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UET TEXTILE MAGAZINE

DEPARTMENT OF TEXTILE ENGINEERING

UET LAHORE, FAISALABAD CAMPUS

Textile Sustainability Working Group

Prof. Dr. Syed Mansoor Sarwar

Vice-Chancellor UET Lahore

“University of Engineering and Technology (UET), Lahore, celebrated 100 years of its academic excellence on 20 November 2021. During these years, the university has played a key role in the development of engineering sector in Pakistan. The textile sector is the backbone of Pakistan’s economy and Department of Textile Engineering, UET Lahore, Faisalabad Campus, has been putting its best efforts to support the textile academia and industry of the country for many years. “UET Textile Magazine” is another such effort by the department. Creative thinking and writing are essential for success in today’s challenging world and this magazine provides a great opportunity to the magazine team and the department to polish such skills. To make this magazine a constant source of guidance and inspiration for academics, students, practitioners, and public at large, the work done by the team of the UET Textile Magazine is indeed worthy of appreciation. Their efforts should certainly serve as a source of motivation for other departments at the UET to initiate similar activities.”

Kudos to the magazine team!

Prof. Dr. Nadeem Ahmad Mufti

Dean Faculty of Mechanical Engineering

Department of Textile Engineering is an important department in the Faculty of Mechanical Engineering of UET. Department has taken a number of initiatives to support the crucial and pivotal sector of the textile in Pakistan's economy. I am gratified to know that the Department of Textile Engineering is bringing out the second issue of their magazine "UET Textile Magazine". It is a productive technical material and subsidiary skill developing tool for the students and professionals. I also applaud the coordination and efforts by the UET textile team on publishing this issue. I wish them all the success.

Prof. Dr. Muhammad Mohsin

Chairmen Textile Engineering Department

“It is with profound pleasure, humility, and anticipation that the Department of Textile Engineering has published its second annual “UET Textile Magazine” in so many years and I am sure it will serve as another great initiative from the Textile Engineering Department for the textile community and industry. I anticipate that “UET Textile Magazine” will be of interest to readers and professionals working in all areas of textile. I would like to acknowledge the services and dedication of the “Magazine Design Team” and all the article contributors. I would also like to thank Eng. Khurram Shehzad, Chief Editor (Faculty), Mr. Ali Raza Sial, Chief Editor (Student) and most importantly Dr. Shaheen Sardar for their technical support in publishing this magazine issue.”

Magazine Design Team

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Magazine Designer

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Documentation

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Brief introduction of UET

Textile Engineering Department

The department started functioning in 2013 with highly qualified and experienced faculty, staff and well-equipped dedicated laboratories. The department has more than 150 laboratory scale equipment installed at the department of textile engineering in its 15 laboratories. Every year more equipment and labs are being added to the textile department. In the year 2022 30 equipment and three new labs are added at the department. The graduates of the textile department are currently working in some of the top textile mills of the country including Nishat, Sapphire, Interloop, Crescent, Ibrahim Fibers, Azgard 9, Sadaqat, Master, Masood Textile Mill, CBL, Cotton Web, Kamal, TTI, US denim and government organizations.

Since the last five years (2018, 2019, 2020, 2021 and 2022), the department of textile engineering has successfully organized the three mega events of textile sustainability annually (1st, 2nd, 3rd, 4th and 5th International Conference on Sustainable Textile, SDC-UK textile design competition for students (Pakistan chapter) and All Pakistan textile brands exhibition for the first time in Pakistan. The last event of 2022 was attended by more than 2000 textile industries and university participants.

The textile sector in Pakistan has an overwhelming impact on the economy, contributing 60% to the country's exports and 46% of the total industrial production. This sector also provides employment opportunities to 45% of country's workforce, which is one of the highest. In today's highly competitive global Environment, the textile sector needs to upgrade its supply chain, improve productivity, sustainability and maximize the value addition to be able to survive. It cannot be thought of without competent professionals in the relevant field. UET's Faisalabad campus is privileged over other campuses of UET for holding a degree awarding department in Textile Engineering field. The following three-degree programs are being offered at department of textile engineering,

i) - BSc Textile Engineering

ii) - MSc Textile and Materials Engineering

iii) - PhD Textile Engineering

B.Sc. Textile Engineering course is based on Outcome Based Education (OBE) and accredited by PEC under level-2 (Washington Accord based). This course of study is the composite one and covers all the five sections of textile. Below are the textile specializations which every student of the department of textile engineering studied during his/her degree duration; 1. Spinning (Yarn Manufacturing), 2. Weaving (Fabric Manufacturing), 3. Knitting (Fabric Manufacturing), 4. Wet Processing, 5. Garment Manufacturing.

MSc Textile and Materials Engineering

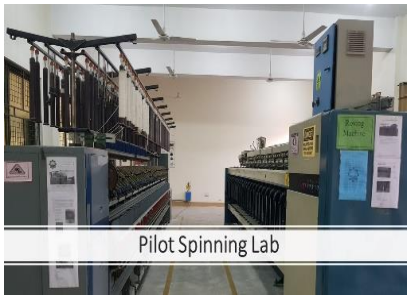
The department has started offering MSc Textile and Materials Engineering in 2020. It is one of the unique MS programs of the country which aims at bringing the students abreast with the most recent developments in Textile and Materials Engineering by enhancing their analytical skills and research capabilities. The program aims at preparing the graduates for careers in R&D, teaching, management of academia, government and industry. Paid Research Associate positions for MS students are also available.

PhD Textile Engineering

Department has started offering PhD Textile Engineering in 2021, making it among very few textile departments of Pakistan to offer the highest degree in textile engineering. The program aims at producing the PhD graduates with the attributes of innovation, scientific research and development coupled with advanced analytical skills in the field of textile engineering. The program will develop highly qualified professionals with the abilities to perform leading and advanced scientific research for the uplift of textile industry of Pakistan as well as to enhance the quality of textile related research at academic institutes. UET has adopted the HEC initiative which allows PhD enrollment after 16-years BSc degree. Candidates having MS degree will also be admitted into the PhD program after the adjustment of their credit hours. In addition, UET has started a great initiative of full tuition fee waiver for full time PhD students.

Some Glimpse of State of Art Labs of Textile Engineering Department

Mini Spinning Lab



Pilot Spinning Lab

Weaving Preparatory Lab

Advance Weaving Lab

Weaving & Knitting Lab

Dyeing & Finishing Lab

Textile Digital Printing Lab

Textile Wet Processing Research Lab

Garment Lab

Textile Pattern Lab

Textile Testing Lab

Textile Nano Material Lab

Textile Recycling Research Lab

SEM Lab

Textile Computer Lab

Annual International Conference on Sustainable Textiles

Organized by Department of Textile Engineering since 2018

1st international conference on sustainable textile 2018 was organized by department of textile engineering. In which many foreigners including Mr. Paul Cowell (Archroma global head of business development), industrial experts and researchers participated. SDC-UK Student textile design competition (Pak region) and Top Pakistani textile brands exhibition were also conducted along with international conference in which more than 200 students and different brands participated.

1st Conference 2018

2nd international conference on sustainable textile 2019 was organized by textile engineering department. Over 1000 visitors including textile companies' owners, CEOs, industrial managers, and students attended the conference. Mr. Mujtaba Rahim (CEO, Archroma), SDC-UK Technical Director, Mr. Ignasi Cubina (Director, EIG C2C Spain), Ms. Aglaia Gomez (Consultant, EIG C2C Spain) as well as other top experts of the textile field have shared their knowledge at the international conference.

2nd Conference 2019

3rd international conference on sustainable textile 2020 was organized by department of textile engineering. Ms. Sussen Margaret Bolt (President, SDC-UK), Mr. Karl Borgschulze (MD, CSI) and Ms. Shelley Andree (Education & Engagement head, SDC-UK) along with other experts shared their thoughts in the conference. SDC-UK Student design competition (Pak-region) and Top Pakistani textile brands exhibition were also conducted along with international conference in which more than 450 students and different brands participated.

3rd Conference 2020

4th international conference on sustainable textile 2021 was held online due to pandemic of corona virus on 19th May 2021. Different scholars, researchers, scientist, industry representative and students attended this online conference. More than 20 international speakers gave their presentations on recent trends and issues of textile industry. Topics of the technical talks cover production of sustainable raw material for textile industry, textile sustainability, wastewater treatment solutions, Textile chemical waste and ZDHC etc.

4th Conference 2021

Department of Textile Engineering, UET Lahore, Faisalabad Campus has organized three mega events of textile Sustainability.

5th International Conference on Sustainable Textile 2022": It was held on 01-12-2022. Different scholars from different countries attended this conference. More than 2,000 visitors from industry and academia participated in the conference. More than 15 international speakers delivered their talks on textile sustainability. Topics of technical talks by the scholars cover applications in smart textile, mission of zero environmental impact, BCI role & sustainability, modeling & simulation of woven fabrics.

"Textile Sustainability Students Competition 2022": More than 850 student projects were received and only 550 were shortlisted for display after initial scrutiny. Students from 45 institutes of Pakistan participated in the competition. Student projects were judged by the relevant professional and the first five projects were given cash prizes and a certificate of appreciation. All the competition participants were given certificates of participation.

Physical Inauguration of "Textile Sustainability Working Group" by Founding Members: Textile sustainability working group was formed on 19th May 2021 during the 4th International Conference on Sustainable Textile but it was announced online due to pandemic of COVID. So far there are 8 founding members and 270 industrial members who have joined the group, which clearly reflects the acceptability and trust of the industry on this group. Physical inauguration of "Textile Sustainability Working Group" was held on 1-12-2022 at the online and onsite training facility of the working group training room at the textile department. After the inauguration, the detailed discussion regarding operations and future activities was also carried out by the founding members.

Abstract of the Technical Lectures Delivered at 5th International Conference on Sustainable Textile 2022

Andrew filarowski

Technical director of the Society of dyes and colorists, UK

The SDC mission is to provide education and community engagement for those who are studying and working with color.

Our main work is about the color community and color education. The environment pays a heavy price from our Industry. More importantly, now than ever that processes and system are in place to reduce environmental impact. This requires a knowledgeable workforce with access to quality information.

Investment in education, knowledge and correct / factual information is needed. He also elaborated that SDC membership provides the members with free access to the range of SDC webinars, reduced prices at their events and VIP access to selected events, subscription to the colorists publication, subscription to the International dyers and finisher, discounted books and many more such opportunities. It provides a base for your career development through courses, training and mainly continuous professional development. Bursaries are also for selected student projects.

SDC courses are developed online and opportunities are available to develop the final year projects or masters /PhD globally. Fellowship of SDC, FSDC requires your peers to validate your claims of professionalism in the Environment and Textiles. SDC can bring together a diverse range of people in this field providing real practical knowledge and application details to an industry that needs to improve its environmental footprint.

Prof. Dae Ho Yoon

School of Advanced Materials Science & Engineering, Sungkyunkwan University, South Korea

Sustainable synthesis of halide perovskite materials and their dynamic applications in photo detection and wearable sensors

Sustainability is the process of living within the limits of available physical, natural, and social resources in ways that allows the living systems in which humans are embedded to thrive in perpetuity. Mainly sustainability is divided into three major aspects (economic, social, and environmental).

UV photodetector is short wavelength high energy photoelectron. Semi-conductor Nano structures are used in UV photodetector wide band-gap oxide semiconductors. One of the major drawbacks of this semiconductor is its massive oxygen vacancy, slow response time and presence of defect sites. By the time, people are moving towards the halide perovskite due to drawbacks of band-gap oxide semiconductors. Nowadays, researchers focus on how to make lead-free Perovskite for photo-detection.

Much other research was carried out, but they had major drawbacks and were not stable enough. Experimental approach of doping in optical properties was carried out and their results showed effects of PL emission excitation and absorption spectral stability, SEM and EDX, XPS Analysis and stability, SEM XRD Analysis.

Applications include Fabrication of UVPD, Detector response to light and varying intensities of light. From these results and applications, it was seen that our device is exceptionally good in UV Photo-detection. Future scope for textiles is that it can be used in Carbon fiber yarn, high performance for perovskite solar cell, flexible electrodes for super capacitors.

In future we are planning to make lead free perovskite (water assisted synthesis), a wearable sensor which can be used in energy harvesting, wearable display application.

Potential applications of our other materials in textile are luminescence dyes, pigments, coating, functionalization with sensing application, TENG (Turbo Electric Nano generator) for energy harvesting. By the time in our lab and by the coming years work is being done on renewable energy, batteries, storage appliances & Water, chemical pollution as global production is to double by 2023.

Karl Borgschulze

Managing Director, CSI (Consulting Service International)

Solutions networks

The world is ready to design, produce source and consume differently. New challenges for Brands and retailers, impacting global supply chain management: Legislators, financial markets, business partners and civil society demand more rigorous compliance and information on sustainability in global chains. Sustainability performance has a direct impact on company`s performance and is becoming, a trademark, a marketing tool, and a safe management.

Businesses, individuals, and other persons include but not limit to investors. German Foreign minister Annalena Baerbock is pushing for an EU import ban on products made with forced labor: A corresponding ban of European companies that wants to sell their products on European market, politician told "And that's why the European parliament`s proposal to ban the import of goods produced with forced labor is in my views, exactly right", Netherland-Authority for consumers & markets (ACM), 28-Jan-2021 Publish guidelines for sustainability claims. 3-May-2021 launches investigations into misleading, sustainability claims to 3 individuals' industrial sectors and has contracted over 170 businesses in these sectors.

70 companies in clothing sector have already contracted United Kingdom companies & markets authority. It is desirable that truthful and accurate, clear and unambiguous, not omit and hide important information, fair and meaningful comparison, full life cycle of the product is disclosed. Development of compliance requirements for the Fashion industry, EU green deal, Circularity capacity building -focusing on the denim supply chain clusters, Circularity capacity building-concepts, Circularity capacity building- fabric development and approach sustainability management certified course by howsear.

UllhasNimikar

President, SDC-UK

Sustainably clothing 8 billion – a challenge.

Quick, cheap and having an appealing look is trendy. Leading brands follow fast fashion. History shows that textile production moved just like a ladder including many Asian countries in its way. Today, 4 geological shifts brought the textile production to be moved in low labor areas, where things are cheap. Textile Clothing today has annual per capita production of 60 billion kilograms and minimum recycling is being done. In 1987 unburnt commission said that it is the development that meets the need of present without compromising the ability of future generation to meet their own needs. Its simple term that what we give we take. Unfortunately, our ecological footprint is 1.7 plants earths. It means we are consuming what we produce this year, but we are using what we should be consuming next year. Today, we have already consumed the considerable resources of earth. Elen marlcarthar foundation study talks about resources through production and right through the end of life, only less than 1% is recycled and its true

yields are utilized. Challenges include excessive use of water and resources, high energy efficiency and indiscrimination use and discharge of all chemicals.

Study tells that on average consumers throw 60% clothing every year. In 2050, 150 million clothing waste will clog landfills. There is need for ideal circulation of fashion. BBC news reports tell that fast fashion is harming the planet. The problems associated to it are high carbon emission, poor labor condition, consumption of land water excessively, land pollution, and formation of microfibers. Since the invention of petrochemicals man is enjoying the fruits of chemical innovations from sunrise to sunset. Due to synthetics, we have food additives, pesticides, paints and adhesives, packing, cosmetics etc. These all involve chemicals including dyes and pigments.

The population is growing day by day, so the need of chemical production also increases each year. The positive side of chemicals is value addition and better lifestyle but contaminated water and hazardous waste is dangerous. Fresh drinking water is left in few places. Concerns on human health and environment including carcinogenic, mutagenic and reprotoxic must be considered. Bio sources that are persistent, and nontoxic, must be utilized to save earth.

Dr. Arshad Mehmood

Head of Business Development & Product Stewardship, Archroma Pakistan

The Archroma Way to Sustainable World

The Archroma Way: Safe, Efficient & Enhanced. It is Our Nature to Protect. Goal is to protect people and our planet. Safe to use, safe to release and safe to wear. Efficient - It is our nature to rethink sustainable manufacturing. Innovating such application processes that minimize resources and maximize productivity both for us and our customers' manufacturing as well as by setting ourselves ambitious sustainability goals. Enhanced - It is our nature to add another level of value: Your innovation is critical. Functionalities and aesthetics give additional value helping consumers to achieve their goals for an enhanced life. Archroma is a global leader in sustainable color and specialty chemicals. The company has taken several initiatives to offer green solutions and its contribution towards sustainability. Archroma is a global specialty chemicals company that produces sustainable solutions for textile, paper, packaging, and coatings industries. The company is committed to contributing to the United Nations Sustainable Development Goals (SDGs) and has made significant strides in achieving several of them. Affordable and Clean Energy (SDG 7): Archroma has implemented energy-efficient practices in its operations, reducing its energy consumption and greenhouse gas emissions. The company has also developed technologies that help its customers reduce their energy consumption. Responsible Consumption and Production (SDG 12): Archroma produces sustainable dyes and chemicals that help its customers reduce their environmental impact. The company has also developed a range of eco-friendly products that are free from harmful substances. Climate Action (SDG 13): Archroma has set a target to reduce its greenhouse gas emissions by 30% by 2023, compared to its 2018 baseline. The company has also developed technologies that help its customers reduce their carbon footprint. Life Below Water (SDG 14): Archroma has developed a range of sustainable chemicals that are safe for aquatic life and has implemented practices to minimize its impact on water resources. Partnerships for the Goals (SDG 17): Archroma has partnered with various organizations to advance sustainability in the textile industry, including the Sustainable Apparel Coalition and the ZDHC Foundation. CEO Archroma, Pakistan, Mr. Mujtaba Rahim is fighting the good fight. He has spent much of his professional life believing that, for

change to happen, one needs to contest the status quo. “We need to challenge the status quo with the deep belief that we should make our industry sustainable”. Blue sign approved total 81% of our sales in volume.

Dr. Mohammad Faizul Yahya

Head of Strategic Planning, University Technology Mara, Malaysia

Modeling and Simulation Woven fabrics

Whenever we want to develop a new product or sustainable textiles, important factors are material properties, design engineering and how can we use the big data and AI in products. In Industry 4.0, simulation is that we can easily generate a big data and it also helps to become a key for developing a lot of structures. Finite element analysis is that big square shape problem can be break down into smaller problems and eventually these problems are being solved which resemble with square shape input. Discretization is one of the critical processes. This assign loads at nodes conditions and interaction of those nodes. For example, 2D problems, 3D, or non-liner shapes etc. FEA in textiles is that how to develop a woven fabric which defines the geometry, its cross-section and how yarns are interlaced.

Woven fabric impact model creates geometry and the impacts on their shapes. Woven composite model explains how weft and warp are interacted in matrix. Woven composite tensile model, two-way uniaxial model and 3D woven fabric tensile model defines different properties including yarn shape simulation stress and cross-sectional shape of yarn.

Prof. Dr. SeshadriRamkumar

Texas Tech University, USA

Sustainable technical textiles

Technical textiles are especially important these days. Technical textiles basically save the world and are saving the world as a supplement to vaccination. So, the question arises, why technical textiles is still saving the world because technical textiles are still made from synthetic materials. So, textile fibrous materials and chemical engineering people have a lot of work to do to see the possibility of making these technical textiles using sustainable products, sustainable methods and sustainable finishing methods. Now we are working on the next generation technical textiles by using sustainable materials. In order to develop next generation technical textiles, we need to sense, and we need to shape. What is the research and market space for technical textiles and how to keep it safe that is no more than decontamination. Protective textile needs to be soft. Technical textile can be just simply fiber, yarn, and fabric whose function is not just simply aesthetic rather it is focused on giving certain functionality characteristics.

A perfect technical textile example is Joint Service Lightweight Suit Technology (JSLIST). It is typical US army uniform for chemical and biological defense, but technical textile has some minute drawbacks and one of them is comfort property which somehow does not exist. Since summer 2020, especially for face mask, we are trying to bring sustainable fibers into filtration application. This is predominantly polypropylene based. Surgical face masks are important in COVID-19 because these viruses can change background. Vaccinations are life savers no doubt, but face mask are another protection. In 2020, face mask was predominantly manufactured in China. This mask combination which has some amount of sustainability product into it by infusing sustainable natural materials.

Non-woven are reducing number of processes, then of course cost

comes down. They are biodegradable, comfortable, and sustainable. Typical examples of non-woven are moistened hand wipes. Predominantly it is polyester based and the other one is typical surgical gown. In face masks, we are taking this and adding a cotton layer with addition of melt blown nano and sub-micron fibers. This is how N-95 was made. Materials for environmental protection that is soft, flexible and oil absorbent. Sustainable oil absorbent is predominantly made from synthetic fibers which are particularly melt blown and are ridiculously small they can lead to secondary contamination. They are not going to degrade. We are trying to get out of synthetic fibers and use natural fibers. We are replacing synthetic with natural fibers to make it sustainable and biodegradable. We are also trying to minimize harmful effects of dyes.

Dr. Mattia Bartoli

Center of Sustainable, Future Technologies – CSFT, Torino, Italy

Use of textile derived biochar to produce conductive composites

Carbon group worked on different kind of carbons such as carbon graphite, carbon black etc. Since 2002, they discovered more sustainable carbon fibers that provide electrical, mechanical, and optical properties. Conversion of waste cotton textile to carbon (biochar). Biochar is any kind of carbon produced from thermal cracking of biomass in oxygen limited environment. Biochar is cheap and renewable resources-based production. The main disadvantages are lack of established commodities in all countries and poor information on real biochar industry. All these combines with poor scientific appealing. Waste cotton fibers are produced every year in huge amount. Their conversion in a high value carbon material could match environmental and economic interests. Cotton fibers were pyrolyzed at high temperature. Biochar composed by twisting rods with a length around 30-100 micrometer and a diameter around 2-5 micrometer.

Pressure responsive cotton textile biochar containing composites, electrochemical applications: energy storage, polymer wire made with cotton textile biochar containing composites. Waste textile made of cotton is not a waste in fact it is an opportunity to produce new advanced materials.

Dr. Le Thai Duy

Research Professor, Ajou University, Korea

Sustainable Textile integrated supercapacitors with washability & stretchability

Smart textile is one of the trending types of research projects nowadays. Wearable electronics play a key role in emerging industrial evolution to make human life better. Its foundation lies on several distinct areas computing & data storage, industrial sensing, wireless communications, energy storing & harvesting. Smart textiles typically require several components challenging to design, develop and to produce. E - textiles are integrated with electrical components and energy storage. The choice of consideration of materials is very necessary such as deformability, washability, cost effectiveness and sustainability in developing stretchable and washable textile capacitors using low-cost composite. Fabrication method is in three steps. Firstly, CNT combine with elastomer then MoO3 nanoflakes elastomer then MoO3 nanoflakes and then crocking them with textile. This makes better charge transfer due to MoO3 flakes.

Cyclic voltammetry test show that MoO3/C+ P have 2 times better current density than C+ P textile.

To evaluate sustainability of electron composite, two mechanical measurements are performed: Stretching test show that there is small change in electrochemical performance of electrode which indicates textile super-capacitor can sustain, washing test performed in two stages before or after cell assembly. The detergent strongly affected the electrode morphology. Luckily detergent bring good effect, it increases surface area by increasing active sites on electrode. Current density and specific capacitance of electrode improved 10 to 20 times, However, post washing remove active materials that compensate 5 to 8 improvement limit time on textile super-capacitor from prewashing and post washing. Mechanical test confirmed sustainability of composite. However, super-capacitors are used for smart textile application such as supercapacitor combining with sensor for e- textile application.

Dr. Shahid Rasool

Senior Lecturer, PI-Taxonomy, North Umbria University, UK

Bringing the textile sector into a circular economy model

Innovative group worked on different kind of innovations such as circular economy model, global textile sector etc., and discovered more sustainable bi-lateral Projects that provide manufacturing, production, and contribution of GDP with less wastage of raw material. From Pakistan's textile perspective, it is clear that textile is 46% of total manufacturing, 40% of total environment, 4th largest production of cotton, 3rd in yarn production, 8.5% contribution of GDP, 3rd largest in cotton consumption, 3rd largest in hosiery manufacturing. The main disadvantage for the industry is the lack of policies in all country and poor information on real industry.

Drivers for transition who are self-evident are achieved by sustainability agenda, market force, reputation capital and technological zeitgeist. Cotton fibers are produced every year in huge amount. In this regards British council, SMEDA, TEVTA, Government of Pakistan and Interlope etc. worked to help in sustainability in textile sector. Taxonomy is the science of naming, describing, and classifying organisms and includes all plants, animals, and microorganisms of the world. It is the cycle of an ideology, collaboration, and a community.

Dr. Shafiq Ahmad

Director, Better Cotton Initiative (Pak & Central Asia)

BCI role and sustainability

Cotton is arguably the world's most important natural fibre: Nearly everyone on Earth encounters cotton daily, Cotton production support 250 million people's livelihoods (ICAC). But cotton production has challenges like: Water Management, soil depletion, working condition, Incorrect/ overuse of pesticides.

Sustainable cotton demand is increasing. May 2017, London, the Sustainable Cotton Communiqué was launched. Thirteen of the world's most renowned clothing and textile companies, in the presence of His Royal Highness the Prince of Wales, signed the 2025 Sustainable Cotton Challenge. On October 11, 2017, Washington, D.C. the 2nd announcement at Textile Exchange's annual Sustainability Conference, additional 23 of the world's most renowned clothing and textile companies committed using 100 percent sustainable cotton by 2025.

By December 2021, 162 companies (including subsidiaries) signed up to the 2025 Sustainable Cotton

Challenge and committed to sourcing 100% of their cotton from one or more of the recognized programs and initiatives by 2025. 25% (40) achieved their target by 2020.

To help cotton communities survive and thrive, while protecting and restoring the environment. Because we know the world does not just need cotton, it needs Better Cotton. We remained steadfast in our commitment and purpose to promote more sustainable cotton production. Building on our achievements, we are moving ahead with our ambitions to deepen our impact on the ground. Without farmers, there would be no Better Cotton. We have invested time and resources into better understanding what farmers need and want, whether Better Cotton is delivering on this, and how we can further improve our offering for farmers and their communities.

Agriculture having a role to play in reducing emissions, it also has the potential to store large quantities of atmospheric carbon in the soil**.** By 2030, we aim to reduce greenhouse gas emissions per tonne of Better Cotton produced by 50% (compared to 2017 baseline). We have harnessed our findings to develop a comprehensive four-year activity plan and detailed budget for introducing traceability into the Better Cotton network. Our top priority is to find ways to make this work in a way that delivers what consumers want in terms of traceability and what farmers need to achieve a thriving market.

Our 2030 Strategy is related to climate change mitigation**,** pesticide use**,** women's empowerment and soil health. In 2022, we are focusing our efforts on the delivery of our 2030 Strategy and on finalising our remaining 2030 targets. Recently, we have run a public consultation on the revision of our Better Cotton principle and criteria.

Mr. Najem Abedi

Country Head, Jeanologia

Mission of zero environmental impact

Jeans is the best-selling garment in the world. 5 billion units of annual production of jeans, is entailed in creating 15% of clothing waste that ends up in landfill. 20 % of polluted water is being produced by textile industry each year. Mission Zero takes note of recycling post-consumer waste by remitting it to urban factory that fabricate it with sustainable material. Jeanlogia, knock together indigo dyeing, and fabric finishing with Anubis G2 dynamic technology and garment finishing implies G2 laser e-flow process with zero EIM, saving the cost. Traditional process has 73, 57 L/Kg textile water footprint whereas mission Zero actuates zero water waste by ozone technology, zero substances of concern and CO_2 footprint reduction. G2 ozone e-flow, smart boxes, laser hi-tech and H2 Zero grounds for banishing pumice stones and chemical discharge. Quantification of water, energy, chemical and human health factors, benchmarking of results and classifying the impacts of process, all is done by EIM. A world that is going to be their world for next decades must be cleaner, more transparent, with more shots and indeed, more zestful. Consequently, Mission Zero, guaranteeing control and reparations in a testable way of any fated impact and fostering more jobs, that gives the elbow room of becoming a proficient white-collar to wonted worker, is necessary.

Mr. Nadeem Afraz

UMT Lahore & University of Sargodha

Sustainable reactive foam dyeing of cotton fabric

Textile industry is facing a lot of issues these days like sustainability, water and energy efficiency issues, liquor ratio reduction and process time reduction, reduce consumption of water, reduce dye fabric cost. Foam formulation is a dispersion of air in a liquid.

It saves significant number of expensive dyes. It requires less energy for drying. It is significantly less pollutant. Challenges in fabric foam dyeing include selection of foaming agent, preparation of foam, efficient application of small amount of foam and uniform distribution of foam before it collapses. Pre-scoured half bleached plain 1/1 Cotton fabric of 230 g/m² was used in this research, Bi-functional dye Reactive yellow was used in this study that was provided by CHT. Lab-scale foaming agents, foam stabilizers and other axillaries were acquired from commercial source.

The foam dyed 2.5% shade exhibited good shade with foaming agents' sodium Lauretha Sulphate (SLES) and it was comparable with 1% pad-dry-cure method. For generation of foam one liter solution is converted to seven liters so lot of dilution and subsequently increasing the dye amount to 2.5% would still be cos effective as compared to pad dry cure method. Typically, 38% water and energy is associated with foam dyeing as compared to pad dry cure. Foam agent Unifroth-520 with addition of Sodium-triply Phosphate but K/S value slightly lower with sodium phosphate stabilizer. The foam dyed samples 1% shade exhibited slightly higher tearing strength values than the reactive dyed Pad-dry-cure fabric for all foam agents for all foam agents with and without stabilizers. The 2.5% shade concentrations of foam dyed has exhibited moderate higher tearing strength values than the reactive dyed pad-dry-cure fabric but slightly higher than 1% shade of foam dyed sample. The foam dyed fabric 1% shade has exhibited a random pattern of air permeability as compared to pad-dry cure cotton fabric.

Foam dyed 2.5% concentrations has exhibited slightly lower wet rubbing fastness rating of 4 as compared to 4-5 for dry. Wet rubbing fastness remained stable for foaming agents In case of foam dyeing 1% and 2.5% shade concentration, it exhibited good color fastness to washing. It was established that Reactive yellow dye has charged sulphate group in chemical structure that help in foamability of foam dye formulation. It was concluded that reactive foam dyed cotton fabric 2.5% color shade exhibited equivalent performance properties in comparison with 1% shade of cotton fabric dyed through pad-dry-cure method. It was concluded, the reactive foam dyed cotton fabric results were achieved in comparison to pad-dry-cure by using foaming agents Sodium lauryl sulphate with addition of stabilizer Sodium phosphate.

Prof Dr. Muhammad Mohsin

Chairman, Textile Engineering, UET Lahore, FSD Campus

Progress On Textile Sustainability and Way Forward

Textile sustainability working group at department of textile Engineering, UET Lahore Faisalabad Campus was started on 19th May 2001. In only this short time, it has 8 founding and 270 general textile industry and academia members. Textile Sustainability Working group is quite active and so far, 3 group meetings, 4 industrial training, 4 R&D projects and development of online and onsite training facility have been carried out. It carried out research on various areas of textile sustainability like innovative and sustainable yarn development, chemical, machine and functional materials development. It has over 40 active research members.

Dr. Mohsin and department has licensed the technology to interloop related to "sustainable, water, chemical and cost efficient textile bleaching". This project was sponsored by HEC-TDF program and interloop. Technology is jointly developed by UET-Textile Department and Interloop. This patent protected technology involves the machine and process modification. This technology leads to significant saving of around 30% in chemical and 88% in water at Interloop since 2019. As per Interloop production data of division 2, there is water saving of 34.51 million Liters per year, chemical saving of 57141 Kg per year, CO_2 emission reduction of 0.226750 million Kg per year and minimum load on ETP. This technology can be used for both continuous and exhaust methods. Other textile industries interested in this patent protected technology can contact UET Textile department.

Department team lead by Dr. Mohsin and Dr. Aamir has developed the patent protected technology for Textile industry and post-consumer waste recycling into carbon black, bio-oil, smart textile, composite and conductive inks. Certain other Textile sustainability related projects at department include natural dyeing without toxic mordant, nano bubble dyeing and finishing, water and energy efficient foam Dyeing & Finishing, 100% bio mosquito repellent, Formaldehyde free, Bio resin, plant and bio-based textile wastewater treatment, sustainable fiber development from agro waste, halogen and formaldehyde free fire-retardant, metal free antimicrobial finish, fluorocarbon free bio based-oil and water repellent, sustainable digital printing. A number of textile sustainability trainings including productivity improvement, ZDHC training, screening based on MRSL, chemical management and GHS implementation in industry have been carried out at the department. UET textile sustainability research group has produced 5 PhDs, 17 MSc, 9 patents, over 100 impact factor papers, 44 international conference papers, 6 book chapters and 110 journal papers. There is also active collaboration with the textile industry of the country.

Prof. Dr. Elsayed Ahmed Elnashar

Professor of Textiles & Apparel, Kaferelsheikh University, Egypt

Sustainability of the research for application in smart textiles to counter climate change

Modern theory of water purification entitled as “filtration theory of liquid chromatography mass spectrometer” determines the minute quantities of compounds. Mass spectrophotometry is a convenient, versatile method for the characterization and identification. Objectives of this experimental investigation related to novel filtration theory is to establish a new theory of liquid chromatography-mass spectrometry, granular media of jet filtration and to establish mathematical formulas describing the process pressure theory of jet filtration liquid chromatography-mass spectrometry and to express the treatment of jet-filtration technologies for textile. The application of smart textiles in water desalination is to counter climate changes and to develop a new hybrid desalination system using wicks/solar still evacuated solar water heater. This presents a new hybrid desalination approach comprising of evacuated solar water heater. The application of smart textiles is alternative soil cultivation to counter climate changes, in geotextiles, in civil engineering (GEOTECH), and mostly in nonwoven fabrics. The synthetic fibers like glass, polypropylene and acrylic fibers are used and its end use application can be geosynthetics, geotextiles, georgics, geo-membranes. The applications of smart textiles in rubber and car tire to counter climate changes, the extraction of rubber from the hand lion plant rubber is used in many things we need every day, including car tires. The low permeability: HDPE geo-membranes is secure because leachate does not penetrate them, for chemical resistance: HDPE can resist to a wide range of chemicals. It can be used for great protection: Anti-aging, anti-UV, anti oil and salt, for anti-corrosion and high temperature resistant.

Glimpse of the Events Organized by Department of Textile Engineering in 2022

CEO Interloop Visit & Inauguration of Recycling Lab at the Department

"Textile Recycling Research Lab" was inaugurated by Mr. Naveed Faazil (CEO, Interloop Limited) at Department of Textile Engineering, UET Lahore-Faisalabad Campus. It is the most comprehensive textile recycling lab of the country. Interloop is already collaborating in a textile recycling project which is being carried out at the department. He also visited the labs of textile department & appreciated the progress and R&D activities of department. Areas of further mutual collaboration were also discussed.

Industrial Tour to Sapphire Textile Mills for the Students of Department

Students of B.Sc. Textile Engineering (session 2019, 2020) have visited Sapphire Textile Mills as part of their industrial tour and training.

Training on Outcome Based Education (OBE)

Training was conducted by the Chairman Textile Engineering (Prof. Dr. Muhammad Mohsin) on achieving Outcome Based Education (OBE) to the Engineering Departments of UET Lahore Faisalabad Campus.

Seminar on Garments Manufacturing & its Marketing in International Market

+Mr. Ghulam Sabir (CEO, SNA International) visited Department of Textile Engineering, UET Lahore-Faisalabad Campus. He visited various labs & facilities available at department. He gave informative lecture in the seminar for the students of the department.

AM Interloop Visit to Department

Mr. Junaid Ali Javed (Assistant Manager, Corporate, Interloop Pvt. Ltd.) visited Department of Textile Engineering, UET Lahore-Faisalabad Campus.

He gave awareness lecture on role and importance of EHS in textile industry. He has conducted EHS audit of the textile Department. He was impressed by the EHS protocol implementation of the department of textile engineering.

Alumni Reunion at the Department

"Textile Alumni Reunion" was arranged at Department of Textile Engineering, UET Lahore (Faisalabad Campus). Textile Alumni shared their industrial experiences with the current students of textile engineering department. Prof. Dr. Muhammad Mohsin (Chairman, Textile Engineering Department) and other faculty members thanked the Alumni for joining the event and appreciated the efforts of current students to organize the event.

Students of the Department Visited SOS for Community Service

Students of UET's Textile department visited the SOS Faisalabad and presented the gifts to children of SOS. Department students spent good time with the SOS children. This community service was carried out under the supervision of Eng. Ahsan and financed by students and faculty of Textile department.

Recruitment Drive (MTM)

Masood Textile Mills (pvt.) Limited conducted recruitment drive for B.Sc. Textile Engineering (session 2018) at Department of Textile Engineering.

Recruitment Drive (Sapphire)

Sapphire Finishing Mills Limited, Lahore conducted recruitment drive for B.Sc. Textile Engineering (session 2018) at Department of Textile Engineering. A quiz competition was also arranged for students by SFL, and gifts were distributed among the students.

Students of 2020 Session arranged Welcome party for session 2021.

UET B.Sc. Textile Engineering session 2020 arranged a welcome party for session 2021. Session 2021 was warmly welcomed and was offered all kinds of assistance in future.

Training on OBE implementation

A Training on OBE implementation was arranged for the faculty of UET Lahore, Faisalabad campus. The topic of the training was "Continuous Quality Improvement & OBE". Trainer was Prof. Dr. M. Mohsin, Chairman, Department of Textile Engineering, UET Lahore, Faisalabad Campus.

Inauguration of Three Labs at the Department by the Worthy Vice Chancellor

Inauguration of Pakistan's 1st most comprehensive "Digital Printing and Smart Textile Lab", "Textile Recycling Lab" as well as "Textile Computer Lab" by the worthy Vice Chancellor, UET Lahore. He appreciated the R&D efforts of the UET textile engineering department and ensured his full support. All the three labs having latest equipment are either developed through faculty funded project from PSF, PHEC or industry.

Textile Computer Lab was developed with the partially supported of Interloop Pvt. Ltd. Following textile related software have already been installed while more are under process: Gerber (Garments, pattern making & 3D apparel designing), Chemdraw (Textile processing, structure and mechanism of dyes, chemicals and fabric), CLO 3D (Garment, 3D designing with true-to life garments visualization), -DB weave (Weaving, fabric design and modeling), Texgen (Weaving, fabric designing 3D structure), -Minitab (spinning, and other textile data analysis), etc.

Ministry of Science and Technology Delegation Visit to the Department

A delegation from Pakistan Science Foundation (Ministry of Science and Technology) visited department of textile engineering. They have appreciated the progress on the textile recycling project funded by PSF. They have visited textile lab facilities and applauded the ongoing research projects of the textile department.

Executive Director of Ittehad Textile & His Team Visit to the Department

Mr. Ahmad Sultan Nazim (Executive Director, Ittehad Textile Industries) with his team visited Department of Textile Engineering, UET Lahore-Faisalabad Campus. They have shown keen interest in sustainable products & process technologies. Ittehad team visited the textile lab facilities and manifested heed in joint R&D and further collaborations with textile department.

Team from Ibrahim Fibers Ltd Visited the Department

Mr. Muhammad Arshad (AGM, Marketing and R&D) and Mr. Hafiz Muhammad Fahad (Sr. Engineer, SPG) from Ibrahim Fibers Limited paid a visit to Department of Textile Engineering, UET Lahore-Faisalabad Campus. They appreciated the department's labs and R&D efforts. IFL team has taken keen interest in some R&D projects being carried at the department and collaboration in this regard is likely to begin soon.

Farewell party for textile 2018 session

A farewell party was arranged for textile 2018 session by textile 2020 session as per the tradition of the department.

Medical Camp at the Department

Medical Camp (one to one session) of Psychologist and Nutritionist was organized for the students of UET Lahore, Faisalabad Campus by Department of Textile Engineering in collaboration with Little Voices Rehabilitation Center, Faisalabad. More than 80 students from all the departments of the campus get the one to one professional advice from the 10 experts. Due to huge response from students, camp time need to be increased to cater all the students. Special thanks to the Little Voices Rehabilitation Center for their voluntary work.

Industrial Tour to Gohar Textile Mills for the Students of Department

Industrial visit of students of B.Sc. Textile Engineering was arranged at Gohar Textile Mills.

3 Plantation Drives at the Department

Department is very active in the development of greenery and plantation drive. More than 500 plants are already planted near and around the department and more will be added to this number. 3rd Plantation Drive at Department of Textile Engineering, UET Lahore, Faisalabad Campus was started by the Worthy Vice Chancellor, UET Lahore for the year 2022. He appreciated the well management of the grass, lawns, and plants around the department. Credit goes to the advisor plantation Eng. Ahsan and all the students of textile specially 2018, 2019, 2020 and 2021 sessions.

Department regularly organize the intra-departmental plantation competition. All the sessions of textile participated in the plantation drive, however textile session 2021 won the first position and awarded with the shield of appreciation.

Seminar on Mental Health & Nutrition Awareness held at the Department

Seminar was held related to Mental Health & Nutrition Awareness for the students of the UET Lahore, Faisalabad Campus. It was organized by Department of Textile Engineering, UET Lahore, Faisalabad Campus in collaboration with Little Voices Rehabilitation Center. CEO little voices rehabilitation center, Mrs. Qurat ul Ain Malik and Nutritionist Dr. Zunaira was the technical team lead for this seminar. It was quite informative and interactive session and at the end quiz took place along with distribution of prizes for the students giving the right answers.

Orientation of Session 2022 by the Department

New intake session 2022 was welcomed by the department and senior students. It was a well-managed program where new students were guided about the facilities and activities of the department.

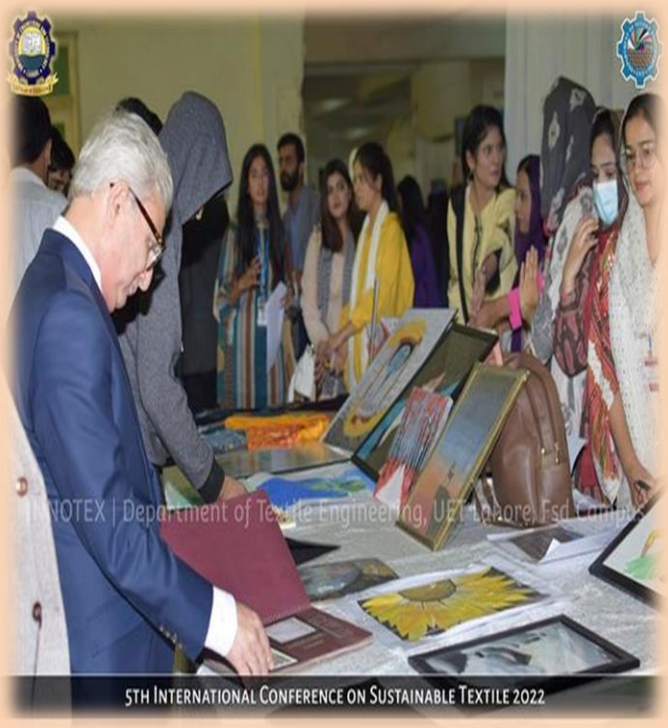
Delegation Visit from Textile Industry and Funding members at the Department

A delegation from textile industry and founding members of textile sustainability working group visited department of textile engineering. They have appreciated the progress on the textile sustainability research projects. They have visited textile lab facilities and applauded the ongoing textile sustainability research projects of textile department.

Textile Sustainability Student Competition 2022 Arranged by Department at the 5th International Conference on Sustainable Textile 2022

More than 550 students from 45 institutes of Pakistan participated in the Textile Sustainability Student Competition 2022, held at UET Lahore, Faisalabad Campus. More than 850 student projects were received and only 550 were shortlisted for display after shortlisting. It is the biggest textile sustainability competition and gathering of the country where international conference on sustainable textile also took place.

All the student projects were evaluated by the relevant expert judges and top six position holders were given the cash prizes. While all the participants were given certificate of attendance. It is a wonderful gathering where student and industry learn mutually and appreciate the young talent of the country working on textile sustainability.



Appointment of Chairman Textile Engineering as Campus Coordinator

Prof. Dr. Muhammad Mohsin (Chairman, Department of Textile Engineering) was given the additional charge of "Campus Coordinator", UET Lahore-Faisalabad Campus. He will now put his efforts for not only the development of the textile engineering department but for the whole campus as well.

Seminar by Regional Manager of Swistex Chemical

Engr. Jawad Ahmad (Regional Manager, Swisstex Chemicals) visited department of textile engineering, UET Lahore-Faisalabad campus. He gave a lecture to the students of textile engineering on the topic of "Role of Textile Engineers in Multinational Companies" He also visited the lab facilities of textile engineering department. He appreciated the research work being carried at the department.

Dr. Shaheen Sardar

Associate Professor, Textile engineering department,
UET Lahore Faisalabad Campus

The applications of computers and software for the competitiveness of the textile industry in Pakistan

Why computers are required for economic growth.

Textiles are the basic needs of the humankind, and the textile industry will continuously produce the endless clothes for the growing global population. In return, the textile businesses will continuously help in the economic growth of the countries through national trade, international trade, and significant employment. Most of the textile production is in the emerging and developing world, and the textile industry of Pakistan is one of the major producers and exporters for the textile products. However, there is an intense competition in the developing countries due to the higher expectations of the customers related to the various criteria such as low cost, more flexibility, more productivity, low risk, more environmental sustainability, mass customization, good quality, and more product variety. One of the major strategies to fulfill all these criteria is the creation and adoption of the computer technologies in the textile industries. This article has been devoted to the textile industry of Pakistan to recall the support of the computer technologies for the economic growth in a sustainable way. In the past, the fast adoption of the computer technologies has significantly accelerated the global economic growth [1]. In the future, the investments in the computer technologies will significantly increase the global competiveness of the textile and clothing industry [2]. In the following, the major computer software and technologies have been presented for the textile industry.

2D/ 3D design, modeling, and printing software

TUKAcad: TUKAcad is 2D pattern designing software for customized pattern making, efficient marker making, printing of patterns, and the selection of best design and color [3].

Optitex: Optitex can be used for deigning and simulation of apparel and technical textiles. This software can be used for the 3D simulation of 2D textile products. Moreover, this software can be integrated in several MS office program such as MS Word [4-5].

Gerber AccuMark: This is the mostly used pattern making software in the textile industry of Pakistan. Gerber AccuMark 2D can be used for the 2D pattern making, marker making, and marker optimization. This software is used by world's famous companies in order to decrease the led time, improve product fit, and saving fabric. Gerber AccuMark 3D can be used for the integration of 2D patterns into the 3D environment. In the 3D environment, companies can perform the virtual simulations. Gerber AccuNest can be used for the maximum utilization of the fabrics, resulting in the least cost designs [6].

Computer Aided Manufacturing (CAM)

In the computer aided manufacturing (CAM), the manufacturing process can be automated using software and computer-controlled machines. The computer-aided product is designed by CAD software, and the practical implementation of this designed product is performed by CAM software. The basic purpose for the development of CAM was to facilitate the transfer of 2D designs into 3D manufacturing. The connection between design and manufacturing is an essential step towards the validation of the virtual designs. Hence, the CAM facilitates the manufacturing of the physical samples, and the physical products are the goal of the manufacturing processes [7].

Hence, the CAD systems should be compatible with the manufacturing requirements. The textile manufacturers are already using 3D virtual prototyping and simulations software, such as Modaris 3D fit, to test the 2D patterns. Several CAM software can be adopted in the textile industry. The 3D modeling software (e.g., such as Fusion 360, Maya, ZBrush, and Rhino) can be integrated with 3D printing software for physical samples [8].

Life Cycle Assessment (LCA) tools

In future, the survival of the textile companies would be based on the environmental impact. Life Cycle Assessment (LCA) tools can be used to estimate the ecological impacts of the textile products. Textile industry in Pakistan can use the various specialized software for the measurement of the environmental impacts of their products [9]. In the following, some LCA tools have been highlighted.

- **Eco chain Mobius:** Easy to use and 14 days free trial.
- **Eco chain Helix:** Moderate difficulty and demo version available.
- **GaBi:** Moderate difficulty and 30 days free trial.
- **Oneclicklca:** Moderate difficulty and 14 days free trial.
- **openLCA:** Moderate difficulty and totally free.
- **SimaPro:** Moderate difficulty and demo version available.

Energy management software

Textile industry involves the higher amounts of energy at each manufacturing stage. The various general and specialized energy management software tools can be used for the energy planning, efficiency improvement, and emission reduction. The many service providers and software tools can help the textile industry in the energy management. Some of the famous software tools for energy management include Facilio, Wattics, DEXMA energy intelligence, Galooli, Watchwire, Goby, Strata, JadeTrack, inavitas, Vitality, Planetly, Datakwip, Veritone Energy, CEnergy, and AQue [10].

Computerized textile machinery

Computers are used in all the departments of the textile industry. Specially, the computerized machines would increase the speed, productivity, and product variety in the textile industry. For instance, the computerized jacquard loom produces the high-quality fabric design using the input data of computers. Also, computerized knitting machine works on the computer's instructions for the efficient creation of the knitted design. In addition, there are many software that come with the testing machines, which collect the data based on the testing and compute results automatically. There are many computers software that come with the textile processing machines such as spectrophotometer, software for the measurement of fastness properties, and the digital printing technology. Moreover, the many embroidery machines are controlled by computer software. In future, many textiles machinery would be controlled by computers. Specially, the applications of robotics are emerging in the textile industry to increase productivity [11]. The robots depend only on the computers.

Management software in the textile industry

Computer software plays a central role in the management of different activities in the different textile divisions including fiber sourcing, yarn manufacturing, fabric production, sewing, and customers. Companies can create or adopt various software such as LOGIC ERP, Orderhive, NetSuite, FitOneBox, Vastralaya, Invoay, TrakSYS, businessMATE, Bigdbiz, and Clover [12].

Concluding remarks

The survival of the textile industry of Pakistan would be impossible without the adoption of the available computer technologies. The textile manufacturers and supply chain managers should take timely steps towards the implementation of these technologies. However, the implementation of these technologies is a challenging task due to the issues such as resistance from employees due to change, lack of skills, and availability of financial resources. The keyway to address these issues is the taking of initiative from small things and moving gradually towards the full implementation of the computer technologies. In this way, the employees would start accepting these technologies in addition to the skills development. In addition to the most famous computer applications and software highlighted in this article, many specialized and general software tools are available to help the textile industry. A positive attitude and practical steps towards the adoption of these computer technologies would ensure the competitiveness of the textile industry in a strategic way.

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Revolutionizing the Textile Industry: The Future of Digital Textile Printing

Abstract:

The textile industry has undergone a transformation in the digital age, with the advent of digital textile printing. The shift towards digital textile printing has transformed the industry, enabling faster production times, reducing waste, and increasing customization options. The global digital textile printing market is expected to grow rapidly, with technological advancements and changing consumer preferences. The market is expected to be driven by increasing demand for sustainable and eco-friendly textile printing, rising disposable income, and the growing trend of customizing textile products. However, the high initial investment and lack of skilled labor may hinder market growth. The adoption of digital textile printing technology is also expected to create new opportunities in the textile industry. The future of digital textile printing looks promising, and companies must adapt to remain competitive and meet changing consumer demands.

Introduction:

Digital textile printing is a relatively new technology that has taken the fashion industry by storm. It involves. printing designs directly onto fabric using digital printing. machines. This process has revolutionized the way that fabrics are designed and produced, making it possible to

create high-quality, detailed, and intricate designs on a wide range of fabrics. The technology has also made the production process more efficient and cost-effective, allowing for smaller print runs and greater customization. In this article, we will explore the importance, market, and future of digital textile printing in the fashion industry. Importance of Digital Textile Printing in the Fashion Industry: Digital textile printing has become an increasingly important part of the fashion industry, particularly as designers and manufacturers seek to reduce waste and improve sustainability. The technology allows for on-demand printing, which means that fabrics can be printed as they are needed, rather than in large batches that may go unused. This reduces waste and helps to minimize the environmental impact of the fashion industry [1].

Digital textile printing has also made it possible to create more intricate and detailed designs on a wider range of fabrics. Traditional printing methods often resulted in designs that were limited in their complexity, as the printing plates could only handle a certain level of detail. Digital printing, on the other hand, can produce designs with an almost unlimited level of detail, making it possible to create fabrics with incredibly intricate patterns and designs. The technology has also made the production process more efficient and cost-effective. Traditional printing methods often required large print runs to be cost-effective, which could result in unsold stock and wasted fabric. Digital printing allows for smaller print runs and greater customization, which means that fabrics can be printed to order, reducing the amount of waste and unsold stock [2].

Market for Digital Textile Printing in the Fashion Industry:

The market for digital textile printing in the fashion industry has grown rapidly in recent years and is expected to continue to grow in the coming years. According to a report by Allied Market Research, the global digital textile printing market is expected to reach $3.9 billion by 2025, growing at a CAGR of 17.9% from 2018 to 2025. This growth is being driven by several factors, including the increasing demand for sustainable and environmentally friendly production methods, the growing popularity of fast fashion, and the increasing use of digital printing in textile design. Digital textile printing is particularly popular in the fast fashion industry, where the ability to quickly produce on-trend designs is essential. The technology allows designers and manufacturers to create new designs quickly and easily, and to produce them in small quantities. This means that new designs can be brought to market more quickly, and that the industry can respond more rapidly to changing trends and consumer demand [3].

Future of Digital Textile Printing in the Fashion Industry: The future of digital textile printing in the fashion industry looks bright, with the technology continuing to develop and evolve. Advances in digital printing technology are making it possible to print on an ever-wider range of fabrics, including silk, cotton, and even leather. This is opening new possibilities for designers and manufacturers, allowing them to create new and innovative designs on a wider range of fabrics. There is also growing interest in using digital printing technology to create smart textiles. One of the major benefits of digital textile printing is that it allows for greater flexibility and customization compared to traditional printing methods. This is particularly valuable in the fashion industry, where trends and designs are constantly evolving. With digital printing, designers can quickly create and test new designs, and adjust them as needed without incurring the high costs and lead times associated with traditional printing methods. This can help fashion brands to stay competitive and responsive to changing consumer demands. Moreover, digital textile printing is also more sustainable than traditional printing methods [4]. Traditional printing methods often involve large amounts of water, energy, and chemicals, which can have negative environmental impacts. In contrast, digital printing can be more precise, resulting. in less waste and reduced energy consumption. Furthermore, some digital printing systems use water-based inks, which are more environmentally friendly than traditional inks. Another advantage of digital textile printing is that it can enable new business models and opportunities. For example, the rise of e-commerce and on-demand manufacturing has made it possible for brands to offer personalized and made-to-order products. Digital printing can support these business models by allowing for efficient and cost-effective production of small quantities and custom orders. This can help brands to reduce waste and inventory costs, while also meeting the needs and preferences of individual customers. In terms of market trends, the

global digital textile printing market is expected to continue to grow in the coming years. According to a report by Markets and Markets, the market is projected to reach $3.2 billion by 2023, growing at a CAGR of 17.2% from 2018 to 2023. Factors driving this growth include increasing demand for sustainable and eco-friendly printing methods, as well as the rising popularity of on-demand and customized products. In addition, the COVID-19 pandemic has also accelerated the adoption of digital printing in the textile industry. The pandemic has disrupted global supply chains and led to increased uncertainty and volatility in the market. In response, many brands have turned to digital printing to reduce costs and improve supply chain flexibility. For example, digital printing can help to shorten lead times and enable production of small quantities of products, which can be particularly valuable in times of market uncertainty. Looking ahead, the future of digital textile printing looks bright. As technology continues to evolve, we can expect to see further improvements in print quality, speed, and cost-effectiveness. Additionally, the continued growth of e-commerce and on-demand manufacturing is likely to drive further demand for digital printing in the fashion and textile industries [5].

Conclusion

In conclusion, the future of digital textile printing is bright, with numerous advancements in technology and growing demand from various industries. With its numerous benefits such as reduced waste, increased speed, and customization capabilities, it is no wonder that more and more companies are adopting digital textile printing methods. The market for digital textile printing is also expected to see significant growth in the coming years, driven by factors such as increasing demand for sustainable and eco-friendly production methods, the growing popularity of fast fashion, and the need for faster turnaround times. As the industry continues to evolve, it will be important for companies to stay up to date with the latest technologies and trends in digital textile printing. This will require investment in research and development, as well as a willingness to experiment with new techniques and materials. In addition, it will be important for companies to prioritize sustainability in their digital textile printing processes. This can be achieved using eco-friendly inks, recycling programs, and the adoption of circular business models that prioritize reducing waste and minimizing environmental impact. Overall, the future of digital textile printing is promising, and companies that invest in this technology stand to gain a significant competitive advantage in the years to come. With its ability to offer high-quality, customized products with faster turnaround times and reduced waste, digital textile printing is quickly becoming the preferred method of production for companies across a range of industries.

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Towards Sustainable Supply Chain Management in the Textile Industry Importance, Need, and Best Practices

Abstract:

The adoption of sustainable supply chain management (SSCM) practices in the textile industry has become increasingly important in recent years due to the industry's impact on the environment and the well-being of workers. The adoption of SSCM practices can not only mitigate environmental risks but also promote social responsibility within the supply chain. This paper provides an overview of the importance and need for the adoption of SSCM practices in the textile industry, along with best practices for implementation. It also includes a case study of Hewlett-Packard's implementation of SSCM practices in its supply chain. The review highlights the need for the textile industry to embrace SSCM practices and to establish a comprehensive framework for monitoring and reporting on sustainability performance. The implementation of SSCM practices in the textile industry can contribute to long-term sustainable development and promote social responsibility within the industry.

Introduction

The textile industry is a significant contributor to global pollution, resource depletion, and social inequality. According to the World Wildlife Fund (WWF), the fashion industry produces 10% of global carbon emissions, consumes 1.5 trillion liters of water annually, and accounts for 20% of industrial wastewater [1]. The industry also relies heavily on non-renewable resources, including petroleum-based synthetic fibers, and relies on labor-intensive manufacturing processes that often lead to poor working conditions and low wages for workers. The textile supply chain is extraordinarily complex, involving numerous stakeholders, including fiber and yarn producers, fabric and garment manufacturers, distributors, wholesalers, and retailers. It is often challenging to monitor and regulate sustainability practices throughout the supply chain due to its global nature and the involvement of multiple actors. However, in recent years, the adoption of sustainable supply chain management practices in the textile industry has gained momentum. Sustainable supply chain management refers to the integration of environmental, social, and economic considerations into supply chain operations [2]. It involves the implementation of sustainable practices throughout the supply chain, from raw material sourcing to product disposal. The adoption of sustainable supply chain management practices can have significant benefits for the textile industry. It can reduce the environmental impact of textile production and help mitigate the industry's contribution to climate change. Sustainable supply chain management practices can also improve working conditions and promote social equity throughout the supply chain [1,3]. Additionally, adopting sustainable practices can enhance a company's reputation and brand value, potentially leading to increased customer loyalty and market share.

Importance of Sustainable Supply Chain Management in the Textile Industry

Sustainable supply chain management in the textile industry is critical to ensure long-term environmental, social, and economic sustainability [4-6]. The adoption of sustainable practices in the textile supply chain has a significant impact on the environment, as it can reduce resource depletion, pollution, and waste. Moreover, it can improve the social and economic well-being of workers and communities involved in the supply chain. Customers are increasingly demanding transparency and

responsible practices from companies, and sustainable supply chain management can help companies build their reputation and strengthen their brand value [5]. The textile industry is a complex and global supply chain, involving a wide range of stakeholders, from cotton growers to garment workers to retailers. The complexity of the supply chain makes it challenging to monitor and regulate sustainability practices. Moreover, the textile industry has a reputation for labor abuses, such as child labor, forced labor, and poor working conditions. These issues highlight the urgent need for sustainable supply chain management in the textile industry. The textile industry's social and environmental impacts are too significant to ignore, and the industry must take immediate action to address them.

Best Practices for Adopting Sustainable Supply Chain Management in the Textile Industry

Several best practices can help the textile industry adopt sustainable supply chain management practices successfully. These include:

Collaboration and Transparency: Collaboration and transparency are essential for achieving sustainable supply chain management in the textile industry. Companies need to collaborate with suppliers, customers, and other stakeholders to create transparency and build trust in the supply chain. By sharing information, companies can identify areas for improvement and work together to address sustainability challenges [7].

Sustainable Materials: The use of sustainable materials in textile production is critical for achieving sustainable supply chain management. Companies need to ensure that the raw materials they use are sourced sustainably, such as organic cotton, recycled polyester, and bamboo [2]. By using sustainable materials, companies can reduce their environmental impact and create a more sustainable supply chain.

Energy Efficiency: Energy efficiency is another critical aspect of sustainable supply chain management. Companies need to adopt energy-efficient production processes and reduce their carbon footprint. For example, they can use renewable energy sources, such as solar and wind power, to reduce their reliance on fossil fuels [1].

Water Conservation: Water is a precious resource, and the textile industry is a significant consumer of water. Therefore, water conservation is an essential aspect of sustainable supply chain management. Companies can adopt water-efficient production processes, such as using recycled water, reducing water usage, and implementing wastewater treatment systems.

Social Responsibility: Social responsibility is a vital component of sustainable supply chain management in the textile industry. Companies need to ensure that their workers are treated fairly and have safe working.

conditions. Moreover, they need to eliminate child labor, forced labor, and other labor abuses from their supply chain [6]. By promoting social responsibility, companies can improve the well-being of workers and create a more sustainable supply chain.

Conclusion

Sustainable supply chain management is essential for the textile industry's long-term sustainability. The textile industry faces significant environmental, social, and economic challenges, which require a collaborative and holistic approach to address. The adoption of sustainable practices can lead to reduced environmental impact, improved social conditions, and cost savings for companies. Effective collaboration among stakeholders, including suppliers, customers, and regulators, is crucial to implement sustainable practices throughout the supply chain. Best practices such as supplier assessments, transparency, and continuous improvement can support the integration of sustainable practices into textile supply chains. Ultimately, the adoption of sustainable supply chain management practices will enable the textile industry to operate in a more responsible and sustainable manner, benefitting both the industry and society.

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Bast fibres an ecofriendly substitution to cotton fibres: A sustainable

Bast fibres are mostly used in structural parts in composites, ropes, nets, upholstery, filter media and packing materials. Bast fibres mostly have cellulosic background therefore, they may be considered like cotton fibres in the chemical structure. Cotton fibre growth and processing into a textile product requires a lot of energy and water. Roughly 20,000 liters of water is needed to grow and process one kilograms of cotton fibres in textile products. Apart from huge amounts of water and energy consumption, cotton crops also require the use of pesticides to keep it safe from pest attacks. The use of pesticides has adverse effects on human and marine life and the bird's population in the area. Growing and processing cotton fibre is not environmentally friendly. But cotton on the other hand possesses unmatched comfort and coloring properties.

Cotton fibres are used in a large variety of apparel due to soft feel, thermal comfort, moisture regulation and air permeability. Bast fibres are generally harsh and stiff that undermines their use in textile products. Recently researchers have taken a lot of interest in softening the bast fibres and their subsequent use in the apparel industry as an alternative to cotton fibre owing to the availability of raw materials free of cost every year in millions of tons. Softening of bast fibres is a complicated process and researcher are faced with problems such a strength, color and weight loss of the fibres which ultimately leads to low usage of such fibres in the apparel industry. Softening of the fibres can be carried out in both acidic and basic media within a tight range of PH with minimal strength and weight loss. Upon softening the bast fibres can be blended into cotton/ synthetic fibres and spun into yarns via ring and rotor spinning. The count range depends upon the properties of the bast fibres e.g., maturity, fibre diameter, structure, morphology, and strength.

Coarse counts are much easier to process as compared to the fine counts mainly due to large fibre diameter and micronair values of the bast fibres. In coarse counts the bast fibres-cotton blended yarns have been known to outperform 100% cotton fibres-based yarns. The same yarns were also found to be

superior in the fabric processing and performance as compared to the cotton yarns. It is also established by the researchers that bast fibres-based fabrics can be dyed in similar colors to that of cotton fabrics with the same color properties. A lot of research is going on these days to successfully adopt these fibres in industrial processing and reduce the portion of cotton fibres in apparel. Successful adoption of bast fibres in the apparel industry will have fruitful effects on the environment and economy as well.

Major bast fibres are hemp, flax, jute, ramie, sisal, banana and more recently okra fibres.

- The flax fibre comes from the annual plant Linum usitatissimum and has been employed since ancient times in clothing. The plant grows in temperate, moderately moist climates, for example, in Belgium, France, Ireland, Italy, and Russia. Apart from fibres, its seed is used to produce linseed oil.
- The hemp fiber comes from the plant Cannabis sativa having its origin from central China. Hemp plants are also grown in parts of central Asia and eastern Europe. Fibres can be obtained from the stem. Hemp seed oil is known for its medicinal uses. Hemp plant leaves and flowers are used in drugs.
- Jute fibers are obtained from two herbaceous plants, (i) Corchorus capsularis originating from Asia, and (ii) Colitorius originating from Africa. Jute plants are grown mainly in India, Bangladesh, Thailand, and Nepal. The plants are harvested manually, dried and water retted for up to a month before being applied into any application.
- Okra or okro comes from the genesis Abelmoschus esculentus. It is also known in many English-speaking countries as ladies' fingers or ochro, is a flowering plant in the mallow family. It has edible green seed pods. The Okra plant is cultivated in warm temperate regions around the world. The fibre comes from outer layer of the stem. The extraction process is time consuming and laborious.

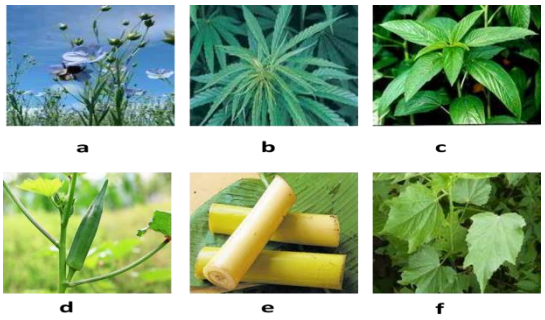

Figure 1: (a) Hemp, (b) Flax, (c) Jute, (d) Okra, (e) Banana, (f) Kenaf fibre sources.

- Banana fibre is a lignocellulosic bast fibre that belongs to the family of Musaceae (Musa sepientum). It is produced in more than 130 countries and known as fourth important food crop after rice, wheat, and corn. It is a good source of dietary fibres, vitamin C and manganese. Banana fibre is. extracted from psuedostem of banana plant after harvesting the fruit leaving millions of tons of plant-based waste every year.
- Kenaf fibres are derived from Hibiscus cannabinus and H. sabdariffa genesis, respectively. Kenaf is grown for production in China, Egypt, and regions of the former Soviet Union, India, and Thailand. Kenaf plants grow up to 5 m at maturity in only five months. It is reported to yield approximately 6–10 tons of dry matter per acre, nine times the yield of wood.
- The ramie fiber comes from the bark of Boehmeria nivea, a member of the nettle family (Urticaceae). The plant is a native of China. Ramie fibre has been used for fabrics and fishing nets for centuries. It is also grown in the Philippines, Japan, Brazil, and Europe. The ramie plant grows approximately 1~ 2.5 m high with stems 8~16 mm thick. The roots send up shoots on harvesting, and two to four cuttings are possible annually.

A variety of bast fibres are plants are harvested every year. These fibres are available in millions of tons every year and possess an opportunity to be employed in the apparel industry as an alternative to the cotton fibre that will reduce the environmental and economic impacts of the cotton growth and processing.

Textile Sustainability Working Group

"Textile Sustainability Working Group" is formed by Department of Textile Engineering (UET Lahore, Faisalabad Campus) and supported by other key stakeholders as "Founding Members" including TTI, BCI, CERAD, Interloop, KICS, WWF and Archroma Pakistan. The group was announced online during the 4th International Conference on Sustainable Textile 2021 due to COVID pandemic. This Working Group will conduct training and seminars, regular sharing of knowledge and best practices, mill assessment related to energy conservation and textile sustainability and joint R&D projects.

Textile sustainability is a global challenge, and it needs coherent efforts from various stakeholders like universities, mills, textile chemical companies, testing companies, brands, associations and NGOs to collaborate in order to achieve the target of textile sustainability in textile supply chain. These efforts are needed not only to attract more international brands, more textile orders, more jobs but for the less usage of resources like good quality water, less wastewater discharge, less air emissions and environment protection of the country. Textile is the backbone of Pakistan economy but situation of textile sustainability in Pakistan needs more coherent efforts. Therefore, "Textile sustainability working group" at Department of Textile Engineering, UET Lahore, Faisalabad Campus is established to take more practical and coherent steps towards textile sustainability with the support of the collaborators and relevant stakeholders.

The website of Textile sustainability working group is officially launched and details can be found at https://conferences.uet.edu.pk/textile/icst/2021/textile-sustainability-working-group/

Textile Sustainability Working Group

Founding Members

Founding members of textile sustainability working group are:

- Department of Textile Engineering UET Lahore
- BCI (Better cotton initiative)
- TTI testing laboratories
- WWF
- CERAD
- Interloop
- KICS
- Archroma Pakistan

General Members

More than 280 members since 19th May 2021 have already registered for textile sustainability working group. More and more textile industry and other stake holders are joining this group.

Projects

There are more than 30 Key projects in the textile sustainability research group related to textile sustainability. You can find the project details in given link.
https://conferences.uet.edu.pk/textile/icst/2021/projects/

Textile Sustainability Research Group

Active research is being carried out in the textile sustainability research group on various areas of sustainable textile which include new fiber development, new fabric development, new garment development, new textile specialty chemical development, new machine development, new process development, value addition, IT based textile solutions, energy conservations, recycling of textile, indigenous bio based carbon development, sustainability training and support in certifications like ZDHC, STeP, Higg Index etc.

Trainings

Textile sustainability working group regularly organizes various trainings on textile supply chain, ZDHC, textile sustainability and textile industry. You can find the list of trainings under given link.
https://conferences.uet.edu.pk/textile/icst/2021/trainings/

Equipment

Department of textile engineering have state of the art 12 labs related to textile and over 150 equipment are installed in it.

Scientist/resource persons

Textile sustainability working group have active research group in which more than 40 scientist/resource persons are working on textile sustainability.

Developed Technologies

There are various developed technologies available for pilot trials and commercialization to the textile industry related to textile supply chain, Energy and IT.
https://conferences.uet.edu.pk/textile/icst/2021/developed-technologies/

For free membership, register here

If you are not already the member of this group then type this link on google and get registered yourself
https://bit.ly/3vHBZkD

Research work Carried out by TEXTILE ENIGNEERING Department

The Department of Textile Engineering is actively involved in research related to textile engineering and textile sustainability in collaboration with the top textile industry of the country. The Faculty of Textile Engineering Department has published over 170 research papers, six books/book chapters, seven patents in the last five years. In addition to BSc Textile Engineering students there is active 20 MSc Textile and Materials Engineering students and 10 PhD Textile Engineering students at the department which is actively involved in the research.

Department faculty have also won a number of research projects from various funding agencies including HEC, PSF, PHEC, and textile industry. Certain key research projects carried out by the department include;

1. Development of energy and water efficient textile bleach recycling system
2. Development of sustainable fiber, fabric and their coloration from agro waste (Banan, okra etc)
3. Development of digital printing inks and optimization of digital printing process.
4. Recycling of textile and tyre industrial wastes for the development of indigenous carbon black
5. Water and energy efficient foam processing Dyeing & Finishing
6. Productivity improvement of the textile industry
7. Garment industry machine line efficiency
8. Recycling of textile into value added digital printing inks
9. Sustainable process (water, energy & chemical efficient) development
10. Recycling of textile wastes into value added product
11. Sustainable natural dyeing without toxic mordant
12. Textile process optimization for organic cotton and better cotton
13. Development of water less dyeing and finishing process
14. Eco friendly, sustainable & halogen free fire retardants for textile
15. Sustainable and durable oil & water repellent for textile
16. 100% bio based anti-viral and anti-microbial textile
17. Eco friendly bio Mosquito repellent finishing for textile
18. Development of novel dyeing process
19. Efficient synthesis of fluorescent materials
20. Nano bubble dyeing and finishing machine and process development.

SCAN ME

Key Focus Areas of the Research at the Department

- Innovative & sustainable yarn development
- Innovative & sustainable fabric development
- Sustainable textile chemical development
- Sustainable garment manufacturing
- Sustainable textile machine development
- Medical Textile
- Textile mill productivity improvement
- Recycling of textile
- Water and chemical efficient textile process development

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