SLITA
Sri Lanka Institute of Textile & Apparel

1st RESEARCH SYMPOSIUM ON TEXTILE AND APPAREL INDUSTRY 2023

BOOK OF CONFERENCE PROCEEDING

"TEXTILE & APPAREL INNOVATION FOR ECONOMIC DEVELOPMENT"

23rd June 2023

Bandaranaike Memorial International Conference Hall (LAVENDER HALL)

ORGANIZED BY RESEARCH CENTER
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Proceeding of the 1st Research Symposium on Textile and Apparel Industry - 2023

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Message from Hon. Dr. Ramesh Pathirana, M.P.
Minister, Ministry of Industries

I am delighted to drive a dynamic community of diverse people in presenting a distinctly different experience at the 1st Research Symposium 2023. Sri Lanka Institute of Textile and Apparel has aptly selected the theme of "Textile and Apparel Innovation for Economic Development". The Research Symposium focuses on dissemination of the new knowledge and finding solutions to new challenges encountered in the areas of Textile, Apparel and Management of Textile and Apparel.

No one can stop in a comfort zone and let others fly pass them. In a highly competitive academic arena and business landscape new thoughts and directions are the key to success. In this context, innovation for success is a must through the research.

Global spending on Research and Development (R&D) has reached a record high and it amounts to almost US$1.7 trillion. Countries have pledged to substantially increase public and private R&D spending as well as the number of researchers by 2030. As a part of Sustainable Development Goals (SDG), many countries try to stimulate greater investment in both private and public sectors by setting national targets for R&D spending as a share of GDP.

This Research Symposium is coloured by the recognized key events and followed by new findings as an outcome of the respective research. I would like to take this opportunity to convey my sincere gratitude to the Sri Lanka Institute of Textile and Apparel and its Board of Governors and Management and wish successful Research Symposium – 2023.

Message from Hon. Prasanna Ranaweera, M.P. State Minister, State Ministry of Small and Medium Enterprise Development

It is with great gratification I am sending this message at another landmark event of the Sri Lanka Institute of Textile and Apparel. During the past years, Institute has achieved tremendous growth especially in Higher National Diploma, Diploma and Certificate level courses, quality of courses, infrastructure and industrial relationship. As the State Minister, I have humble pleasure over the achievement of SLITA.

From its inception, SLITA has marched a long way with Ministry in achieving the national goals of the country. The newest addition to this list is the Research Symposium themed "Textile and Apparel Innovation for Economic Development". SLITA has capabilities of developing key research priority areas in line with value addition for the Textile and Apparel Industry, as the Apparel Industry along contributing a larger portion to the GDP of the country.

Research and Development (R&D) typically help business improve, upgrade and innovate new products and services. Proper R&D strategies help the companies to achieve higher customer satisfaction, boost sales revenue and increase their competitive edge against industry competitiveness. The whole scenario of the success of business revolves around Research & Development. It is my pleasure to congratulate the success of this event of the Research Symposium and to the staff of SLITA who have worked hard to raise SLITA to this height.

Message from Ms. Thilaka Jayasundara
Secretary, Ministry of Industries

I consider myself very privileged to issue a congratulatory message on the occasion of the inauguration of the 1st Research Symposium of Sri Lanka Institute of Textile and Apparel embracing the theme "Textile and Apparel Innovation for Economic Development". I convey my congratulation to the Sri Lanka Institute of Textile and Apparel for organizing the event. I am highly impressed achievement of SLITA over the years as a Government Institute for recognize as a primarily an educational institute, producing highly competent human resources for the Textile and Apparel Industry.

I hope SLITA would be able to expand its research activities not only nationally but also beyond our shore to have collaborations with internationally reputed research organizations of the region. As I understand that one of the prerequisites for obtaining degree awarding status is to have well-equipped research team, and I think this symposium would enable SLITA to send a message to the relevant authorities on the research capabilities of SLITA.

The rapidly changing world created much confusions, chaos and also an element of excitement. Advancing technology and growing needs for workforce intelligence have created a wave of transformation and accordingly, researchers have unparalleled responsibility to find innovative methods for such transformation in a world of Volatile, Uncertain, Complex and Ambiguous (VUCA world).
I am confident that the Sri Lanka Institute of Textile and Apparel will move forward in the years to come and be the leader in teaching and research in the Textile and Apparel sector in our region.

Message from Mrs. Nandanie Samarawickrama, Chairperson, SLITA
Additional Secretary, Ministry of Industries

It is an honor and pleasure to express my best wishes for the inauguration of the 1st Research Symposium as the Chairperson of the Sri Lanka Institute of Textile and Apparel.

This year, 2023 is very remarkable in terms of upgrading SLITA courses to a degree level and aligning courses to industry 4.0 standards. The Institute produces 3000 students in a year who serve not only in Sri Lanka but also in other countries as well. Most of the students flourish in the Textile and Apparel Industry from the knowledge they have gained in the SLITA.

This is a very important research symposium for Sri Lanka as its deals with both technical and management aspects of the textile and apparel industry. I can assure you that this initial small step pave the way for a long journey for researchers of SLITA and other institutes for the development of the Textile and Apparel Industry. This is a dire need of the industry and the country as the industry is facing huge challenges under the present economic conditions.

I would like to express my sincere gratitude to the staff of SLITA for their enormous commitment and enthusiasm in organizing the 1st Research Symposium focusing on the Textile and Apparel Industry.

Message from Archt. Sarath Fernando
Director General,
Sri Lanka Institute of Textile and Apparel

Sri Lanka Institute of Textile and Apparel is categorized as Educational Institute by the Department of Public Enterprises of the General Treasury. SLITA provides services in the areas of training, testing and technical services to the textile, apparel and allied industries. Over the last 40 years, Diploma and Higher National Diploma etc. have been conducted and SLITA is on the progressive path to obtaining degree awarding status. This research symposium will fuel to obtain the degree awarding status and to be recognized as a degree awarding institute very shortly.

SLITA looks forward to the next twenty-five years and beyond in the belief that Textile and Apparel education and research will continue to be of greater importance for the Sri Lankan economy. As Sri Lanka has undergone several obstacles in the recent past, the still Apparel industry contributes around US$ 5 bn to the GDP of the country.

Today's researches are more influential than any other day, because Sri Lanka is trying to achieve the highest level of economic growth in the very near future. Sustainable economic growth is invariably needed and it depends on innovative thinking and the creation of new knowledge.

I take this opportunity to congratulate SLITA and its academic, technical and non-academic staff for the tremendous effort in organizing the 1st Research Symposium of SLITA.

Message from Prof. M.M. Pathmalal
Conference Chair

Sri Lanka Institute of Textile and Apparel, semi Government Institute, has organized the 1st Research Symposium as part of the promotion of research activities seeking to obtain degree awarding status.

1st Research Symposium themed on "Textile and Apparel Innovation for Economic Development" by focusing mainly the development of the textile and apparel industry. This theme is timely and relevant as this industry is the main contributor to the Gross Domestic Product of Sri Lanka and also one of the largest foreign exchange-earners.

In Sri Lanka, universities have a strong commitment towards high-quality research of local and international relevance and importance. SLITA also will be able to take the same path and rank among the best institutes in Sri Lanka and in the world.

As the main objective of the Research Symposium is to disseminate knowledge through research conducted by the staff of SLITA and a few external organizations. The symposium promotes healthy interaction among members of SLITA academics and industry.

I congratulate the success of this research symposium of SLITA.

Message from Prof. Hemantha Dodampahala
Key - Note Speaker
Chairman, National Research Council

I take this opportunity to send my warm wishes to the 1st Research Symposium of Sri Lanka Institute of Textile and Apparel (SLITA), as Chairman of the National Research Council.

National Research Council (NRC), is a pioneering body to promote, fund and monitor fundamental and applied research and its related activities. NRC is committed to facilitating and fostering the research activities of Sri Lanka. One of the objectives of the National Research Council is to promote and facilitate the areas of Science and Technology, in higher educational institutions, public sector research institutes and other government institutes. NRC is therefore looking forward to extending our services to SLITA.

Innovation through research is the key to the success of institutions and countries at large. Sri Lanka Institute of Textile and Apparel will have a better future to achieve its goals and objectives, through enhancing the research functions.

Finally, I express my gratitude for organizing this 1st Research Symposium of Sri Lanka Institute of Textile and Apparel and wish to the success of the endeavors of the Research Symposium.

Message from Eng. S. Ilangovan
Director Training & Technical,
Sri Lanka Institute of Textile and Apparel

The Textile and Apparel Industry has made several strategies to maintain & expand its market share in international trade and continue to prepare to overcome the challenges, especially with the economic recession. In the present scenario, the workforce shortage, cultural issues, overhead cost, migration of competent employees, overall political stability and lack of raw material sources are much critical for surviving in the global dynamic market.

New design creation, innovation for product and process improvement, application of automation in production and research are recognized as key to sustainable development of the industry as well as the country. The research is one of the major indicators for categorizing countries as developed nations. The institute, SLITA with its continued contributions as a supplier of the competent workforce to industry for the last four decades, adding research as its core service is a remarkable milestone in the journey.

The first research symposium "Textile & Apparel Innovation for Economic Development" scheduled on 23 June 2023 will assists and encourage industrialist , professionals and innovators etc, to do research in Textile and Apparel .

I am honored by sending the message for the symposium and my heartfelt congratulations to the staff of SLITA , the industry and other stockholders.

Message from Mr. M.P. Kannangara
Director Operations,
Sri Lanka Institute of Textile and Apparel

I am delighted to write this message for the 1st Research Symposium of Sri Lanka Institute of Textile and Apparel and wish to congratulate the proceeding of the Research Symposium.

Sri Lanka Institute of Textile and Apparel (SLITA) is one of the pioneering institutes of textile and apparel education in Sri Lanka. Apart from its service of providing education, testing and technical services plays a prominent role in terms of income generation for SLITA.

SLITA has earned a wider reputation over the years by producing capable human resources to serve the textile and apparel industry both locally and globally. However, it was a long-felt need to obtain the degree awarding status for SLITA. Now SLITA is on the correct path to do so and hopefully, very shortly degree awarding status is to be received.

Inculcating research culture is one of the objectives of this research symposium and also this research symposium endorses the research potential of the academic staff of SLITA. Therefore, I would like to send my congratulatory message for the success of the 1st Research Symposium of SLITA.

Message from Mr. B.L.S.P. Nishantha
Conference Co-Chair
Dean (Act.), Faculty of Textile and Apparel Studies
Sri Lanka Institute of Textile and Apparel

Sri Lanka Institute of Textiles and Apparel has continued to promote conducive environment to increase the level of research methodology, data analysis and capacity development. After a period of research output slow down by the covid-19 pandemic. Institute has organized its first research symposium with the assistance from University of Sri Jayewardanepura. The introduction of a scientific research methodology is vital to uplift the textile and apparel industry in Sri Lanka. The Faculty of Textile and Apparel studies keen on the application of research findings in a practical manner such as the mahogany dyeing process in Hayleys Fabrics plc. The Sri Lanka Institute of Textile and Apparel is a dynamic community. Each year, our faculty, staff and students inspire us with more and more projects and I look forward to the coming year as an inspirational year full of research activities.

We hope to create a research culture at SLITA, where faculty and students are trained to deliver cutting-edge knowledge into practice.

I would like to acknowledge the staff members who publish the comprehensive research papers.

Finally, I would like to salute the organizing committee and others who have worked hard to contribute to the success of this symposium.

Message from Mr. Nirosh Rajapaksa
In - Charge Research Centre
Sri Lanka Institute of Textile and Apparel

It is a great pleasure to convey my heartfelt congratulations on the inauguration of the 1st Research Symposium of the Sri Lanka Institute of Textile and Apparel.

I, being the In charge of the Research Centre, have been working to establish the research culture and activities of the center during the last 5 months. I observed the potential of the staff in conducting research and arrangement of the research symposium. It was a new academic experience for me, the staff, and SLITA. According to my view, shortly SLITA will be considered as a degree-awarding institute. Research activities to be enhanced to cope-up wit SLITA will be considered as a degree-awarding institute. Research activities to be enhanced to cope-up with this situation.h this situation.

Finally, I thank the management and staff for the fullest contribution given to the success of this event.

STUDY ON THE INFLUENCE OF CLOTH COVER FACTOR ON THE COLOR MEASUREMENTS OF DYED 100% COTTON WOVEN PLAIN FABRICS

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ABSTRACT

Theis research aimed was to study the influence of cloth cover factor on the color measurements of dyed 100% cotton woven plain fabrics. For the experiment, there are nine 100% cotton fabrics were produced using different weft densities (picks/inch) and different weft yarn counts. Due to the practical problems, warp density (ends/inch) and warp yarn count were used as fixed parameters. Then, the cloth cover factor was calculated using the standard formula using the above variables. For dyeing the 100% cotton fabrics reactive (R) and vat (V) dyes were used with standard recipes and fabrics were dyed in red, blue and yellow colours, since they are primary colours. Fabric samples were tested by using a spectrophotometer and L, a, b color values were measured. Variations of Lightness, chroma and hue due to the changing of cloth cover factor were given by measures L, a and b data from the spectrophotometer. The total colour difference has been calculated using the formula: $\Delta E = [\Delta L2+\Delta a2+\Delta b2]1/2$. According to the above results of the experiment, it was observed that the cloth cover factor has a direct influence on color values and when the cloth cover factor decreases the color tends to be darker redder and yellower.

Keywords: Woven plain fabric, warp and weft density, Warp and weft cout, reactive and vat dyeing, Col

GETTING IMPORTANT SOCIOECONOMIC BENEFITS FROM SUPPLYING FACTORY-MADE UNIFORMS AS COMPARED TO SIMPLY SUPPLYING UNIFORMS FABRIC

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ABSTRACT

About 4.5 million schoolchildren in Sri Lanka receive free school uniforms from the government at the beginning of each school year. A set of uniforms is provided free of charge to all students on the island from first to thirteenth grade divided into three groups; Junior (grades 1-5), Intermediate (grades 6-9), and Senior (grades 10-13). These uniforms are in different sizes for both sexes, therefore this project is being implemented annually by the government. The data related to the current program for this study was obtained primarily through the Ministry of Education, Department of Census and Statistics – Sri Lanka, as well as mass media. The information related to the proposed methodology was developed based on the primary data obtained through garment factories. Also, to further confirm the data of the proposed method, some uniforms were taken, and the necessary specification sheets, pattern boards, and mini markers were created manually and calculated. The statistics of students were obtained from the year 2017, and this research was finally conducted in the year 2020.

It was found that many socio-economic problems and political challenges have been created nationwide due to the present practice. These problems include the waste of resources, the difficulties for some parents in making ready-made uniforms from fabric, and political commitments that worsen the situation (such as giving out two free uniforms instead of one). Based on the present study's results, it is clear that the current approach for ensuring that all fabrics are distributed fairly is labor-intensive, time-consuming, and expensive. But if uniforms were mass-produced in factories, they would be more efficient and cost-effective, resulting in greater societal benefits. Among the social and economic benefits that can be experienced through the approach that refers to are reducing fabric waste, generating new job opportunities, saving foreign exchange in the country, and strengthening the local currency versus foreign currencies.

Instead of providing uniform fabric, the amount of fabric that can be saved by producing in factories and providing only one set of uniforms to all the students on the island exceeds 35 lakhs (3,500,000) meters. It is 1,177,000 meters of fabric for shirts, 1,580,000 meters for gowns, 360,000 meters for shorts and 395,000 for trousers for all three categories in mass production of uniforms, the actual benefits are two to three times more than the benefits of one set of uniforms because the output is not limited to one set of uniforms, and the entire market demand can be targeted for production. In conclusion, the results indicate that the government might save money by providing students with sewn school uniforms rather than the uniform cloth currently offered. Apart from the obvious benefits of giving students pre-made uniforms rather than having them sew their own, the recommended approach can generate economic growth, improve the nation's financial standing, and benefit the public.

Keywords:School uniforms, Free uniform fabric, Mass produced uniforms, Ready-Made uniforms, School uniform cost

PRODUCTIVITY ENHANCEMENT THROUGH WORKPLACE DESIGN TECHNIQUES IN SRI LANKAN APPAREL INDUSTRY

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ABSTRACT

Workplace design aims at grouping the resources or labor in an efficient and best pattern to obtain an optimum or proper balance of the resources and flows of the production or assembly processes. Poor layout design has been determined as the major problem in the apparel industry in Sri Lanka. The Study deals with increasing efficiency and labor productivity in line by eliminating bottlenecks and reducing the non-value activities at each workplace by the work sharing method. This Research includes the calculation of earned minutes, and available minutes, and identifying bottleneck and non-value-added activities. The aim of this study is to focus on increasing efficiency and labors productivity by rearranging/redesigning the workplace among the operators and workstations through work-sharing techniques.

Keywords: *Productivity, Workplace design, efficiency, Labor productivity, Hourly target*

HAND DRAWING EXERCISES FOR BEGINNERS IN THE PATTERN INDUSTRY: HOW TO DEVELOP GARMENT PATTERN DRAWING SKILLS?

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ABSTRACT

A garment pattern is a template that is used to create clothing items. It consists of pieces of paper or fabric that are cut and sewn together to form the shape and style of the garment. The importance of garment pattern-making is often overlooked by novice fashion designers who focus more on the creative aspects of design. However, without a well-made pattern, even the most beautiful fabric and style can result in a poorly fitting and unflattering garment. Therefore, it is a must to draw an accurate pattern to create a quality garment product. Knowledge of pattern making is a valuable skill that all garment sector workers should possess. Therefore, many vocational training centres have included pattern making as part of vocational training courses in various garment fields.

However, students who are joining training courses have different levels of drawing skills. Some of them are born with talent and some of them need a lot of improvement to draw a pattern accurately. Most of the time, the instructors correct the pattern drawn by beginners. Therefore, it is required to find a methodology to improve pattern drawing skills by the hand of the students.

In this research conducted with the participation of various training course students at the beginner level in the garment sector, it was found that various hand drawing exercises can significantly improve the student's ability to draw patterns. It was observed that practicing a few hand drawing exercises within short period students were able to improve shapes and pattern drawing skills This study is primarily based on qualitative data as it deals with human hand drawing skills.

It needs to be further investigated how much we can improve the pattern drawing skills of a beginner with more hand drawing exercises and practicing those exercises for a much longer period.

Keywords: Apparel Industry, Pattern construction, drawing skills, garment, practicing

EXTRACTION OF NATURAL DYES FROM BASELLA ALBA (SRI LANKAN GREEN SPINACH) FOR SILK FABRIC: MORDANT-FREE DYEING TECHNIQUES TOWARDS RESOURCE EFFICIENCY

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ABSTRACT

The increasing demand for natural dyes presents opportunities for farmers and artisans to produce and sell their natural products, generating employment and contributing to local economies. This study uses a natural colourant extracted from Basella alba fruit, Sri Lankan green spinach, to dye silk fabrics without mordants. Colorimetric and fastness qualities of silk fabric were studied using B. alba as the major colorant and the effects of different pH values (pH 4±1 and 7), and extraction temperatures (300c to 600c). The dyed samples were tested according to the standard washing method of ISO 105-C06 to analyze the colorfastness of the dyed samples The study found that B. alba extract can be effectively used as a natural colourant in silk fabric applications, providing better washing fastness properties at low-temperature (40°C) dyeing process. The extraction of natural dye from B. alba fruit can be utilized to dye silk fabric, producing novel and fashionable natural pastel shades such as yellow, pink, beige and purple tints. The findings of this study are encouraging for countries like Sri Lanka, as it suggests the possibility of sourcing natural dyes extracted from locally grown plants and creating a niche market for naturally dyed products. This study aims to promote sustainable and environmentally conscious practices in the textile industry and generate economic opportunities for local communities in Sri Lanka.

Keywords: *Silk fabric, Natural dye, Sri Lankan green spinach, Basella alba fruit*

EFFECTIVENESS OF THREE DIFFERENT DETERGENT POWDERS TO SUCCESSFULLY REMOVE A TEA STAIN OFF A POLYESTER COTTON BLEND SCHOOL UNIFORM FROCK

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ABSTRACT

Since children's uniforms are more subject to damage than those worn by adults, stain removal is a significant consideration that must be taken consideration when choosing a detergent powder for school uniforms. Using a stain remover will allow kids to reuse their uniforms longer. The effectiveness of three commercially available brands of fabric detergent was compared in this study. White frock material and stain have used all samples with steeped tea, washing under average household washing temperatures and water quality using each of the three detergents. The liquor ratio of 1:50 was used for the treatment. The detergent concentration was 4g/l. Delta E (ΔE) values of the fabric were measured and compared to a controlled sample to determine each detergent's treated samples' color differences and efficacy. Results showed that detergent powder A demonstrated the best performance in achieving the desired outcome. "A" had the lowest delta E value, which suggests that it produced the least color difference or change when compared to a standard sample or when compared to the other two detergent powders treated samples. Lower Delta E values indicate greater accuracy, while high Delta E values indicate a significant mismatch. This implies that fabric treated with detergent powder A was more effective in maintaining the standard color or appearance of the fabric. The results of the study can help Sri Lankan parents and school administrators to select the best detergent for maintaining the quality and longevity of school uniforms.

Keywords: *Delta E (ΔE) (Colour difference), Stain removal, School Uniform, Detergent, School Uniforms*

AN EFFECTIVE METHOD OF EVALUATING COLOUR DIFFERENCES IN SRI LANKAN SCHOOL UNIFORM WHITE SHIRTING MATERIAL.

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ABSTRACT

Colour of a textile material is an important parameter, and the correct white colour of a school uniform reflects the cleanliness and purity of the student. It is essential to introduce an effective method of instrumental colour evaluation as visual assessment is subjective and challenging. Hence, the study aims at assessing the most suitable instrumental colour value analysis for white uniform materials. The study was carried out as mixed method analysis and fabric samples were subjected to colour evaluation under a spectrophotometer. Colour is evaluated using theoretical and weighted CIE94 and CIELAB colour evaluation formulas against the reference sample colour values (L=86.262, a=5.813, b= -16.447, c=17.444, and h=289.467). It is identified that the theoretical formula resulted in equal colour variation values for both CIE94 and CIELAB, however, the weighted formula has large variations from 0% to 80%. Colour variations value is dependent on individual coordinates, and it is linked to human perception. Hence, the study concludes that the theoretical colour evaluation formula for and is preferred for colour evaluation of white uniform materials and further individual variation of coordinates needs to be assessed for the most accurate results.

Keywords: *Colour value, Colour Evaluation, Delta E, Colorimetry, white uniform*

THE RELATIONSHIP BETWEEN PERFORMANCE AND SKILLS: A STUDY OF PRODUCTION SUPERVISORS OF XYZ GROUP IN THE APPAREL INDUSTRY IN SRI LANKA

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ABSTRACT

The apparel industry in Sri Lanka is a significant source of export revenue. Maintaining the Apparel Industry afloat will largely depend on how productive its workforce develops. It has been found that communication, problem-solving, analysis, decision-making, and technology skills are necessary for achievement. However, the expected performance standard has yet to be fulfilled in the marketplace. The main objective of this research is to identify and suggest to upper management the knowledge and abilities that will improve the effectiveness of XYZ Group's production supervisors in the apparel industry. The objectives included identifying performance indicators while assessing the connection between skills and Performance. The mixed-methods approach was used in this study. Qualitative and quantitative methods were used to analyse the necessary abilities of production supervisors of XYZ Group in the Apparel Industry. Out of 120 production supervisors at knit factories of XYZ Group, 45 were randomly recruited to the study. Performance is the dependent variable, whereas the other five (05) are the skills used in communicating, solving problems, analysing data, making decisions, and handling technical tasks. Correlation and regression analyses were employed to verify the hypothesis and identify the most important skill in determining Performance. Results showed a favourable relationship between Performance and various talents such as Communication, Problem Solving, Analytical, Decision Making, and Technical, with Decision Making being the most significant and Analytical being the least.

Keywords: *Performance, Skills, Apparel, Supervisors, Influential*

WHEN TO POST AND WHAT TO WRITE?: CONTENT MANAGEMENT IN INSTAGRAM TO IMPROVE CUSTOMER ENGAGEMENT (WITH SPECIAL REFERENCE TO SRI LANKAN FASHION AND APPAREL BRANDS)

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ABSTRACT

Today, brands are more interested in maintaining their social media (SM) profiles, and upholding decent virtual customer interactions, to succeed in the competitive business arena. The objective of this research is to study how a Post's Length and the Day of publication will shape customer Engagement with brands' social media profiles. The study focuses on the Instagram platform, where it has investigated 14 official Fashion and Appeal brands' Instagram pages in Sri Lanka, which are with more than 50k followers. The results were generated by using the multinomial logistic regression method. The findings depict that, among the variables chosen, Post's Length has a greater influence than the Day of publication. The findings of this research will mainly facilitate the owners and the SM managers of Fashion and Clothing brands when taking strategic decisions upon consumer engagement. This study was limited to the Sri Lankan context, where only 384 posts from top Fashion brands were explored.

Keywords: *Consumer Engagement, Instagram, Day of Publication, Post Length, Fashion & Apparel Brands*

NEW ALGORITHM FOR SEWING PRODUCTION LINE BALANCING

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ABSTRACT

Sewing production line balancing is a critical management practice of establishing workstations, consisting of machines and operators in chronological order on the production floor to optimize the output. Improper balance of production lines results in organizational issues such as shipment delays, order air freight, order rejection, unnecessary overtime, and higher manufacturing costs and labour-related informal institutional issues like losing social life, work-family conflict and organizational issues such as physical health problems, public humiliation, occupational stress and related mental health issues. These labour issues enrich the women's labour turnover rate which is considerably high in the Sri Lankan apparel industry. The labour turnover influences the low labour productivity of the Sri Lankan apparel industry which was found as 57% by an empirical study. In this research, factories that were suffering from production-related problems were selected by collecting and analyzing organizational key performance indicators (KPI). The relationship between various variable constraints and production output was analyzed hourly, daily, and long-term basis. The algorithm was developed based on the intensity of the impacts of variables on production efficiency. Direct observations, tacit knowledge, and mathematical testimonials were used in case of developing a feasible solution. This algorithm consists of two stages. The first is Load and Capacity balancing and the second is Line Balancing. This line balancing technique was practiced in more than 10 medium-scale factories and achieved more than 10% enduring increment of efficiencies. There are many line balancing techniques in the literature such as the Hoffman method, ranked weighted positional method, simulation method, probabilistic techniques, upper and lower control method, and Yamazumi method. Yamazumi method is the most frequently seen method that is practiced in Sri Lankan apparel industry. The proposed method is more sensitive to constraints such as labour absenteeism, learning factor, order of assembly, and skills of machine operators which are not concerned with the Yamazumi method. There are six steps in the proposed sewing production line balancing algorithm as Balance Time (BLT), Linear Process Chart (LPC), Theoretical Manning Level Table (TML), Manpower Assignment Table (MAT), Line Layout (LLT), and Machine Layout (MLT). This research aims to introduce a more practical and feasible algorithm for line balancing based on a strength-balance structural ideology instead of the existing objective-time-based balancing configuration. It is recommended for any style and production line under any intensity of variable constraints. An individual performance-based incentive scheme is highly recommended to be incorporated with this line balancing technique, especially for the continual and sustainable improvement in production efficiency.

Keywords: Line Balancing, Assembly line, Apparel production, labour turnover, sewing production

MYCOREMEDIATION OF SYNTHETIC TEXTILE DYES BY ASPERGILLUS NIGER AND ITS DYE DECOLORIZATION PATHWAY:A SUSTAINABLE WASTEWATER TREATMENT

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ABSTRACT

The textile industry, one of the largest sources of foreign exchange earnings in Sri Lanka, struggles with the treatment of heavy loads of textile wastewater which is highly persistent in natural degradation processes. Therefore, the present study aimed to evaluate the mycoremediation potential of Aspergillus niger on synthetic textile dyes and elucidate its dye decolorization pathway. Different fungal strains isolated from textile wastewater and sediment samples were subjected to solid medium and liquid medium dye decolorization experiments. Color removal was calculated by standard spectrophotometric methods. The dye decolorization pathway of A. niger was studied by biosorption assay and enzymatic assays (Laccase, Tyrosinas, Lignin peroxidase, Azoreducatase, and Manganese peroxidase), using CI Direct Blue 201 (DB) as the model dye. The responsible enzymes were partially purified by DEAE and Sephadex and verified through SDS-PAGE. All the experiments were done in triplicates and controls were maintained without the addition of fungi. Out of 77 different fungal strains, A. niger (MN990895) showed complete decolorization of DB dye within 36 h of incubation. Optimized conditions for the dye decolorization were recorded as 28- 40 0C of temperature, 6-7 pH, and shaking at 100 rpm. A. niger showed 8.4 ±1.2% of biosorption at the point where live biomass showed complete dye removal. The enzymatic studies showed higher involvement of extracellular crude enzymes in DB dye decolorization (72.7 ±3.3%), mainly by the activity of lacccase which was further confirmed by the distinct protein bands around 75-100 kDa on SDS-PAGE. The FT-IR spectra and seed germination assays confirmed the degradation and detoxification of DB dye with the treatment of A. niger. Thus, the present study suggests the potential applicability of A. niger for the development of an enzyme-based low-cost and environmentally friendly textile wastewater treatment system in the future.

Keywords: *Textile dye, Decolorization, Mycoremediation, Aspergillus niger, Laccasse*

EXTRACTION OF NATURAL DYES FROM MAHOGANY BARK (SWIETENIA MACROPHYLLA) AND ITS APPLICATION ON COTTON FABRIC

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ABSTRACT

The drive for sustainable and cleaner production in the modern textile processing industry has sparked interest in the natural dyeing of textiles due to their biodegradable nature and compatibility with the environment. Synthetic dyes have long been used because of their availability, uniformity, reproducibility, and adaptability, but they have drawbacks such as toxicity, non-biodegradability, and environmental pollution. Due to environmental concerns, an economic interest in natural dyes has recently increased. The objective of the study was to evaluate a commercially viable natural dyeing process by optimizing the parameters of natural dye extraction conditions and dyeing of cotton fabric with natural dyes as an alternative to synthetic dyes to achieve uniform dyeing, better colour fastness, and other quality parameters. In this study, Swietenia macrophylla (Mahogany bark) was utilized as a natural source to extract dye and used to dye 100% cotton fabric. It is waste by-products produced by the local furniture industry. Mahogany dye was extracted at 80 ◦C for 90 minutes using both aqueous and alkaline medium (pH11-13). The results of the study showed that the alkaline medium yielded better results compared to the aqueous medium. Mordanting pre-bleached cotton fabric with Al2(SO4)3, CuSO4, and MgCl2 was done before dying to enhance the affinity between the fabric and the dye molecules. Al2(SO4)3 and CuSO4 treated samples yield better results with high color depth and even colouring. Na2SO4, a levelling agent, and a sequestering agent are used with the natural dye as dyeing auxiliaries to dye the fabric for one hour at 90◦C. The liquor ratio was set at 1:8 (on the weight of the fabric) and the pH was kept between 4-5 in the dye bath, for better dye exhaustion. Dyed samples were then soaped using a suitable soaping agent and dried. Finally, CIE lab color values and colourfastness values were collected and analysed for each sample. Except for colourfastness to light, all of the specimens show colourfastness levels greater than 3. While colourfastness to light is 2/3 with MgCl2 and CuSO4, it is only 2 with Al2(SO4)3 and has to be improved through future research. This successful approach can be utilized by the textile industry to address the water pollution caused by synthetic dyes, promotes safer working conditions for dyeing operators and ensures safer products for consumers. Furthermore, this initiative is in line with the United Nations Sustainable Development Goals 6, 8, 9, 12, 13, 14 and 15.

Keywords: *Natural dyes, Swietenia macrophylla, extraction, mordanting, colourfastness*

REMOVAL OF COMMERCIAL DYES USING BIOCHAR PREPARED FROM INDUSTRIAL EFFLUENT SLUDGE

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ABSTRACT

Most commercial dyes are hazardous but used in industries due to their unique properties. However, it has resulted in industrial effluents, which could negatively affect the environment and human health. Removing commercial dyes from these effluents is essential before they are released into the environment. This study focuses on removing commercial dyes from effluents using biochar (BC) prepared from industrial effluent sludge, which has a high adsorption capacity and unique chemical nature. In contrast, modified BC is prepared by chemical treatment. The dye removal percentage was evaluated after passing through the modified biochar-filled column bed (2 mL/min filtering rate) using a UV-vis spectrophotometer. At a concentration of 0.5 ppm, the dye was completely removed with an efficiency rate of 100%. However, as the concentration increased to 3.5 ppm, the removal percentage gradually decreased and ultimately reached 50%. Investigation into different volumes for the saturation point showed that the maximum efficacy in eliminating the dye by biochar remained consistent at 100% for 0.5 g of biochar, throughout the volume range we explored. The saturation point of 0.1 g BC was observed when 38 mL of 10 ppm dye was passed through the column. However, the percentage removal gradually decreased with the volume added because of the filling of vacant sites on the modified BC. The saturation point could not be obtained for 0.2 g BC and 0.5 g BC within a considerable volume fraction since the modified BC has a tremendous adsorption capacity to remove commercial dyes owing to their effectiveness after the chemical treatments.

Keywords: *commercial dyes, industrial effluent sludge, biochar, environmental remediation, dye removal*

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