



## 62<sup>nd</sup> Technological Conference on Textile Innovations

R K Gaur<sup>a</sup>, Arindam Basu & Pankaj Kumar

Northern India Textile Research Association, Ghaziabad 201 017, India

The 62<sup>nd</sup> Technological Conference, held on October 24-25, 2024, at the Northern India Textile Research Association (NITRA) in Ghaziabad, brought together prominent experts, researchers, and professionals from the textile industry. Organized jointly by NITRA, Ahmedabad Textile Industry Research Association (ATIRA), Bombay Textile Research Association (BTRA), and South India Textile Research Association (SITRA), the event focused on innovations in the textile sector. The conference was graced by Sh. Giriraj Singh, Hon'ble Union Minister of Textiles, Government of India, served as the Chief Guest of the event.

During his address, the Hon'ble Minister highlighted recent government initiatives aimed at promoting the Indian textile industry, especially within the technical textile segment. He emphasized the need for India to focus on areas where it could emerge as a global leader and expressed his satisfaction with the ongoing activities of Textile Research Associations (TRAs). He was particularly impressed with the progress TRAs have made in the development of various technical textile products.

Dr. Arindam Basu, Director General, NITRA, welcomed the attendees and noted that this year's conference also featured research work conducted by the other four TRAs, i.e. IJIRA, MANTRA, SASMIRA and WRA. Sh. Vidit Jain, Chairman, NITRA, presented a combined report on the activities and achievements of the TRAs. He highlighted significant research and industry collaborations, including those initiated under the National Technical Textile Mission.

A total of 25 papers were presented across six technical sessions: Conventional Textiles; Protective Textiles; Agro Textiles; Composites & Sports Textiles; Sustainable, Environment-Friendly, and Medical Textiles; and Machines and Fibre/Fabric Development. The conference featured a parallel session on Protective Textiles and Agro Textiles.

### Key Highlights from the Sessions

**Conventional Textiles Session:** Chaired by Mr. Anjani Prasad, Managing Director & Vice President, South Asia Textile Effects of Archroma, the first presentation by Mr. S. Sivakumar focused on "Dyeing and sizing of yarn for handloom weavers' society in cheese dyeing machine." This study aimed to streamline the sizing process to align with mechanized methods, improving efficiency, consistency, and reducing resource wastage.

In another notable presentation, Ms. Shital Palaskar & Afreen Begum discussed "Anti-microbial functional finishing on cotton using plasma technology for biomedical applications." They explored the use of plasma enhanced chemical vapor deposition (PECVD) to coat cotton with polyoxazoline, resulting in highly effective antimicrobial properties against *Klebsiella pneumoniae* and *Staphylococcus aureus*, with significant potential for use in biomedical textiles such as wound dressings and bandages.

Mr. N.K. Nagarajan's presentation on "Effect of trash and microdust accumulation in lattice compact apron and its influence on compact yarn quality" emphasized the importance of removing trash and microdust to improve cotton quality and yarn manufacturing. Mr. Mayur Basuk's work on "Fabrication and characterization of stretchable and non-stretchable wool blended denim fabric" showed that blending wool yarn with denim enhanced thermo-physiological comfort and dimensional stability, leading to a more functional fabric.

**Protective Textiles Session:** Chaired by Mr. Sandeep Hora, Partner/CEO, Aeronav Industrial Safety Appliances, the session featured a range of presentations on safety textiles. Mr. Swami Sharan's research focused on optimizing the layers of specialized fire-fighting suits, evaluating factors such as flame spread, radiant heat transfer, and thermal resistance to improve protection. Ms. Shreyasi Nandy presented a method for enhancing the flame retardancy of cotton fabric through chemical treatment, increasing its limiting oxygen index

<sup>a</sup>Corresponding author  
E-mail: rkgaur@nitratextile.org

(LOI) and ensuring durability even after repeated washing.

Mr. Shashikant Patil discussed the "Behavior mechanism of composite under high energy radiant heat," exploring the impact of fire-retardant fillers in composite materials, aimed at enhancing heat resistance and preventing fire penetration. Dr. M.S. Parmar presented his research on "Development of extreme cold climate clothing from cellulose-based high Clo value and low-density natural fibre." This work involved blends of weed fibre and polyester, tailored for use in extreme cold climate clothing such as sleeping bags and jackets, with promising results in terms of thermal insulation and comfort.

The Agro Textiles session, chaired by Dr. S.L. Jat, Senior Scientist, (Agronomy) AFNAAS, ICAR-Indian Institute of Maize Research, Delhi unit, presented key innovations in sustainable textile materials. Dr. Nidhi Sisodia presented her research on the potential use of banana and sunnhemp fibres in agrotiles, exploring these fibres as sustainable materials. Banana fibres are recognized for their strength, durability, moisture absorption, thermal resistance, and UV resistance, while sunnhemp fibres are valued for their strength and resistance to harsh environmental conditions. Both fibres hold promise for applications such as mulching, seedling mats, geotextiles, and biodegradable packaging. Dr. Sisodia reported that the fineness of sunnhemp fibres ranged from 23 to 52 denier, with strength varying from 28g/tex to 48.14g/tex, while banana fibres showed a fineness between 30 and 52 denier and strength from 12 g/tex to 28 g/tex. The moisture regain of banana and sunn hemp fibres was found to be 11-13% and 12-14%, respectively.

Mr. Ravi Prakash Singh presented his work on the development and characterization of high-performance hail protection nets. By integrating nanotechnology with textile engineering, he developed nets that combine nano-composite materials with weaving and knitting techniques. These nets, incorporating Calcium Carbonate ( $\text{CaCO}_3$ ) into an HDPE polymer matrix at a 0.30 wt% concentration, were optimized for shading percentage and wind blockage to create a stable microclimate for crops, offering an innovative solution for crop protection against hailstorms.

In another presentation, Mr. Murtuza Z Channiwalla discussed the development of protective workwear (gloves and socks) for leptospirosis protection for farm and field workers. The research involved

creating detoxifying functional fabrics by applying Titanium Dioxide ( $\text{TiO}_2$ ) for its photocatalytic properties, along with natural and synthetic antimicrobial agents. The efficacy of these gloves and socks was rigorously assessed for pathogen resistance and durability under real-world conditions.

The session on Composite and Sports Textiles was chaired by Dr. Abhijit Majumdar, Professor at IIT Delhi. A significant area of research in this session focused on providing impact protection for sports personnel. Dr. Rupam Chauhan presented her study on impact protection and comfort characteristics of shear thickening fluids (STFs)-infused 3D knitted fabrics for sports textiles. STFs were impregnated into 3D spacer knitted fabrics to dissipate impact energy. The study showed that the STF-coated fabrics absorbed more energy than commercial foams and provided better thermal comfort in terms of thermal conductivity, air permeability, and water vapor permeability.

Mr. Partha Bairi discussed his research on "Graphene-Coated Natural Fibre-Reinforced Composites with Improved Mechanical Properties", emphasizing their use as sustainable alternatives to petrochemical-based fibres like carbon and aramid in aerospace, automotive, and defense industries. Graphene-coated jute fabric reinforced epoxy composites demonstrated improved mechanical properties and higher Izod energy absorption compared to uncoated jute composites.

Mr. Dinesh Mareward presented his research work on "Design development of light weight cricket pad using non-newtonian fluids". The study used STFs to enhance the physical properties of cricket pads, including increased tensile strength, tear strength, and compressibility. The developed pads showed an 11% reduction in weight compared to commercial alternatives, indicating a safer, lighter option for sports protective equipment.

The well-known fact is that researchers are intensively working on carbon fibre, being a unique material among high performance fibres, which is used for Aerospace to industrial applications. The development of CNT-reinforced acrylic precursors for carbon fibre was presented by Dr. T.V. Sreekumar, highlighting the incorporation of carbon nanotubes (CNTs) into carbon fibre precursors. This research aimed to enhance the strength and performance of carbon fibres used in high-performance applications like aerospace.

Mr. Ankush Sharma presented his research on natural fibre-based sandwich composites for porta cabin applications. The study focused on developing sandwich composites with woven jute fabric skin layers and polyethylene terephthalate (PET) or polyvinyl chloride (PVC) cores. The research revealed that the jute-PET composite with a 0°/90° orientation demonstrated excellent impact properties, while the hybrid composite, combining jute and bamboo fibres, improved mechanical and thermal insulation properties, suitable for structural and semi-structural applications.

The session on Sustainable, Environment-Friendly, and Medical Textiles was chaired by Mr. Ayan Chakraborty, Vice President, Ginni Filaments Limited, and focused on innovative approaches to addressing environmental challenges in the textile industry. Ms. Deepali Plawat presented her research on “Development of the indigenous HEPA filter media using nano fibre Technology”. With increasing concerns over air pollutants and the need for efficient air filtration systems, this work aims to reduce reliance on imported HEPA filters, which are typically made from fibreglass and other synthetic materials. Ms. Plawat’s research explores the use of electrospinning technology to develop HEPA-grade filter media in India, utilizing nanofibre technology for superior filtration efficiency. Her findings indicate that particulate filtration efficiency can exceed 99.95% with nano-coated meltblown media, with further potential to improve performance by experimenting with various substrates and nano-coating types.

Mr. Lalit Giri Goswami followed with his presentation on “Spinning of yarns using mechanically recycled cotton fibre with virgin fibre”. His study aligns with the principles of the circular economy—reducing, reusing, and recycling. His research showed that using recycled cotton fibres can save significant resources, such as agricultural land, CO<sub>2</sub> emissions, and water. However, he found that quality yarn production becomes challenging when the recycled fibre content exceeds 20% in ring spinning and 30% in open-end rotor spinning technologies. Despite this, using double or siro yarns could improve the quality of recycled cotton yarn.

Mr. Prasanta K. Panda presented his work on “Preparation of CNT based lyocell fibres. Lyocell, a regenerated cellulose fibre produced using N-methylmorpholine-N-oxide (NMMO), is an eco-friendly alternative to traditional fibres. However, the mechanical properties of these fibres tend to be low. Mr. Panda's

research demonstrates that incorporating Single-Walled Carbon Nanotubes (SWCNT) into the lyocell precursor enhances the fibre’s tensile strength by 30%, improving the overall performance of this sustainable fibre.

Mr. Pankaj Kumar shared his findings on reducing water and chemical consumption in textile processing in the Panipat textile cluster. His case studies highlight the importance of adopting more sustainable practices in water-intensive industries. By implementing modified methods and chemicals with minimal investment, he achieved a 25% reduction in water consumption and a 20% reduction in chemical usage without compromising product quality. His work showcases practical solutions for improving sustainability in MSME textile processing units.

Mr. S. Sivakumar presented his research on “Development of scouring process chemicals for reduction of TDS & COD in the resultant effluent”. Despite advancements in dyeing technology, effluent pollutant levels remain a concern, particularly TDS and COD. Mr. Sivakumar's work focuses on formulating scouring chemicals that reduce these pollutants and exploring alternative alkali sources to reduce reliance on caustic soda. Industry-level trials demonstrated a 20-30% reduction in TDS and COD compared to conventional methods, with no negative impact on fabric quality.

The fifth and last technical session focusing on Machines and Fibre/ Fabric Development, was chaired by Mr. Anoop Pandey, AVP, Birla Corporation Limited (Unit: Birla Jute mills). The session included a series of insightful presentations on advancements in textile technology, with a focus on enhancing quality, productivity, and sustainability.

Mr. N. K. Ngarajan presented his research work on “Investigation on inter-fibre cohesion of cotton and its influence on yarn quality attributes”. His study analyzed the cohesive force between cotton fibres and its influence on yarn quality attributes. A comparative evaluation of 30 Indian cotton varieties and 22 imported cotton varieties was conducted using instruments like MDTA for opening work and Zwick for cohesive force testing. The study revealed significant findings, including that the Israel Acalpi cotton variety exhibited 19% higher yarn tenacity in open-end spinning and 10% higher in ring spinning compared to the Peru Pima variety. Additionally, Indian cotton varieties with higher cohesive forces showed 4% to 9% increased yarn tenacity in ring spinning, highlighting the critical role of inter-fibre cohesion in improving yarn quality.

Mr. Partha Sanyal followed with his presentation on a “New drafting system for jute drawing”. In response to limitations in traditional screw gill jute drawing frames, Mr. Sanyal introduced an improved roller drafting system for the jute finisher drawing stage. The system, featuring a series of rollers instead of faller bars, facilitates higher machine speeds and simplified operation while maintaining control over fibre movement. A comparative study between a roller drafting finisher drawing frame running at 130m/min and a conventional screw gill system at 50m/min showed no significant difference in sliver irregularity or yarn quality, demonstrating the system’s effectiveness in enhancing jute spinning efficiency.

Mr. Hitesh Jariwala presented his work on “Development of highly electro-conductive non-metallic textile for sensing application and EMI shielding”. Through in-situ chemical and electro-chemical polymerization, conductive monomers such as aniline and pyrrole were polymerized directly onto textile substrates. The resulting textiles were characterized for their electrical conductivity, thermal stability, mechanical properties, and morphology. The research demonstrated the textiles’ potential as sensors for gas detection, strain and pressure sensitivity, and electrical response. Additionally, the textiles showed promising

EMI shielding effectiveness across various frequencies, paving the way for their application in wearable health monitors and protective clothing for electronic environments.

The session concluded with a presentation by Mr. Biswarup Nandi and Mr. Joyjit Mukherjee on “Development of retrofit automation technology in conventional jute spinning frame”. The team focused on modernizing the outdated power transmission mechanism in jute spinning machines, which traditionally relied on gear, sprocket, and pulley trains. By retrofitting the system with two induction motors and a Variable Frequency Drive (VFD) system, along with servomotors for roller speed control, the researchers achieved significant energy efficiency improvements. The new system consumed only 4.8 units per hour, compared to 5.85 units per hour by the conventional machine, while maintaining consistent yarn parameters like speed, draft, twist, and bobbin dimensions.

The session and the conference concluded with a closing address by Dr. Arindam Basu, Director General, NITRA, who expressed confidence that India will soon become a global hub for technical textiles, with TRAs playing a pivotal role in contributing through R&D advancements.