (SLS824: Part2:2018) were satisfactory for both products. To confirm the effect of synbiotic effect of the prebiotic used, shelf life assessment of the products carried out. The most promising product with satisfactory level of probiotic counts at this point of the study was 30% PA incorporated smoothie.

**Keywords:** *Synbiotic, probiotic, prebiotics, Buffalo milk*







# Industrial Relations and Environmental Economics



**ID 44**

**SOCIO-ECONOMIC DETERMINANTS OF ENERGY CHOICE FOR COOKING:  
EVIDENCE FROM HOUSEHOLDS IN SRI LANKA**

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Clean energy is an essential factor in linking economic growth, human development, and environmental sustainability. The need to move from solid fuels to clean fuels is highlighted by the fact that one-third of the world's population still uses solid fuels for cooking. Therefore, this study investigates the demographic and socioeconomic factors influencing cooking energy choices at the household level in Sri Lanka. Data were obtained from the Sri Lanka Household Income and Expenditure Survey 2019 (HIES) covering 19,875 households. Multinomial logit model is used to identify influential factors affecting household cooking fuel choice. Solid fuel is the dominant household cooking fuel choice in Sri Lanka, used by 59.5 percent of households, while clean fuel accounts for 39.2 percent. Empirical results reveal that household income, household food expenditure, age of the household head, education level of the household head, employment status of the household head, education level of the spouse, household size, ethnicity of the household head and residential sector are essential factors in deciding the choice of clean cooking fuel in households. The findings suggest the importance of establishing a sustainable national energy policy by addressing the demographic and socioeconomic factors that influence energy choice. Further, attention should be given to providing appropriate incentives to households to switch from solid to clean energy, mainly in the rural and estate sector, as the transition to clean energy is not immediate.

***Keywords:*** *Energy, Clean fuel, Solid fuel, Cooking fuel, Sri Lanka*

**ID 49**

**DETERMINANTS OF MONETARY POVERTY AMONG HOUSEHOLDS IN SRI LANKA**

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Poverty has a major impact worldwide and has a wide range of effects on people, communities, and societies. Inadequate access to necessities, disparities among education, health, economic outcomes, social inequality, political instability, and criminality are all frequently caused by poverty. In Sri Lanka poverty remains a significant challenge along with the country's overall economic deterioration. The prime objective of this research is to find the determinants of monetary poverty among households in Sri Lanka. For this purpose, 19,911 micro data on individual households that representing the entire country from the Household Income and Expenditure survey (HIES) conducted by the Department of Census and Statistics (DCS) are used. Binary logistic regression model is used to find the determinants of monetary poverty and to quantify effects. The logistic regression model results show that, household income, employment status of household head, residential sector, gender of household head, land ownership, education level of most educated person, health status of household and age of household head are influential factors to being poor. It was clear that the likelihood of poverty varied significantly between sectors. Specifically, lower educational attainment and unemployment significantly increase the likelihood of falling into poverty.

**Keywords:** *Household, Monetary poverty, Binary logistic regression, HIES, Sri Lanka*

**ID 67**

**EMPLOYEE ENGAGEMENT AND PERFORMANCE: OF A TELESALES  
INSURANCE BROKER COMPANY IN SRI LANKA**

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This study aims to investigate the relationship between employee engagement and business performance of telesales insurance broker companies in Sri Lanka, with a focus on the interpersonal and technical skills of telesales agents. The primary objective of the study is to determine the extent to which employee engagement among sales agents affects the business performance of insurance broker companies in Sri Lanka. This study provides an overview of the telesales insurance broker industry in Sri Lanka, including its growth, significance, and contribution to the country's insurance sector. To ensure a representative and unbiased sample for this study, a stratified sampling technique was used for the study. The sample consisted of 106 sales agents from the insurance broker company, with representation from all three branches. Multiple linear regression analysis and Correlation Analysis is used to examine data on employee engagement and company performance over a period. Dependent variable for the multiple linear regression analysis is Total policy value and independent variables are Basic Telephone skills, Customer Engagement, Customer Management, Occupancy rate, Productivity, Age and Years of experience as a Call Centre Agent and Shrinkage. The factors influencing the average policy value in tele sales insurance broker companies. Using a regression model, the study demonstrates that approximately 66.3% of the variation in the average policy value can be explained by the selected predictor variables. Among these variables, average productivity emerges as the most influential factor, indicating a strong positive relationship with the average policy value. Higher levels of average shrinkage are associated with a decrease in the average policy value. Basic telephone skills and customer engagement are also found to significantly influence the average policy value, emphasizing the significance of effective communication and strong customer relationships. Age exhibits a positive relationship with the average policy value, suggesting that increased age corresponds to higher policy values, potentially due to experience and industry knowledge. The correlation analysis reveals a significant positive correlation between Technical Skills and Interpersonal Skills. These findings provide valuable insights for tele sales insurance broker companies, guiding efforts to enhance productivity, reduce shrinkage, improve telephone skills, foster customer engagement, and recognize the impact of age on policy values. By optimizing sales agent performance and customer interactions, companies can drive higher policy values and achieve better business outcomes. Recommendations for tele sales insurance broker companies to enhance performance and achieve better business outcomes include investing in sales agent training programs, implementing quality control measures, enhancing call management skills and customer engagement, and encouraging a culture of continuous learning and improvement.

**Keywords:** *employee engagement, business performance, interpersonal skills, technical skill*

**ID 68**

**EFFECT OF LEAN TOOLS IN MINIMIZING WASTES IN SRI LANKAN APPAREL INDUSTRY**

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In today's highly competitive business environment, organizations are constantly seeking ways to improve their productivity. To achieve this goal, one approach that has gained popularity by manufacturing organizations is the adoption of *lean manufacturing*, which are aimed at reducing waste and improving quality. The concept of *lean* is rooted in identifying and eliminating the seven wastes commonly associated with manufacturing processes: overproduction, waiting time, transportation, unnecessary inventory, motion, defects, and over processing. Literature suggests that organizations that have successfully implemented *lean manufacturing* have successfully reduced the waste. Therefore, this study aimed to investigate the effect of *lean tools* on reduction of seven wastes in ABC (Pvt) Ltd company, with the goal of identifying the most effective *lean tools* for mitigating each of the seven wastes. *5S*, *TPM (Total Productive Maintenance)*, *Kaizen* and *Pull System* are the *lean tools* which were used in the study. The population of this study were the assistant and above-level employees who are working in the manufacturing and technical departments of the case company. A representative sample of 175 employees was selected using stratified random sampling and data was collected using questionnaires distributed to the selected employees. Data were analyzed by using SPSS, Smart PLS 4. Pearson correlation analysis was conducted to determine the relationship between *lean tools* and the reduction of the seven wastes of lean. The Pearson correlation analysis reveals significant positive relationships between *lean tools* and reduction of seven wastes. Specifically, there is a positive relationship between *5S* and waste reduction in motion. *TPM* shows positive relationships with waste reduction in both transportation and motion. *Kaizen* also has a positive relationship with waste reduction in motion. *Pull System* demonstrates significant and strong positive relationships with waste reduction in inventory, waiting, overproduction, overprocessing, and defects. Therefore, it can be concluded that the implementation of *lean manufacturing* leads to reduction of seven wastes. These insights provide practical guidance for organizations aiming to enhance efficiency and minimize waste. Specifically, the *Pull System* can be recommended for addressing waste in inventory, waiting, overproduction, overprocessing, and defects, while *TPM* is more effective for waste in motion and transportation than the other *lean tools*.

**Keywords:** *Lean tools, Seven wastes, Manufacturing organizations, Pearson correlation*





# Marketing and Management





**ID 22**

**THE EFFECT OF THE ONGOING ECONOMIC CRISIS IN SRI LANKA ON  
MIGRATION OF YOUTH FROM THE COUNTRY**

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A decline in investment, industrial production, Gross Domestic Product (GDP), employment, household deposits, economic sentiment and the stock market, and an increase in bond yields can be sighted in Sri Lanka at present due to the economic crisis. According to data from the Central Bank, the Inflation Rate in Sri Lanka has increased to 29.8% in April from 18.7% in March 2021. The services Purchasing Managers Index (PMI) in Sri Lanka had fallen to a 7-month low of 51.3 in March 2021. The Sri Lankan rupee has lost more than a third of its value since a flexible exchange policy was implemented by the Central Bank in March 2021. This paper examines the effect of the economic crisis on migration of youth (16 – 35 years old) in Sri Lanka, using both qualitative and quantitative research using independent variables of better educational opportunities, better career prospects, mental frustration and entrepreneurship intention along with the dependent variable of migration intention. The findings suggest that there is a moderately strong relationship between better educational opportunities, better career prospects and mental frustration on migration intention of Sri Lankan youth, but no relationship is established between entrepreneurship intention and migration intention. The strongest relationship is established between better career prospects and migration intention (0.544). The model explains 35.3% of the variance on migration intention with independent variables. The study also finds that migration is expected to have both positive and negative impacts on the lives of young migrants, with many benefiting from improved economic conditions and educational opportunities, but also facing challenges such as cultural adjustment and separation from family and friends. The study concluded that Sri Lankan youth intend to migrate abroad for better career prospects, better education opportunities and due to the mental frustration. The Sri Lankan economy may prosper due to remittance flows, but will suffer in the long-term with brain drain of skilled and unskilled labour, unless the conditions in the country are brought to a more stabilized and positive state. Based on the outcomes, research can be extended towards other push and pull factors of migration.

**Keywords:** *economic crisis, youth migration, social and political instability, employment, education*

**ID 57**

**MEDIATING EFFECT OF EMPLOYEE ENGAGEMENT ON ITS DRIVERS AND  
EMPLOYEE JOB PERFORMANCE**

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Employee engagement has become a hot topic amongst management circles. Although the area has already been the subject for hundreds of studies, employee engagement still remains a rarely understood concept with various ambiguities. This study focused on addressing the burning issue of employee retention in XYZ Company which is a pioneer in Sri Lanka's apparel manufacturing and exporting industry. The general objective of the study was to identify the mediating effect of employee engagement on its drivers (i.e., leadership and work-life balance) and employee job performance. Further, the researcher intended to achieve five specific objectives that systematically addressed various aspects of the problem. The findings of this study aim to contribute to the existing literature on the field and to provide useful insights into the elements that influence employee engagement, which can aid firms in creating employee engagement initiatives that work. Carried out in a non-contrived setting with minimal researcher interference, this study tested five hypotheses using a quantitative approach. Data was collected from a sample comprising 100 sewing machine operators selected through non-probability convenience sampling. Each participant was investigated individually using a self-administered survey questionnaire. The results revealed that employee engagement significantly mediates the relationship between leadership and employee job performance as well as the relationship between work-life balance and employee job performance. The findings are consistent with previous studies and suggest that the organizations can improve employee retention and job performance by enhancing leadership practices, and work-life balance, and fostering employee engagement initiatives.

***Keywords:*** *Employee Engagement, Leadership, Work-life Balance, Employee Job Performance*

**ID 59**

**IMPACT OF INTRINSIC AND EXTRINSIC REWARDS ON JOB SATISFACTION OF NON-MANAGERIAL EMPLOYEES OF MAS ACTIVE LINEA INTIMO**

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This study aims to investigate the impact of intrinsic and extrinsic rewards on job satisfaction among non-managerial employees at ABC Apparel Company in Sri Lanka. Employee satisfaction plays a crucial role in organizational success, as it is closely tied to factors like retention, productivity, and overall performance. Understanding the relationship between rewards, recognition, and job satisfaction is essential for creating a positive work environment and retaining talented employees. The objectives include to identify which independent variable out of intrinsic rewards and extrinsic rewards impact mostly on job satisfaction., exploring the correlation between intrinsic rewards and job satisfaction, examining the correlation between extrinsic rewards and job satisfaction, and providing recommendations to enhance job satisfaction through both types of rewards. Intrinsic rewards encompass employee well-being and relationships with bosses and co-workers, while extrinsic rewards involve compensation, work environment, training, and career development. To accomplish these objectives, a quantitative research approach is adopted. A proportionate stratified random sampling method is used to collect data through a survey questionnaire distributed among non-managerial employees from different departments at ABC Apparel Company. The collected data is then analyzed using statistical techniques such as logistic regression analysis and Pearson Correlation Coefficient with the support of tools like Minitab and SPSS. Regression analysis reveals that both intrinsic and extrinsic rewards have a positive impact on job satisfaction. The findings emphasize the importance of implementing a balanced rewards system that incorporates both types of rewards to enhance employee satisfaction. Organizations can leverage these findings to shape their policies, practices, and decision-making processes, while managers and policymakers can utilize them to foster employee well-being, engagement, and productivity.

**Keywords:** *intrinsic rewards, extrinsic rewards, job satisfaction, non-managerial employees*

**ID 61**

**FACTORS AFFECTING TO WOMEN'S CAREER ADVANCEMENT IN OFFICE  
STAFF OF ABC HOSPITALS, SRI LANKA**

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This study addresses the issue of women's career advancement in the office staff of ABC Hospitals, Sri Lanka, focusing on the potential "Glass Ceiling" effect that hinders their progression to senior positions. Women often encounter barriers impeding their career growth within organizations. The term "Glass ceiling" refers to invisible barriers that restrict women's job advancement, also applicable when competent individuals are halted at a specific level within an organizational hierarchy. With this in mind, three hypotheses were formulated to explore the significant relationships between organizational factors, cultural factors, family factors, and women's career advancement. The research involved a sample size of 101 female workers from the office staff of ABC Hospitals in Sri Lanka. Self-administered questionnaires were distributed to collect data, and the study followed a quantitative research design. The findings revealed a positive relationship between women's career advancement and both cultural and organizational factors. However, there was a negative relationship between family factors and women's career advancement in the context of the ABC Hospitals' office staff. The study concludes by highlighting the managerial implications of the research findings, acknowledging the limitations, and identifying areas for future research.

**Keywords:** *Women's Career Advancement, Family Factors, Cultural Factors, Organizational Factors, Glass Ceiling effect*

**ID 63**

**IMPACT OF EMPLOYER BRANDING ON INTENTION TO RETAIN: WITH SPECIAL REFERENCE TO WHITE-COLLAR EMPLOYEES AT ABC PRIVATE SECTOR ORGANIZATION, WESTERN PROVINCE, SRI LANKA**

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In a highly competitive business environment, it is important for a business to retain top-performing employees. Employee branding is a management tool that serves to retain staff. ABC Company is a tyre manufacturing company with an annual turnover percentage of white collar employees from 2018 to 2022 of 2.4%, 1.6%, 1.6%, 14.4%, and 19.2%, respectively, which is very high. So, the primary objective of this study is to identify the impact of employer branding on the staff retention of white-collar employees in ABC organization. The specific objectives of this study are to identify the impact of each dimension of employer branding: work environment, training and development, work-life balance, ethics and Corporate Social Responsibility (CSR), compensation and benefits, on the intention to retain. In this study, 97 white-collar employees were taken as the sample using the simple random sampling technique. An adapted version of the standard questionnaires was used for the data collection. A simple linear regression and a multiple regression model were performed to analyse the relationship between employer branding and its dimensions on employee intention to retain. The findings of the study show that employer branding has a strong, positive significant relationship with the intention to retain. Further, work environment, work-life balance, ethics and CSR, and compensation and benefits have a strong positive significant relationship with intention to retain, while training and development has a moderate positive significant relationship with intention to retain. The findings will be useful for planning, drafting, and implementing various strategies to retain employees and for policymakers to upgrade the policies. All intermediate and intervening variables were not considered in this study, so it can be suggested to consider these factors in future research.

**Keywords:** *Intention to retain (IR), Employer Branding (EB), Ethics and Cooperate Social Responsibility (ECSR), Compensation and Benefits (CB), Work-life balance (WLB)*

**ID 66**

**THE IMPACT OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES ON SUSTAINABILITY PERFORMANCE OF EXPORT MANUFACTURING COMPANIES IN WESTERN PROVINCE IN SRI LANKA**

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Recently, sustainability has become a very important topic in the manufacturing industries across the world. Manufacturing organizations, which previously focused on only economic gains, have now started thinking about the protection of the environment by implementing sustainability practices. A green supply chain is one of these sustainability practices. Based on other scholars' studies, green purchasing, eco-design, environmental cooperation, and reverse logistics are the most dominant practices; social, environmental, and economic performance are the three pillars of sustainability. Even though various studies are conducted by different researchers, there is still no study regarding the relationship between green supply chain practices and sustainability performance in export manufacturing companies in the western province of Sri Lanka. This study aims to examine the type of relationship between the green supply chain practices and sustainability performance in the western province with the objective of finding out the impact of GSCM practices on sustainability performance. The study adopted a field survey approach and used a closed-ended questionnaire in Google forms to collect data across a population by sampling of 141 EPZ-registered export manufacturing companies in the western province. Primary data was collected using simple random sampling, and responses were analyzed using both descriptive and inferential statistical techniques in SPSS software. Both managerial and non-managerial-level responses were considered here. According to the analysis, it was found that eco-design, environmental cooperation, and reverse logistics have positive impacts on environmental performance, except green purchasing. Except green purchasing, environmental cooperation and reverse logistics, only eco-design has positive impacts on economic performance, and only eco-design and reverse logistics have positive impacts on social performance. The study concluded that not all of the considered green supply chain management practices affect the environmental, economic, and social performance of export manufacturing companies in the western province in a positive way.

**Keywords:** *Supply chain management, Green supply chain practices, Sustainability performance*

**ID 70**

**FACTORS AFFECTING TO THE USABILITY OF INFORMATION SYSTEM  
PROJECT MANAGEMENT SOFTWARE**

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High project failure rate is observed in the context of software development either as project cancellation or not meeting budget, time or business objectives. Poor project management processes have been affected on failed projects by 73%. Although a number of factors have been suggested in the context of poor project management, the level of usability of the project management software has been identified as a major factor, as it is an essential part of the project management software. This study aims to identify the factors affecting to the usability of the information system project management software and to find out the impact of each identified factor on the usability of the Information System Project Management Software. The factors, namely efficiency, effectiveness, satisfaction, and learnability, were identified by systematically evaluating the previously published articles, frameworks, and guidelines related to the predictors of information system project management software usability. Identified factors were used to develop a conceptual model considering four hypotheses. Multiple linear regression was conducted to identify the impact of those factors on the usability of the information systems project management software. IT professionals in Sri Lanka were selected as the desired population for the study, and randomly selected 350 IT professionals who are actively using JIRA project management software were considered as the sample for this study. JIRA was selected as it is the number one ranked solution in top application lifecycle management suit in Sri Lanka. According to the data analysis, it was found that all the hypotheses were accepted under 95 confident level. The proposed conceptual model proved to explains 68.8% of the total variation in the usability of the JIRA information system project management software by the factors of the software namely efficiency, effectiveness, satisfaction, and learnability. Based on the analysis result, effectiveness of the software proved to be having the strongest influence to the usability of information system project management software.

**Keywords:** *Usability, Information System, Project Management Software, Project management software usability*

**ID 73**

**THE MEDIATING EFFECT OF GREEN ORIENTATION – A STUDY OF A MULTI-NATIONAL ORGANIZATION**

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The research problem addresses the mediating effect of green orientation on the relationship between leadership, organizational culture, and employee engagement. The literature gap is the insufficient exploration of this mediating effect and its impact on employee engagement and competitive advantage in multinational organizations. The research objectives are to examine the impact of leadership and organizational culture on green orientation, investigate the mediating role of green orientation between these factors and employee engagement, and explore the direct impact of green orientation on employee engagement. This study employs a descriptive research design. A hundred managerial employees were randomly selected from XYZ Company in Sri Lanka and collected data using a survey strategy. Results of the study demonstrated the reliability and validity of data, while a total of five hypotheses were tested, and all were substantiated through the analysis of empirical data. The results confirmed the mediating relationship of green orientation between variables. Also, the study found that leadership and organizational culture have a significant impact on green orientation, which positively affects employee engagement. These findings imply that fostering green orientation within an organization as a mechanism through which leadership and organizational culture impact employee engagement. The study recommends that organizations need to prioritize developing environmentally-conscious leaders, promoting green initiatives and practices, and creating a culture that values sustainability to enhance employee engagement, which leads to higher levels of employee satisfaction and productivity. The study adopts the General Systems Theory framework, categorizing leadership and organizational culture as inputs, green orientation as a linking process, and employee engagement as the outcome, recognizing their interconnections. The findings of this study add new knowledge to system theory and are essential for policy makers and managers to improve employee engagement in multinational organizations. This research emphasizes the broader implications of integrating green orientation into organizational practices, highlighting its potential to foster employee engagement, improve organizational performance, and contribute to a sustainable future in industries.

**Keywords:** *Green Orientation, Leadership, Organizational Culture, Employee Engagement, Mediating Effect*



**ID 80**

**INTERVENING EFFECT OF JOB SATISFACTION OF ITS ANTECEDENTS AND  
EMPLOYEE JOB PERFORMANCE: A STUDY OF A STATE FINANCIAL  
ORGANIZATION**

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Employee job satisfaction plays a significant role of the organizational effectiveness and efficiency. Therefore, the purpose of this study is to identify intervening effect of job satisfaction of its antecedents (i.e. leadership and rewards) and employee job performance. The study was conducted in a major state financial organization in Sri Lanka. Due to changing the rewards and leadership of this organization recently, there was a need to investigate the intervening effect of employee job satisfaction on the relationship between its drivers i.e. leadership, rewards and employee job performance. One general objective and five specific objectives are developed in the study. Rewards and leadership were taken as two independent variables. Job satisfaction was taken as intervening variable and job performance was the dependent variable. A quantitative cross-sectional study with an analytical component was carried out. The sample of this study was 185 employees of this organization. Simple random sampling was adopted as the sampling technique. Self-administered questionnaire with five-point Likert-scale questions were used to collect the data. SPSS 23 was used for statistical analysis namely reliability analysis, correlation analysis, regression analysis and Sobel test. The Cronbach's Alfa relevant for each variable is higher than 0.7 for the reliability analysis. All correlation analysis and regression analysis results were significant and positive relationships. The findings disclosed that there was an intervening effect of job satisfaction on the relationship between rewards and job performance ( $p < 0.05$ ) and leadership and job performance ( $0.05$ ). As well as leadership ( $p < 0.05$ ), rewards ( $p < 0.05$ ) had an impact on employee job satisfaction and job satisfaction ( $p < 0.05$ ) had impact on the job performance. Limitations of this study were cross sectional research design, social desirability bias. Findings of this study provided a valuable insight to the managers and other executive level members to solve problems of employees' job performance and job satisfaction.

**Keywords:** *job satisfaction, job performance, rewards, leadership, intervening effect*

**ID 87**

**AN ANALYSIS OF FACTORS AFFECTING DRUGS PREVENTION TRAINING PROGRAMS' EFFECTIVENESS CONDUCTED BY XYZ GOVERNMENT INSTITUTE IN SRI LANKA**

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Drug prevention approaches are the most common practice in the current world because of the increasing drug abuse trend among youth. Now in Sri Lanka drug addiction has been increased. To overcome this problem many preventions treatment and rehabilitation programs have been implemented. XYZ organization is peer leading institute in Sri Lanka that is directly involved in drug prevention and control activities. This study aimed to identify the determinants of the effectiveness of a drug prevention training program conducted by the XYZ organization. The main objective of the study is to identify the factors affecting drug prevention program effectiveness. Primary data was collected from the trainees who participated prevention training program conducted by XYZ government organization. This is a quantitative study and the unit of analysis is individual. A sample of 115 was collected by using a simple random sampling method. Data was collected through online and printed questionnaires which included both closed-ended and open-ended questions and collected data was analyzed using statistical methods such as multiple regression and correlation. Training effectiveness is considered as the dependent variable while trainer performance, opportunity to perform, trainees' attitude toward prevention and trainees' self-efficacy are considered as the independent variables. Based on the analysis trainer performance, opportunity to perform, attitude toward drug prevention and self-efficacy were positively impacted on the effectiveness of the drug prevention program. According to the findings, it can be advised XYZ organization to pay more attention to the above-mentioned four factors when conducting prevention training programs. Not only for individual people effectiveness of the drug prevention program directly affected the whole Society in Sri Lanka. These findings have implications for policymakers, program developers, and trainers seeking to design effective drug prevention training programs that can reduce drug use and related problems.

**Keywords:** *Training effectiveness, Trainer performance, Opportunity to perform, Attitude toward drug prevention, Self-efficacy*

**ID 97**

**MEDIATING EFFECT OF ORGANIZATIONAL COMMITMENT WITH ITS  
DRIVERS AND EMPLOYEE JOB PERFORMANCE**

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Organizational commitment is considered as a key factor to determine employee loyalty and engagement with the organization's goals. This study examined the impact of leadership and high-performance work practices on employee job performance with the mediating effect of organizational commitment, focusing on administrative-level employees in the Colombo district, Sri Lanka. The data was gathered through a questionnaire. The study considered high-performance work practices and leadership as independent variables; Organizational commitment was considered the mediating variable; and the study's dependent variable was employee job performance. The researcher performed descriptive statistics, correlation analysis, and partial least squares structural equation modeling (PLS-SEM) to obtain the results of the study. According to the results of the study, it was demonstrated that there is a positive relationship between high-performance work practices and employee job performance, with a partial mediation effect by organizational commitment in between the relationship. Further, it was revealed that there is a positive relationship between leadership and employee job performance, with a partial mediation effect of organizational commitment. The findings of the study confirmed and extended previous literature. Research findings are expected to motivate administrative-level workers to make decisions effectively and increase employee job performance in the public sector.

**Keywords:** *High-Performance Work Practices, Leadership, Organizational Commitment, Employee Job Performance*

**ID 103**

**INTEGRATION OF SUSTAINABILITY CONCEPTS AS A MARKETING STRATEGY  
TO EXPAND THE MARKET SPECIAL REFERENCING TO ACL CABLES PLC**

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Sustainability has become critical component in the modern world and organizations have linked sustainability concepts into their business models to achieve economic upswing as long term business strategy. In response to growing consumer consciousness and concerns about environmental issues, manufacturing firms are increasingly embracing various sustainability initiatives as mean to attract and retain more customers. However there is a lack of well-developed theoretical and methodological approaches to analyze the precise effects of sustainability initiatives. Consequently, the specific impact of integrating these sustainability concepts on brand equity within the cable industry in Sri Lanka remains largely unexplored. Hence this study aims to provide preliminary evidence regarding the relationship between green innovation, green marketing and firm's sustainability policies and brand equity of ACL Cables PLC. By shedding light on this relationship the research provides valuable insights that help manufacturing firm to make future decisions regarding sustainability practices. This paper provides a current overview of existing body of literature and research module has designed to measure the relationship between sustainability concepts and Brand equity by conducting questionnaire method. In this study, Two separate questionnaires have tailored for getting feedbacks from executives who representing internal environment and customers who representing external environment to obtain comprehensive view. Selective sampling technique has employed for both samples and sample size has determined as 50 for each component. Qualitative data has analyzed using statistical techniques such as regression analysis. The findings of executive's survey revealed that green marketing and firm's sustainability policies have significant positive impacts on brand equity while green innovation does not play a significant role in determining brand equity. According to the findings of customer's survey, it concluded that green marketing and green innovation has no statistically significance impacts on brand equity, only firm's sustainability policies are driving higher brand equity of ACL Cables. The findings revealed that the level of awareness regarding company's green innovation and green marketing is currently lacking. Hence this study has recommended paying more attention on strengthening sustainability policies and use green marketing as channel to communicate to the customers about green initiatives.

**Keywords:** *Sustainability, Green Innovation, Green Marketing, Firm's sustainability policies*

**ID 104**

**FACTORS AFFECTING JOB SATISFACTION: A STUDY OF ABC BANK PLC**

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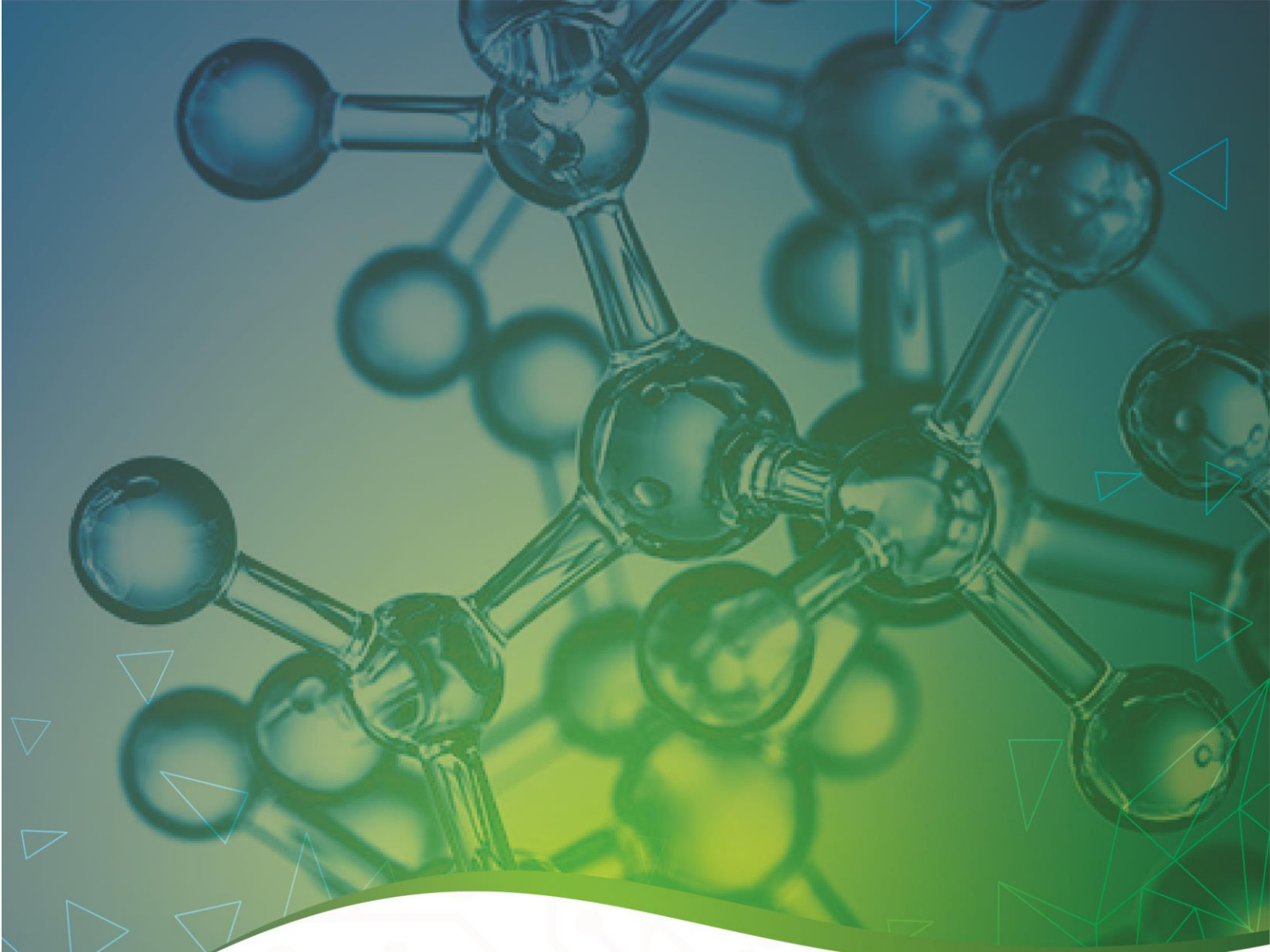
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Private banks play a vital role in Sri Lankan economy. ABC Bank PLC is a one of leading private bank in Sri Lanka registered under Central Bank of Sri Lanka. This study is conducted to branches of ABC Bank PLC in Western province Sri Lanka. The aim of this study is to identify the factors affecting job satisfaction of managerial and non- managerial employees in ABC bank PLC with specific objectives. Sample size of this project is 100. Out of 100, 50 samples represent the Managerial employees while the rest of half represent the non-managerial employees. This is a quantitative study and unit of analysis is individual. The entire research is conducted as a cross sectional study. Job satisfaction is considered as the dependent variable while work place spirituality, leadership, rewards, work life balance considered as independent variables. The analysis part of the research done by IBM Statistical Package for Social Science (SPSS version 23.0) software. The results reveled those rewards, work life balance impact on job satisfaction while work place spirituality and leadership is not impact on job satisfaction of employees in ABC Bank PLC. The results of independent T- test revealed that managerial and the non-managerial employees achieved the approximately equal level of job satisfaction. Based on the research findings, project recommends to offer more flexible policies to the employees and appreciating their new ideas, thoughts and new suggestions. And also, to introduce new reward system and to promote them to maintain their work life balance in order to encourage their performance while enhancing the job satisfaction.

***Keywords:*** *Job satisfaction, Work life balance, Work place spirituality, Leadership, Rewards*



# Polymer Science and Technology



"Building a Sustainable Future through Inspiring Innovation and Entrepreneurship"

ID 39

## INVESTIGATION OF OPTIMUM DISPERSING TECHNIQUE FOR VARIOUS GLOVE DISPERSION FORMULATIONS

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A system, in which the distributed particles of one material are in a continuous phase of another material is called a dispersion. For the glove industry, the addition of ultrafine dispersions of compounding ingredients to latex products is vital to impart novel functionalities to the product while giving superior quality and improved properties. Therefore, this research aims to identify the most effective dispersing technique and optimum formulation for achieving optimum dispersions of ZnO (Zinc Oxide), TiO<sub>2</sub> (Titanium dioxide), ZDEC (Zinc Diethyl dithiocarbonate), and Antioxidants. The study evaluated various dispersing techniques, such as ball milling, pearl milling, attritor milling, and different formulations, including dispersing agents and stabilizers, for their effectiveness in achieving optimum dispersion. In order to identify the optimum formulation, the critical micelle concentration (CMC) value is important as it gives the optimum percentage of dispersing agents. CMC can be varied according to the type of dispersion, type of dispersing agent, total solid content of dispersion, particle sizes, temperature, etc. Apart from that, homogenization, which is achieved by a proper milling process is also vital for a stable dispersion. Describing and understanding the milling process of each and every glove dispersion is sophisticated as it is driven by several parameters, such as the type of the mill, nature of milling (dry or wet), ball size and type, milling speed, milling time, etc. As ball milling, attritor milling, and pearl milling techniques are the most common in the glove industry those processes were compared to identify the optimum dispersing technique. Along with that, the dispersibility of the materials was assessed using the techniques such as zeta potential analysis, viscosity, pH, settling rates, and cloud test results. Further, particle size was also analyzed to check the optimum particle size for the most stable dispersion. Finally, the developed dispersions were used to check the properties of one of the end products in the glove industry, a polychloroprene glove. The results of this research including CMC value for different dispersions with respect to the dispersing agents, higher negative or higher positive zeta potential values, and the effect of milling time and ball size on the efficiency of dispersions, helped to understand the factors that affect the different glove dispersions and provided the insights for the development of more efficient dispersion process and formulations in industrial applications. The attritor mill's efficiency was much better for the introduced formulations than the ball mill and pearl mill. Along with the attritor milling technique, the effect of milling time and the effect of ball size on the efficiency of milling were also theoretically proved. Under the milling time also, the attritor milling process required a small period of time (~30 mins) compared to the ball milling (~24 hours) and pearl milling (~2 hours) processes. The ball size of the attritor mill was also in the mid-range between the ball sizes of the ball mill and pearl mill. Finally, the polychloroprene glove, produced by these developed dispersions, was under the required range of properties.

**Keywords:** *critical micelle concentration, homogenization, zeta potential value, total solid content*

**ID 52**

## **INVESTIGATING THE EFFECTIVENESS OF LITHIUM CHLORIDE-TREATED BANANA FIBERS IN ENHANCING CONDUCTIVITY OF NON-MARKING TIRES**

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Non-marking tires are widely used in various industrial and automotive applications to prevent marking on surfaces. However, one major concern with non-marking tires is the accumulation of static charge, which can lead to safety hazards such as explosions and equipment malfunctions. Different approaches have been attempted to dissipate static charge in non-marking tires, but most of them suffer from drawbacks such as reduced tire durability and increased manufacturing costs. This study was aimed to enhance the conductivity of non-marking tires by using LiCl-treated banana fibers. Banana fibers are known for their porous structure and potential as a reinforcing material in polymer composites. LiCl is an antistatic agent with the ability to dissipate static charge. We hypothesized that treating banana fibers with LiCl would create conductive fibers that could be incorporated into non-marking tires to dissipate static charge. To investigate this hypothesis, first banana fibers were prepared by extraction process and their thermal stability was investigated by TGA (Thermal gravimetric analysis) and sample visualization. Then banana fibers were treated with 17 moldm<sup>-3</sup> LiCl (dried; assay 99%) aqueous solution by immersing fibers into the solution for a day. After filtering out the fibers, they were dried in an oven at 110 °C for 1 hour 30 minutes. The dried fibers were then incorporated into the tire compound and milled using a two-roll mill. Testing buttons and sample tires were prepared, and their resistance and physical properties were analyzed. SEM images demonstrated that the LiCl-treated banana fibers could trap the LiCl effectively inside the fibers, creating a conductive path for static charge dissipation. TGA results showed that banana fibers have enough stability to withstand the process temperature without burning. This suggests that the fibers can be used as a suitable material for modifying tire properties. Also, the incorporation of LiCl-treated banana fibers into the tire compound led to good conductivity with less than 1 MΩ resistivity. Furthermore, physical properties of the tire were improved, including slight increases in hardness, and specific gravity, but a decrease in tensile and tear strength and abrasion loss. Therefore, further optimization can be done for improve physical properties for applications. The findings of this study indicate that LiCl-treated banana fibers are a promising material for enhancing the conductivity of non-marking tires and they can effectively dissipate static charge, reducing safety hazards in industrial and automotive settings. Moreover, the process of treating banana fibers with LiCl is simple and cost-effective.

**Keywords** – *Electrical conductivity, non-marking, antistatic, banana fibers*

**Acknowledgement:** *Special thanks to Stellana Elastomeric Engineering Co. Ltd*



**ID 76**

**DEVELOPMENT OF SILICA-BASED SOLID TIRE TREAD COMPOUND FOR THE WINTER SEASON**

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The aim of this study is to develop a solid tire tread compound with improved winter grip, wet grip, rolling resistance, and better abrasion resistance properties compared to the standard solid tire compound, which utilizes only carbon black as the primary filler. A two-step process was employed to achieve this goal. In the first step, four compounds were prepared to determine the desired BR/SBR ratio in a compound containing natural rubber as a main elastomer and CB. In the second step, two compounds were formulated to incorporate silica with Si69 coupling agents. All the compounds were prepared using an industrial-level internal mixer and two-stage mixing procedure, their physical and curing properties were compared to those of the standard solid tire compound. The abrasion loss was measured using a DIN abrasion tester. The compound that exhibited well-balanced properties, consisting of 30 phr BR, 10 phr SBR, 45 phr Silica, 5 phr CB, and an appropriate amount of Si69, demonstrated notable results. It exhibited a 60% reduction in rolling resistance due to strong filler-polymer interaction, an extended rubbery state down to -54°C owing to a reduced glass transition temperature, and a 20% decrease in abrasion loss. The outcomes of this study contribute significantly to the development of solid tire compounds in the industry, enabling the production of new solid tires that offer enhanced energy efficiency and improved wear properties, while also providing good winter grip without compromising stiffness in the winter season.

***Keywords:*** *winter grip, wet grip, rolling resistance, abrasion resistance, glass transition temperature*

**ID 77**

## **PREPARATION OF FABRIC PRINTING INK USING WASTE FABRIC**

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Although textile goods are needed daily, millions of tons of waste textiles are produced annually. Due to the rapid increase in the production of textiles, the textile and apparel industry is one of the most polluting industries globally. Currently, most of this textile waste is thrown out without recycling since there isn't currently a well-established method for separating mixed textiles. This research is carried out to separate the polyester-cotton mixed fabric and develop the fabric printing ink. Developing a simple process for separating cotton and polyester from their mixed fabrics is indispensable for recycling waste mixed fabrics. Polycotton fabric consists of polyester and cotton fiber. Techniques for the extraction of cellulose from polycotton fabric utilizing sulfuric acids have been developed. This research study successfully separated polyester/cotton blended fabric, and cellulose was extracted from the polycotton fabric. Fourier transform infrared spectroscopy (FTIR) characterized the separated polyester and cotton fiber. At the beginning of this research study, cellulose was extracted using polycotton fabric by sulfuric acid hydrolysis. And extracted cellulose was confirmed using Infrared spectroscopy data. The extraction process was confirmed using data from Fourier transform infrared spectrophotometer using the ATR (Attenuated Total Reflection) technique. The optimization of this protocol was done to obtain Cellulose. Cellulose is a natural polymer that shows biodegradable properties. Using this cellulose, the development of screen-printing fabric ink is carried out. Extracted cellulose was confirmed using FTIR, and XRD (X-ray Diffraction). The reduction of crystallinity of cellulose is confirmed using the XRD analysis. Modifications of Cellulose were carried out with industrially available acrylic binder. Then modified amorphous cellulose was confirmed using FTIR and XRD. Modified ink was printed on cotton fabric. And washing and crocking tests were conducted to confirm the properties of fabric printing ink. The formation of crosslinks between modified cellulose and commercially available binder can be confirmed by the enhancement of properties compared to the control test.

**Keywords:** cellulose, polycotton, screen printing ink, hydrolysis of cellulose

**ID 83**

**OPTIMIZING THE RATIOS BETWEEN COTTON FLOCK AND FRICTION CORD FOR SOLID TIRE HEEL COMPOUND PROPERTIES**

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Friction cords are also called Fiber reinforced rubber compounds, used in the rubber compound to decrease the price of the compound of the heel layer of the tire. But the time-to-time friction compound shortage is a big problem for continuous production. According to collected data from existing heel compounds in the production, a higher variation of tensile strength and elongation was identified for the same Fiber reinforced rubber compound lot, and a low mixing nature of Fiber reinforced rubber compound with rubber compound was observed. This research investigated the effect of altering the ratio of the cotton flock and Fiber-reinforced rubber compound on the properties of the heel compound used in solid tires. In this study, an existing heel compound was used as the control compound, and the properties were investigated by varying the ratio between cotton flock and Fiber-reinforced compound. Then the properties of the compounds were tested by changing the cotton flock without the Fiber-reinforced rubber compound. The mechanical characteristics of the rubber compound, such as tensile strength and elongation at break, were reduced when the cotton Flock increased from 15PHR. Compared to current heel compounds, rubber compounds made with Cotton Flock 15, 25, and 35 PHR without Fiber reinforced rubber compounds have better mechanical properties, and rubber compounds made from the Cotton Flock: Friction Cord 25:55 ratio can be used as an alternative.

**Keywords:** *Cotton Flock, Fiber reinforced rubber compound, Solid tire heel compound, Tensile strength*

ID 84

## THE STUDY OF THE EFFECT OF INCORPORATING AN ECO-FRIENDLY FILLER ON THE COST AND PROPERTIES OF A TOOTHBRUSH SHAFT

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This study mainly focused on implementing a new optimal formulation of a composite by replacing an expensive imported blowing agent with an inexpensive eco-friendly local calcium carbonate ( $\text{CaCO}_3$ ) filler masterbatch to reduce the energy consumption, total raw material, and average energy cost while enhancing its thermal, mechanical, and morphological properties relevant to the SLS Standard 276. Different weight percentages of  $\text{CaCO}_3$  were mixed with the polypropylene (PP) while the total weight of the composite was constant, and the mixture was molded using an injection molding machine to produce toothbrush shafts. Each toothbrush shaft sample's cost and energy savings were calculated. To measure the melting temperature ( $T_m$ ) and heat of fusion ( $\Delta H_m$ ) of the sample composites, Differential Scanning Calorimetry (DSC) analysis and a thermal conductivity measuring method were conducted. Several mechanical properties of the samples were tested and Scanning Electron Microscopy (SEM) analysis was carried out to explain the obtained results. An X-ray Diffraction (XRD) test was conducted to determine the crystallinity of the samples. An aging test was carried out to see the effect of temperature on the mechanical properties of the final product. The results revealed that compared to the standard BA reference sample, the total raw material and average energy cost per shaft were reduced by 2.27% and 34.08%, respectively, in the 4% sample.  $\text{CaCO}_3$  contained samples had almost the same  $T_m$  values but reduced  $\Delta H_m$  and increased thermal conductivity values, leading to reduced molding temperatures, cooling, and cycle time. All the sample shafts were not broken, have a length over 150 mm, and the bristles have a pull strength over 10 N, accomplishing the requirements in SLS Standard 276.  $\text{CaCO}_3$  contained samples had reduced shrinkage in length. The permanent deformation and hardness of the toothbrush shaft decreased with the increment of filler, indicating the agglomeration effect of  $\text{CaCO}_3$ , which was confirmed by the SEM images. The addition of  $\text{CaCO}_3$  caused all the diffraction peaks of the  $\alpha$ -PP to become very weak, but it did not change the crystal form of the PP matrix. Aging test results indicated that the samples had reduced properties at a temperature of 50 °C but were still able to accomplish the requirements in SLS Standard 276. Considering the overall results obtained, the 4% sample had the optimal formulation and was able to replace 4% of the weight of PP with  $\text{CaCO}_3$  filler.

**Keywords:** Polypropylene,  $\text{CaCO}_3$ , Composite, Toothbrush, SLS Standard 276

**ID 86**

## **LUBRICATING PROPERTY ENRICHMENT WITH GRAPHITE AND POLYMER ADDITIVES**

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The lubrication properties of grease can be significantly improved by incorporating graphite as well as polymer additives. In this study, the effect of different percentages of polyethylene glycol (PEG) and 25 % percent of graphite on the lubricating property had been investigated. In this experiment, a series of grease samples were considered with varying percentages of PEG, the percentages vary 0 %, 3 %, 9 %, 15 %, 21 %, 27 %, 30% , and 33% for the pure grease samples and for the graphite added samples PEG percentages of 0 %, 3 %, 9 %, 15 % , 21 %,23 %,25% and 27 % by weight of grease. The dropping points were measured using the ASTM D2265 method. The results showed as the sample containing 0 % of PEG had a dropping point of 185°C, while the PEG pure samples had dropping points of 176°C, 190°C, 220°C, 210°C, 240°C, 140 °C and 162 °C respectively. The samples with 25% of graphite reported dropping points of 215°C, 235°C, 200°C, 203°C, 240°C, and 145°C respectively. The addition of PEG made a huge difference in dropping points. The most suitable percentage of PEG is 27 % and 21 % of PEG with 25 % Graphite. The improvement in the dropping points can be attributed to the ability of PEG to reduce the friction between the graphite particles in the grease. This could allow the grease to form a more uniform and stable structure, which in turn may increase the thermal stability of the grease. Fourier transformation infrared spectroscopy (FTIR) was conducted and the peaks obtained were 2921 (cm<sup>-1</sup>)- Asymmetrical stretching vibration of the C-H group, 2852 (cm<sup>-1</sup>)-Symmetrical stretching vibration of C-H group, 1736 (cm<sup>-1</sup>)- Asymmetrical stretching vibration of C=O, 1559 (cm<sup>-1</sup>)-Asymmetrical stretching vibration of COO group and 1455 (cm<sup>-1</sup>)- Asymmetrical deformation vibration of CH<sub>3</sub> group, 1379(cm<sup>-1</sup>)- Bending vibrations of C-H group and 723(cm<sup>-1</sup>) for the CH<sub>2</sub> rocking vibration. Apart from those characteristics, three peaks were shifted in PEG-containing grease samples. The peaks of 1736 cm<sup>-1</sup>, 1455 cm<sup>-1</sup>, and 723 cm<sup>-1</sup> were shifted into the 1738 cm<sup>-1</sup>, 1459 cm<sup>-1</sup>, and to 727 cm<sup>-1</sup> correspondingly. This shifted peaks evident the bonds getting stronger. In conclusion, this study demonstrates that the addition of PEG the polymer additive, and graphite can significantly improve the thermal stability of grease.

**Keywords:** *Lubrication, Graphite, Polyethylene glycol (PEG), Dropping point*



# Robotics and Software Development



**ID 46**

**AN INTELLIGENT SYSTEM TO INSPECT SKIN DISEASES IN HOUSEHOLD DOGS**

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Skin diseases in pets are a prevalent issue, causing concern for both pet owners and veterinarians. It is estimated that up to 75% of health diseases in animals are related to skin issues. Traditional diagnosis methods for these conditions can be challenging, often requiring advanced testing procedures that can be both costly and time-consuming. Given the increasing use of technology in veterinary medicine, past researchers have explored the use of deep learning methods as a potential solution to improve the diagnosis and treatment of skin diseases in pets. This study aims to develop a deep learning-based intelligent system with a weighted scoring algorithm based on domain knowledge to simplify the identification of skin diseases for pet owners and veterinarians. It proposes a solution to aid dog owners in accurately identifying skin diseases in their pets through the development of a fully functional intelligent system. This system is a combination of a deep learning model using Convolutional Neural Network (CNN) and a question-based feature extraction algorithm utilizing domain knowledge acquired through a survey-based expert consensus study. The system captures images of skin diseases and processes them through a deep learning model to generate predicted scores. These scores are then combined with the results obtained from answering 6 questions, using a weighted scoring algorithm. The final prediction is generated by combining the scores obtained from both the deep learning model and the weighted scoring algorithm. In this study, the proposed system accurately predicted four common skin diseases in pets, including ringworm, mange, dandruff, and yeast infection, achieving an accuracy of 93% - 98%. The system offers several benefits, including saving time and money, ensuring the health and well-being of pets, and providing accurate, timely, and effective diagnosis and treatment of skin diseases. This intelligent system offers a promising solution to overcome the challenges posed by traditional diagnostic methods, providing a cost-effective and efficient way to diagnose skin diseases in pets.

**Keywords:** *Artificial Intelligence, Deep Learning, Image Processing, CNN, Canine Dermatitis*

**ID 75**

**ENHANCING CHATGPT SINHALA: IMPROVING COHERENCE AND  
CONTEXTUAL UNDERSTANDING FOR CONVERSATIONAL AGENTS IN THE  
SINHALA LANGUAGE USING GPT-2**

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The field of Natural Language Processing (NLP) has brought about significant advancements in various applications, such as chatbots and language generation. However, the current performance of existing ChatGPT models in the Sinhala language falls short due to limited access to Sinhala training data. This paper aims to present our ongoing research endeavor, which focuses on developing a Sinhala ChatGPT utilizing the GPT-2 model. To construct the Sinhala ChatGPT, we collected a corpus of Sinhala text from diverse websites and bloggers. The acquired data underwent preprocessing techniques, including tokenization, stemming, and stop word removal. Subsequently, the preprocessed data was fine-tuned on the GPT-2 model using Google Colab. Our fine-tuning process involved utilizing a subset of the Sinhala Wikipedia, Oscar database and a carefully curated dataset comprising Sinhala language questions and answers. The model architecture encompassed 12 layers with 117M parameters, facilitating efficient training on an extensive Sinhala text corpus. The primary objective of this research is to enhance the performance of ChatGPT models in the Sinhala language and provide a solution to the existing limitations. To evaluate the efficacy of the Sinhala ChatGPT, I plan to conduct experiments to assess the quality of the generated text and the model's understanding of user inputs. Evaluation metrics, such as perplexity, BLEU score, and ROUGE score, were employed to gauge the quality of the generated text. Furthermore, we compared the performance of our model with other state-of-the-art models in the Sinhala language domain. Preliminary findings demonstrate that the Sinhala ChatGPT model is capable of generating coherent and relevant responses in the Sinhala language. Nonetheless, further evaluation and testing are necessary to validate the model's effectiveness. Future work will involve exploring additional NLP techniques and expanding the Sinhala training data to further enhance the model's performance. In conclusion, my ongoing research, centered on constructing a Sinhala ChatGPT using the GPT-2 model, has exhibited promising outcomes in improving the performance of ChatGPT models in the Sinhala language. Our study demonstrates that, with a meticulously curated dataset and fine-tuning on the GPT-2 model, it is possible to develop a high-quality Sinhala ChatGPT.

**Keywords:** *chatGPT-sinhala, GPT-2, transformer, text-generation*



**ID 116**

**DEVELOPMENT OF A FULLY ACTUATED MONO-COPTER UAV WITH THRUST VECTORING**

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The fully actuated thrust vectoring mono-copter is a significant step forward in unmanned aerial vehicle (UAV) technology, with potential applications in research, surveillance, indoor flying and entertainment. The advantage of a fully actuated mono-copter over other multirotor drones is its ability to achieve both vertical and horizontal thrust control, enabling more agile and versatile flight maneuvers. Developing a fully operated thrust vectoring mono-copter addresses the need for enhanced maneuverability, stability, and control in UAVs. The design and building of the mono-copter are presented in this work. The objective of this research work is to enhance flight stability and improve maneuverability. The drone's frame was created using 3D modelling software and printed using a 3D printer. Calibration and configuration were performed after assembling all the necessary parts of the mono-copter system. Then PID tuning process was conducted step by step until the drone's stability and maneuverability were optimized. The successful design and construction of the mono-copter enabled the alteration of thrust direction, thereby allowing control over the flight trajectory. The drone demonstrated portability and ease of operation during flight tests. These findings highlighted the feasibility of designing and building a fully actuated, thrust-vectoring mono-copter. By further developing this drone, its shortcomings can be improved and introduced to the world as a more efficient, safer and cheaper product.

**Keywords:** *ducted mono copter, single ducted copter, single rotor drone, multi-copter, thrust vectoring*



# Theoretical and Applied Physics



**ID 45**

## **VIBRATION ANALYSIS OF THE ELECTRICAL MOTORS IN AN AIR CONDITIONER UNIT**

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Monitoring and identifying the faults of electrical motors is better for improving their efficiency of them. This research focuses on the vibration analysis of the electrical motors in an air conditioner (AC) outside unit. This was done to figure out the faults of the motors and improve the efficiency of the motors. First, the RPM (revolutions per minute) value was measured with a tachometer. Then the vibration was measured through x, y, and z directions from the top four corners and the bottom four corners of the AC unit with the BK Connect software. The data were taken from the AC unit in a normal day working condition. Then the data in the time domain was converted to the frequency domain with fast fourier transformation (FFT) analyzer and a graph from each corner was taken for further analysis. The seven highest peak values were taken from every corner and direction for the analysis. There was around an 80% of reduction of the averages of peak values in the bottom four corners concerning the top four corners, because of the insulation which was installed at the bottom. Therefore, the vibration spectrums of the top four corners were taken to identify faults in the motors of the AC unit. The peak values below 60 Hz (five times the RPM value) through the x, y, and z directions of the top four corners were counted for identifying the faults. The faults that can occur in the motors of the AC unit were figured out as probabilities. The faults, which have the highest probabilities, can be solved using the necessary steps for that. Therefore, using insulation at the bottom of an AC unit can improve the efficiency of the motors of it by reducing the vibration.

**Keywords:** *Electrical motors, Vibration analysis, BK Connect software, FFT analyzer, Peak values*

**ID 62**

**PERFORMANCE OF PORTLAND COMPOSITE CEMENT WITH RESPECT TO DURABILITY, STRENGTH AND WORKABILITY**

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In the cement manufacturing process, Clinker is used as the main component. Portland Composite Cement (PCC) is a newly introduced cement type to the Sri Lankan construction industry in addition to the Ordinary Portland Cement (OPC). Cement Production contributes greenhouse gases and as a result causes a various environmental effect. Further, due to the current economic crisis in Sri Lanka, manufacturers are facing difficulties when importing raw materials for cement industry. As a solution, locally available limestone (LS) was introduced as a supplementary material for cement production. Strength and Durability are two major factors which are concerns for quality of cement binder. Although the compressive strength of limestone substituted PCC is specified in the Standards of Sri Lanka Standards Institute (SLSI), a study on durability performances are timely needed to examine. In the present study, three samples were made as 100% OPC, 100% PCC and 88% OPC + 12% Limestone. Standardized testing methods (ASTM C1012-04/ ASTM C1403-05/ BSEN 196-1) were conducted to investigate the durability performance. Mechanical, chemical and physical parameters such as compressive strength, length change, water absorption, chemical characteristics and microstructure analysis were performed. According to the compressive strength results, For PCC, the compressive strength is generally higher compared to OPC and OPC+LS sample at early stages (3 days). However, a significant difference can be observed during the later stage (28 days) compressive strength where the strength of OPC becomes higher compared to other samples. The lowest 28 days compressive strength is observed in PCC. Early age (0-4 hours) water absorption rate of PCC is similar to OPC but at later age (24 hours) rate, it is significantly higher. PCC shows a greater resistance to external sulfate attacks. While OPC expands with external sulfate, PCC shows a shrinkage with a negligible amount. Microstructure analysis was performed to study the porosity profile and hydration characteristics. PCC shows a lower porosity (4.062% (Area)) compared to other two samples where OPC 24.99% (Area) and OPC+LS 5.259% (Area). Lower porosity leads to dense pore solution which improves the mortar durability. Analyzed results indicate PCC as a cement which shows durable performances.

**Keywords:** Composite cement, Strength, Durability, Limestone, Porosity

**ID 72**

**STUDYING THE PHYSICAL PROPERTIES OF A NEWLY DEVELOPED FILTER CARTRIDGE TO REMOVE HARDNESS IN WATER**

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This research was carried out to study the physical characteristics of a novel filter cartridge that effectively removes the water hardness. Water hardness where the water contains excess  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ . It causes problems in domestic and industrial usage. Water hardness has adverse health effects due to continuous and prolonged consumption of hardwater. It has become a major problem among populations in rural areas. There are sophisticated methods to remove hardness in the industrial field, but they cannot be used on the domestic level. To provide an effective solution to this problem, it is essential to introduce a cheap, easy to use and publicly available hardness removing method for domestic usage. A filter system was determined as the best method to remove water hardness at domestic level. First, Zeolite was identified as an efficient hardness removing material. Zeolite was then incorporated with different clay types, starch, and rice husk to act as binding material and for added porosity. It was tested to determine the best firing temperature and material ratio which showed high efficiency. Then a series of test specimens and laboratory scale models were prepared to further analyze the performance of the mixture. Characterizations were done which included SEM, FTIR, XRD analysis, flexural strength testing, flow rate, water absorption, and porosity. The results were analyzed and the material mixture which was most efficient in hardness removing and other characteristic tests was chosen to build the filter cartridge. A salt incorporated regeneration method which enhanced the re-usability and durability of the filter tested and implemented. The final mixture contained Zeolite 50%, 25% of Colombo Clay along with 5% Southern Clay and 20% porous materials. The filter cartridge showed high efficiency with different hard water samples. It had a hardness removing efficiency of 90% and adsorption capacity of 20mg/g. The final cartridge had water absorption percentage (w/w) of 51.0%, The flexural strength of the cartridge was 0.585MPa and the flexural modulus was 52.5MPa. This was able to regenerate its hardness absorbing capabilities after a washing cycle of 0.5M salt solution. This filter cartridge met the expectations as it was cheap, easy to use and durable.

**Keywords:** *Water hardness, Zeolite, salt regeneration, clay, ion-exchange*

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**ID 89**

## **PHYSICO-MECHANICAL PROPERTIES OF FIBER WASTE FILLED NATURAL RUBBER COMPOSITES**

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Fiber-reinforced polymer-based composites (FRP) have significant usage in various applications namely automobile components, tires, boat building, and marine construction. Sri Lanka's traditional boat-making process using fiberglass-reinforced plastics has evolved into making plastic products. In this study, waste boat fiber (WBF) was used as filler to investigate the physico-mechanical properties of natural rubber composites. Further, in this study, WBF is transformed into powders (around 30 microns), and it was characterized by advanced techniques such as FTIR, SEM, and TGA. According to FTIR analysis, WBF showed a peak at 1019 cm<sup>-1</sup> and it was assigned to the Si-O bond. Then, natural rubber (NR) composites were prepared with different types of fillers such as conventionally used carbon black, calcium carbonate, and natural fiber (coco peat fiber). In addition, WBF and WBF mixed silane coupling agent (WBF Si-69) were used as fillers to incorporate with NR and properties compared with conventional types of fillers. The composite prepared without filler was used as the control. The influence of these types of fillers on the physico-mechanical properties was evaluated according to ISO standards. The results indicated that the composite prepared with carbon black -330 showed remarkable improvement in properties in terms of tensile strength, hardness, and abrasion volume loss due to carbon black -330 better dispersion on the NR matrix. Therefore, carbon black is commonly used as reinforcing fillers in the rubber industry. Other than that, the composite prepared with WBF Si-69 exhibited better improvement of elongation at break percentage than the other NR composites. The reason would be WBF Si-69 create better interaction with the NR matrix via the silane coupling agent. Furthermore, NR composite prepared with WBF Si-69 presented moderate performance in terms of resilience, hardness, and elongation at break. Hence WBF Si-69 filled NR composite would be suitable for high-elastic engineering applications.

**Keywords:** *Waste board fiber, carbon black, calcium carbonate, coco peat fiber, physical properties*

**ID 91**

**INDUSTRIAL DEVELOPMENT FOR DETERMINATION OF WATER VAPOR TRANSMISSION RATE OF DIFFERENT MATERIALS**

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The National Building Research Organization (NBRO) conducted a study to determine the water vapor transmission rate (WVTR) of various construction materials, including waterproofing slurries, using the cup method. The study aimed to develop and implement a standard test method for determining the WVTR of various construction materials and to provide insights into water vapor transmission through building materials. The study followed the ASTM E96 standard test method, which uses the cup method to measure the independent transmission of water vapor. The study found that the WVTR of a material is influenced by temperature and relative humidity, and materials with higher WVTR values are more permeable to water vapor than those with lower values. However, there were some exceptions and problems with these principles and generalizations. For example, certain materials may have high WVTR values but may not necessarily be the best choice for certain applications. In addition, the WVTR values of some materials may change over time due to aging or exposure to environmental factors. The cup method was found to be an effective and consistent way of determining the WVTR of different construction materials. The measurement of weight gain or loss using the cup method is done during a 24-hour period. Therefore, it is essential to use a balance that can function well at high R.H. levels. A load cell balance was used to precisely quantify the weight changes during the testing procedure to meet this requirement. Since the load cell balance is specifically made to tackle the difficulties presented by high humidity levels, measurements will be accurate and dependable for the whole experiment. Based on the study's findings, the study recommends that WVTR testing should be incorporated into the standard testing procedures of construction materials. In the context of cementitious waterproofing slurries, which were the primary focus, materials such as StoCrete, Swisstek 2K Aquashield water proofer, Finex PlatinumEasy, and Finex Platinum Flex were assessed. For water proofers, it is recommended that the WVTR value should fall within the range of 0.1 and 10 gm<sup>-2</sup>day<sup>-1</sup>. Among these materials, Swisstek and Finex Platinum Flex demonstrated WVTR values within the desired range. Further laboratory comparison should be done to validate the method.

**Keywords:** *Water Vapor Transmission Rate, cup method, waterproofing slurries, ASTM E 96, Building Materials*

**ID 92**

**PHYSICO-MECHANICAL, ELECTRICAL CONDUCTIVITY AND AGEING PROPERTIES OF GRAPHITE NANOSHEET AND MICRO GRAPHITE FILLED NATURAL RUBBER COMPOSITES**

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Nano graphite is more effective than micro graphite in improving the properties of various polymer materials for different industrial applications. Nano graphite, similar to graphite, has been reinforced in conducting polymers, thermoplastics, and rubbery matrices to develop high-performance nanocomposites. In this study, a comparison was made between the physico-mechanical properties of nano graphite and micro graphite-filled natural rubber composites. Nano graphite (NG) was synthesized using a chemical process, and a series of natural rubber (NR) composites were prepared varying the nano graphite loading from 0.2 parts per hundred parts of rubber (phr) to 1 phr, in intervals of 0.2 phr, while another series were prepared varying the micro graphite loading from 2 phr to 10 phr, in intervals of 2 phr. The physico-mechanical properties such as tensile strength, elongation at break, modulus, hardness, tear strength, and resilience were evaluated according to ISO standards. The results showed that the tensile strength, hardness, tear strength, and electrical conductivity of the composites increased with an increase in the NG loading, while the resilience and sheet resistivity of the composites decreased with an increase in the NG loading. However, the composite prepared with 0.8 phr loading of nano graphite showed a remarkable improvement in terms of tensile strength, hardness, tear strength, electrical conductivity, and sheet resistivity indicating the highest stress a material can withstand without permanent deformation and the highest electrically conductive composite. In the aged results; the composite prepared with 0.8 phr loading of nano graphite showed a better improvement in terms of retention of tensile strength, and retention of tear strength while the composite prepared with 10 phr loading of micro graphite (MG) presented better properties. In addition, the composite prepared with 10 phr loading of micro graphite (MG) presented similar observations to the composite prepared with 0.8 phr NG. Hence, lower loadings of MG could not be sufficient to enhance the performance of NR composites due to poor dispersion on the NR matrix. Therefore, composites prepared with low loadings of NG exhibited good improvement of physico-mechanical properties due to low wettability and better dispersion on NR matrix, and furthermore, 0.8 phr NG loading NR composite would be suitable for high elastic conductive applications requiring good physico-mechanical, thermal ageing and electrical conductivity properties.

**Keywords:** *Nano graphite, micro graphite, natural rubber, physico-mechanical properties, electrical conductivity*



**ID 101**

**INDUSTRIAL POWER ANALYSIS AND FORECASTING POWER CONSUMPTION  
OF A 3 PHASE 4 WIRE SYSTEM**

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Electricity power saving is indeed important today for several reasons. Conserving electricity is a responsible action that individuals, organizations, and communities. Many governments organization and the private sector around the world have set energy efficiency targets and implemented policies to encourage electricity power saving. Electricity power saving is essential for environmental sustainability, cost savings, energy security, and the overall well-being of society. It is a responsibility that individuals, households, businesses, and governments must embrace to ensure a sustainable and resilient future. This study aimed to conduct an industrial power analysis of a 3-phase 4-wire system to analyze the distribution of load among the three phases, analyze the power factor of the system, and analyze the power consumption of the system. The problem addressed by this research was the lack of information on the electrical power consumption patterns of the 3-phase 4-wire system, which can lead to inefficient use of resources and increased energy costs. The methodology involved the use of the KEW 6315 power meter, which was connected to the main power supply. Data were collected on a weekly basis, and the recorded data were analyzed using KEW Windows for KEW6315 software and R programming software. The data collected from the power meter included measurements of active power, reactive power, apparent and power factor, which were used to analyze the electrical power consumption patterns of the system. The findings revealed a balanced voltage condition in the system, indicating consistent and stable voltage levels across the three phases. The power factor, with values approximately equal to one, indicated efficient utilization of power and improved energy efficiency. Mainly a time series analysis was performed and an ARIMA (5,2,0) model was identified as a suitable representation for forecasting the active power energy consumption, providing valuable insights for energy planning and resource allocation. These findings contribute to optimizing power usage, reducing costs, and enhancing system efficiency.

**Keywords:** *power factor, 3 phase 4 wire system, power consumption*

**ID 107**

**ENRICH PERFORMANCE OF THE POSITIVE ELECTRODE IN THE LEAD ACID BATTERY EMBEDDING DIFFERENT ADDITIVES**

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Lead acid batteries have long been recognized as a versatile and cost-effective energy storage solution for various applications, including automotive, renewable energy integration, and telecommunications. However, the performance of lead acid batteries can be hindered by issues such as sulfation during discharging and positive electrode grid corrosion. This research aims to investigate the impact of specific additives on the positive electrode of lead oxide batteries, with a focus on carbon-based additives such as carbon black, graphene, and carbon nanotubes. To assess the performance of lead oxide batteries, a paste is formulated by combining Lead Oxide, Lead Dioxide, and various additives in different ratios. Discharge capacity is conducted to evaluate the effectiveness of these additives. The experimental results demonstrate the influence of different additive compositions on the functionality of lead oxide batteries. When the graphene and carbon black ratio was 0.4% (w/w), the discharge capacity increased to 243.68mAh, and 276.4mAh respectively. Similarly, the addition of carbon nanotubes at a ratio of 0.15% (w/w) resulted in a discharge capacity of 211.4mAh. These findings highlight the potential of graphene, carbon black, and multiwall carbon nanotube as additives in improving the cell capacity of lead-acid batteries. These research findings provide valuable insights into the role of carbon-based additives in lead oxide batteries, contributing to the development of more efficient and reliable energy storage systems.

**Keywords:** *lead acid battery, positive electrode, carbon-based additives.*

ID 112

## SURFACE MODIFICATION OF RECYCLED POLYESTER FABRIC BY IMMOBILIZING SILVER NANOPARTICLES USING GAMMA RAY IRRADIATION AND ITS ANTIBACTERIAL PROPERTIES

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Ionizing radiation techniques such as X-rays, gamma-rays, electron beam and ion beam are applied in nanotechnology to develop new functional materials with potential uses in catalysis, bio sensing, nano-electronics, and fabrication of nano structured materials. The current research work focuses on the gamma radiation induced synthesis of silver nanoparticles (AgNPs). In the study, acrylic acid (AA) monomer was grafted onto the recycled polyester fabric using gamma irradiation via grafting, and AgNPs were immobilized on the grafted fabric, to modify the polyester fabric with antibacterial properties. AgNPs were produced by the reduction of silver ions ( $\text{Ag}^+$ ) in Silver Nitrate ( $\text{AgNO}_3$ ) into silver metal atoms. The synthesis of AgNPs and the stabilization on the recycled polyester fabric was done by  $^{60}\text{Co}$  panoramic wet storage gamma radiation source, instead of using chemical reduction. The size of the AgNPs is dependent on the irradiation dose, dose rate, the pH, and the initial concentration of the silver ions were studied. The optimal dose for the formation of well-distributed AgNPs was obtained as 15 kGy and the optimal initial concentration of the acrylic acid was found to be 20%(v/v%). AgNPs loaded with polyester fabric exhibited yellowish brown after the irradiation process. The Degree of Grafting (DG) at 20% of AA monomer concentration and 15kGy dose was recorded as 62%. It was confirmed that the DG depends on the monomer concentration, absorbed dose and dose rate. The absorption and scattering plasmonic optical properties of AgNPs were analyzed using UV-Visible spectroscopy. Surface Plasmon Resonance (SPR) peak was obtained at 450.50 nm. The chemistry of the modified polyester fabric was characterized using Fourier-transform infrared spectroscopy (FT-IR), and the surface morphology was examined with confirming the presence of AgNPs using Scanning Electron Microscopy (SEM). Further, crystalline structure of the AgNPs, was obtained using X-ray diffraction (XRD). The antibacterial properties of the modified fabric were studied by evaluating its disinfection *Staphylococcus aureus* a Gram-positive bacteria species.

**Key words:** *ionizing radiation, silver nanoparticles, gamma-irradiation induced grafting, polyacrylic acid, polyester fabric*

**ID 114**

**GAMMA IRRADIATION EFFECTS ON SAPPHIRE GEMSTONES: A  
COMPARATIVE STUDY OF UV-VIS AND FTIR SPECTRA IN NATURAL AND  
TREATED GEMS**

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Gamma irradiation is a commonly employed treatment for gemstones like amethyst, topaz, and beryl resulting in permanent color changes. However, sapphires exhibit momentary color modifications that revert to their original form over time, leading to the deceptive practice of selling irradiated sapphires as natural stones. This research focuses on investigating the composition changes in irradiated sapphires and differentiating them from natural ones using Uv-Vis Reflectance and Diffuse Reflectance FTIR spectroscopic analyses. As the test samples, a group of pink, blue and purple hued natural sapphires were used to study the mechanism. Gamma radiation was used to irradiate natural sapphire samples, with particular attention to potential radioactivity. The study revealed distinct changes in the Uv-Vis Reflectance spectra of irradiated sapphires. The irradiation process produced consistent color patterns, with decreased blue intensity in pink sapphires and improved brightness in darker-hued samples. Notably, certain blue sapphires developed a pink-yellow hue. FTIR analysis showed similarities in peak patterns before and after irradiation, such as Si-O stretching vibrations and C-H stretching bond vibrations likely originating from surface organic fats. The presence of CO<sub>2</sub> molecular vibrations and characteristic Al-O structural vibrations of Al<sub>2</sub>O<sub>3</sub> were also observed. UV-Vis reflectance spectra exhibited significant differences between pre and post-irradiation, confirming the color changes. Post-irradiation spectra displayed broad troughs attributed to Cr<sup>3+</sup> transition metal ions, adding a pink hue, while troughs related to Fe<sup>3+</sup>-Fe<sup>3+</sup> and Fe<sup>2+</sup>-Ti<sup>4+</sup> inter-valence charge transfers responsible for blue hues decreased or vanished. Additionally, the O<sup>2-</sup>-Fe<sup>3+</sup> inter-valence charge transfer contributed to the observed yellow hue. These findings shed light on the color change mechanism in irradiated sapphires, addressing the challenge of detecting irradiation and enhancing transparency in the gemstone industry.

**Keywords:** *corundum crystals, Gamma Irradiation, Color grading, Gemstone enhancements*

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and those who cannot change their minds  
cannot change anything.**

- George Bernard Shaw -

