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THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION
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AN OVERVIEW OF SITRA'S R&D WORK AND SERVICES - 2022-23

The year 2022-23 was a very turbulent one with the textile industry strenuously managing to cope up the higher cost of production. Furthermore, very sluggish global demand for textile exports, had compound issues to the textile industry. This kind of volatility in the Textile Industry during the year had a rippling effect in SITRA's membership as well, while the mills enrolled as members during the year, same number of mills had to leave membership either due to closure or unviable operations of the units. Hence, the total membership of SITRA during the year remained practically the same as previous year at 147 comprising 187 units. In addition, 44 small textile units availed services under Technical Support Scheme.

In such an adverse environment facing the industry, SITRA reoriented its focus on multiple need-based services, attracting robust response from the industry.

SITRA with its revamped and reoriented multiple services and R & D activities, and by judicial fiscal management, had strengthened its financial portion. SITRA had registered an appreciable surplus of income for yet another year.

Along with its focus on services, SITRA was able to record good progress in the R &D activities during the year. The year witnessed SITRA working on as many as 29 projects. Good progress was achieved on many of the projects during the year, most significantly those carried out as in-house projects. Of the 29 projects, 6 were completed during the year. The projects covered wide-ranging areas of interest and benefit to the industry. An overview of the work done during the year in different areas are given below.

FIBRE TO YARN CONVERSION

Mills have Electronic yarn clearers (EYC) which function either on capacitance or the optical principle. It is claimed by the manufacturers of optical yarn clearers that yarns cleared by their clearers are closest to the visual assessment by the user and yarn faults are directly determined unlike the clearers using the capacitive measurement of mass for determining faults.

The off-line yarn fault classifying helps in determining the faults in cop yarn, the clearing curve to be set and clearing efficiency of the yarn clearing system. And using these, a spinner can set the optimum clearing curve for a better yarn fault removal and also avoid unnecessary cuts. By way of optimum clearing of yarn, improvement in the machine efficiency can be achieved.

With a view to establish an off-line optical yarn fault classification system, along with the existing capacitance type yarn fault measuring an additional optical measuring head has been fixed in the same yarn path. Simultaneous measurement of yarn faults both in the capacitance and optical measuring were carried out under identical testing conditions like speed, tension and atmospheric conditions. Results showed that faults measured by the Optical clearer are relatively lower and the % reduction varies between counts for different yarn fault types. In some fault classes, the faults measured in the capacitance clearer are not measured by the optical clearer.

An attempt has been made to formulate and standardize a method to measure the lint content in blow room lines and explore ways to optimize the lint content in the trash collected under various beaters in blow room lines. Raw material, feed material and delivery material for each and individual beater were collected and tested in AFIS and trash separator. The wastes in each and every beater was also collected and tested in trash separator. Opimisation of the lint content was done by varying the settings and speeds. Results showed that by optimising the lint content in blow room lines, the mills would be able to improve the yarn realisation without affecting the yarn quality. It was also observed that mills are not effectively utilising `Seed trap` in Blow room lines which helps to improve lint content by eliminating full seeds before they are fragmented.

Research on combing efficiency in modern combers has been able to arrive at a formula that estimates a consistent and repeatable value that forms a measure of combing performance using single fibre length data of AFIS against the existing guideline proposed by SITRA in the year 1975 and revised it up to the year 2010, in line with the changes in comber technology. The earlier guideline, used digital fibro-graph, which measures fiber length based on span length concept. The new combing index, is calculated with respect to percentage noil extracted and the length data results obtained from testing. mean fibre length improvement, short fibre reduction and % noil extracted were considered and validated with available data (34 trials) of different nipping rates, make of machines and waste% and are found to be in line with the existing practice of comber performance evaluation. Guideline values are suggested accordingly.

The effect of picking intervals on fibre quality and nepping behaviour in cotton has been investigated as a continuation of the work done by SITRA previously on the relationship between the fibre properties and processed fibre properties by means of nepping propensity with respect to fibre length, fibre fineness and fibre maturity. In the present work, an attempt has been made to relate fibre properties of cotton pick-wise and nepping propensity of fibre and its nep size distribution. Two varieties of cotton samples SIMA-5 (Long staple cotton – 2 picks) and Suvin (Extra long staple cotton – 2 picks) were taken for this study and all the samples were tested using high volume instrument (HVI-1000; ASTM D 5867-12) for length, uniformity ratio, strength, elongation, micronaire and maturity ratio. The fibre quality of each sample was also evaluated using AFIS PRO2.

The results showed that there was no significant differences in fibre properties between pickings, except for maturity coefficient and length in the SIMA5 variety but, in SUVIN cotton, marked differences in fibre properties such as fineness, elongation, maturity and nep count per gram were observed. The results also confirm the generally accepted theory that nepping propensity increases when the slenderness ratio increases.

One of the major challenges faced by cotton growers is obtaining high-quality fibre with desirable properties. Plant hormones or phytohormones are known to play a crucial role in regulating plant growth and development, including fibre development in cotton. Hence, a project was initiated to study the impact of plant hormones on fiber properties of cotton. Foliar application of phytohormones - Indole acetic acid (IAA) and gibberellins (GAs) (that play important roles in the development and growth of cotton fibers) on cotton has been explored as a means to enhance fibre properties. Hormone sprays were done at SIMA CDRA field for SUVIN variety and CICR field for 3 varieties, at an interval of 30 days, from the 90th day of sowing. The results of the cotton in the first and second pick showed consistently good results in terms of maturity, length, elongation and strength while there were reduced neps, short fibres and immature fibres. The findings of this study could contribute to the development of sustainable and efficient strategies for enhancing cotton production.

The paper on “Supply of pre-dyed and starched cotton yarn in cone form using cheese dyeing machines to handloom weavers in Tamil Nadu, sponsored by the Government of Tamil Nadu, attempts to evaluate dyeing and sizing of yarn in hank form vis-à-vis in cone form using a low add-on, low viscous solution. It has become imperative to look for alternate solutions to realise a cost-effective method of dyeing and sizing of the yarns meant for handlooms. With the advent of latest technologies, it is possible to carry out the dyeing and sizing of yarns in the cheese form using cheese dyeing machines. Key findings of the Preliminary study show that overall, the quality of yarn of yarn dyed and sized in cheese form seem to be better than that of yarn dyed and sized in hank form and the cost of processing dyeing and sizing in cheese form seem to be a viable option for all range of shades viz., light, medium and dark.

OPERATIONAL STUDIES

SITRA's monthly online survey of raw material cost (RMC) and yarn selling price (YSP), which was launched in April 2013 helps mills to compare their RMC, YSP, Net output value (NOV), as well as yarn quality, production rate & yarn realization (pertaining to 10 counts in each mill) with other mills every month. This survey gives vital information about the trend in the movement of count-wise YSP and RMC between months of popular counts. To suitably reflect the fluctuations/volatility in the commercial efficiency of spinning mills over a period, SITRA has developed a new index by name MPEI (Market Performance Evaluation Index) which clearly portrays the commercial trend of the cotton spinning industry. MPEI is an arithmetic index that is derived by having April 2013 as the base month and the base index set to 100 for that month. During the quarter under review, MPEI showed an increasing trend, registering 71, 75 ad 79 index points for the months of January, February and March 2023 respectively. This increasing trend was mainly due to substantial reduction in the raw material cost which offsets the marginal reduction in the yarn selling price during the quarter.

ENERGY MANAGEMENT

An attempt has been made to develop an intelligent controller for improving the “OEE” of OHTCs. Wire framing and designing the layout and structure of the“app” (application software) have been done and the “app” architecture is prepared for explaining the project and its requirements in an efficient way to the project developers. Few OEMs were approached for partnership in the development of the project. An “app'

for tracking and tracing of OEE (Overall Equipment Effectiveness) and SEC (Specific Energy Consumption) on a real time basis using state of the art technologies is planned. The ROI for an OHTC after incorporating the software, has been worked out and the OHTC manufacturers would be persuaded to incorporate this software while selling their product as a package.

A mobile app is planned to be developed for count-wise power consumption standards in terms of kw per 1000 spindles for"g1g2g3" machines of ring spinning process PcS"GPA". It is planned to segregate the machines/system of ring spun single yarn manufacturing process into 3 sub-groups namely "G1, G2 and G3" for the purpose of analyzing energy efficiency in detail. In addition to energy efficiency of machines and process, the app will be useful to mills in determining how much should be the sanctioned demand, UDS (units per day per spindle), transformer capacity, the kVARs requirement, no. of distribution panels, etc. It wil also be useful to mills in estimating their energy saving potential.

CHEMICAL PROCESSING

Under the project funded by DST-WOSA, an attempt was made to develop Antioxidant Cosmeto textiles for controlled release of Vitamin E for the welfare of pre-term infants, patients having vitamin and immune deficiencies. Vitamin E nano-formulation was prepared and applied on the cotton fabric by pad-dry-cure method with better add-on % by optimizing the cross-linking agent, curing time and temperature. The vitamin E nano-formulation treated fabric was studied for antioxidant activity and also for durability and vitamin-E release (*in-vitro and in-vivo*).

Handloom societies that help small handloom weavers procure yarn in hank form, get them sized by primitive techniques viz., cistern dyeing & sizing methods, open vat dyeing process, etc and finally converts the yarn into warp sheet or weft pirn as the case may be. However, the processing of yarn in hank form has many disadvantages and hence it becomes imperative to look for alternate solutions to realise a cost-effective method of dyeing and sizing of the yarns meant for handlooms. With this objective SITRA conducted a preliminary comparative study between dyeing and sizing of yarn in hank form vis-à-vis in cone form and a low add-on, low viscous solution was used to size the yarn in cheese form. The study showed that dyeing and sizing of yarn in cheese form present many advantages. Based on the above mentioned study, SITRA approached the department of Handlooms, Government of Tamil Nadu for a pilot project titled "Supply of Pre-dyed and starched cotton yarn in cone form using cheese dyeing machines to the Handloom weavers" under the study, it is proposed to dye and size about 450 Kg. of 80s Combed yarn in both cheese form and hank form using cheese dyeing machine and traditional dyeing method respectively and compare them for their quality parameters and cot viability. Based on the study, it is proposed to submit a detailed report to the Department of Handlooms.

Under funding from NTTM, Ministry of Textiles, Govt. of India, SITRA initiated a new project for development of natural herbal extract coated seed protection bags using natural fibres with long lasting mechanical and insecticidal properties. Vegetable fibres such as Agave Americana, sisal, Jute and pineapple leaf have the long lasting mechanical properties and hence are planned to be used to develop seed protection / grain storage bags. The available natural fibres will be spun into yarn with required linear density. Fabrics of suitable construction will be developed using these yarns and will be treated with insecticide or suitable agents such as silica sols to produce water repellence. The seed / grain storage bags will be developed out of the treated fabrics and the properties will be evaluated.

In order to overcome the challenges faced by EFTs in terms of Total Dissolved Solids (TDS) and COD in the resultant effluent, SITRA has attempted to develop a Pre-treatment process for their reduction. After a through evaluation of RFD fabrics, a particular recipe was identified with a high degree of polymerization compared to conventional fabrics wherein its Strength was found to 40% higher, the Total Dissolved Solids (TDS) and COD reduced by 40 % and 30% respectively compared to the conventional pre-treatment method. Dyeing trials would be taken with to assess depth of shades against conventional dyeing. The technical know-how would be dessiminated after carrying out the commercial trials.

An attempt was made to use nano- composites with the biopolymer support to act as a photo catalyst to remove colour from textile industry dye effluents Initial trials were conducted last year using synthesized ZnO nanoparticles with various parameters such as time, nanoparticle concentration, and Blue MR dye concentration optimized for effective decolourisation. In addition to colour removal, chemical oxygen demand (COD) and biological oxygen demand (BOD) reduction were also investigated. The optical properties of the

reactive blue MR dye was analyzed using a UV-Visible spectrometer. Results showed that effective decolourization can be achieved using nanocomposite treatment of dye effluent water. The optimized concentration was used for the decolourization of industrial dye effluent to study the efficacy of prepared nano-composite. Results revealed that a reasonable reduction in the colour value, COD and BOD was observed for the industrial dye effluent.

MEDICAL TEXTILES

Electrospinning is a well-established and versatile technique which utilizes electrical forces to produce polymeric nano fibers. The key features of nanofibers such as high surface area to volume ratio, smaller pore size with high porosity, strong mechanical property, malleability, and biomimetic nature of Extra Cellular Matrix (ECM), make them an ideal candidate for use in various applications such as nanocatalysis, tissue engineering scaffolds, protective clothing, filtration, optical, electronics, healthcare, defense & security and environmental engineering. The limitation of electrospining is its productivity. Under funding from the National Technical Textile Mission, Ministry of Textiles, it is planned to overcome this deficiency by developing a high productivity electrospinning setup that would also be versatile (applicable for both solvent as well as melt spinning) and have the capability for hybrid nanofibrous coating on single substrate. A Prototype machine has been successfully developed and trails have been conducted with different polymers such as PVA, PAN, PCL and PVDF. Defect free nanofibers with the fiber diameter of 100nm-700nm were produced. Fabrication of Pilot scale machine with 500mm electrode width and with two polymer feeding modules is in progress.

In the absence of established standards for measuring viral filtration efficiency (VFE) of face masks, a study was taken up to develop a reliable method to assess the viral filtration efficiency of HME filter and surgical face masks under both normal and higher challenge conditions, with longer exposure time and validate it through laboratory studies with a BFE tester by adapting and modifying it to simulate viral aerosols. Based on comprehensive laboratory trials, a method for the assessment of viral filtration efficiency of health care materials at normal and higher challenge conditions was optimized.

Existing drug-delivery methods still find it challenging to convert water-insoluble drugs into soluble ones without affecting their biological properties by the stabilisers such as micelles, polymers and solvents. Given the versatility of on-demand and focused drug delivery- in terms of smart functionality, drug-solubilisation and fabrication, a method has been developed of introducing an electrical stimuli into the bandages for enhancing the solubilisation of curcumin and study their wound healing, anticancer and antibacterial treatments. The method can make more aqueous solubilisation of curcumin via electrochemical method and the rate of release is programmable by varying the current.

Leggings have become a popular fashion choice for women, with many wearing them for both exercise and daily activities due to their comfort and versatility. While leggings can be comfortable and stylish, there have been concerns raised about potential health problems associated with their use such as tightness, itching, and chafing. A project was taken up to study the relationship between compression properties of leggings and its possible side effects when used on a regular basis. Data collected from female college students across multiple colleges using a questionnaire was analysed. Majority of the students report that Itching and irritation, pressure / red marks, restricted movements, sensation of feeling too warm and sweaty while wearing tight-fitting leggings were some of the negative aspects of leggings. Studies on the constructional and compression properties of the leggings is under progress.

CONSULTANCY SERVICES

The requests for consultancy services have been consistent from SITRA's member as well as non-member mills over the years. Such assignments, on wide areas of specialisation, were taken up under specific requests from mills. During the year, around 125 consultanciy assignments were attended to, was utilised by 17 member mills and 108 non-member units .

TESTING AND CALIBRATION SERVICES

Various fibre, yarn and fabric samples are being tested at SITRA's physical and chemical testing laboratories, that are accredited by NABL for ISO/IEC-17025.

Measures taken by SITRA to report test results quickly in recent years include running the laboratories in two shifts and providing the "Rapid testing facility" that gives option to mills to receive results at a faster pace by rapid conditioning of samples. Post the COVID pandemic, there is an increased awareness among the industry to test various medical textile products for different microbial properties. Receipt of samples for these parameters have also witnessed a steady rise in recent years. During the year, SITRA laboratories carried out a total of 1,02,752 tests, which included fibre, yarn, fabric and medical textile samples for various physical, chemical or biological properties.

During the year under review, as many as 312 spinning, weaving and knitting units availed the service of SITRA to receive calibration certificates for 13540 textile testing and quality control instruments. Testing the quality of spinning and weaving accessories/ spares in order to select the right quality is another service being offered by SITRA and 1,863 samples covering various accessories like paper cones, worm & worm gear wheel, cots, partition pad, spinning rings, spindles, ring travellers and carton boxes received from 275 units were tested.

TRAINING

Nine different training programmes were offered duing the year which include 6 functional programmes, an international training programme and some batches under medical textiles. In all, 661 persons were trained during the year. Under operatives training, 53 operatives were trained during the year on right methods of working in textile mills for effective performance. The details of the various programmes are given in Table 13.

SERVICES TO DECENTRALISED SECTOR

The services of the 7 Powerloom Service Centres (PLSC) in Tamil Nadu, managed by SITRA, have been extensively used by the powerloom sector. A total of 42517 samples comprising of yarn and fabrics have been tested and 110 persons were trained in the area of loom maintenance, operation of shuttleless looms, calculation of fabric production, etc. The PLSCs have attended to 3,135 liaison visits and also inspected 20,254 looms during the year. A total of 18 consultancy assignments were carried out and 106 designs were created during the year.

MOUs SIGNED

During the year, Memorandums of Understanding / Agreement were signed with the following organisations/ Institutions/agencies:

1) GCL International Limited, India a certifying body has entered into a memorandum of understanding with SITRA for utilizing its services for testing and certification purposes.

2) WWF, India has renewed its memorandum of agreement with SITRA towards utilizing SITRA's expertise and testing services for their ongoing projects on water conservation & abatement of pollution.

3) Kratu Scientific Solutions, Chennai, a non-woven fabric manufacturing across all verticals, for utilizing the services of SITRA's NABL accredited laboratories for testing of their PPE suits.

4) Loyal Textile Mills Ltd, Cuddalore a textile manufacturing units across all verticals, for utilizing the services of SITRA's NABL accredited laboratories for testing of their materials covering fibres to finished materials

COMMERCIAL AGREEMENT SIGNED

a) Agreement with M/s. MAK India Ltd., for commercialization of SITRA's development

SITRA has synthesised a cationising chemical and has successfully developed a single step pre-treatment cum cationisation process methodology for dyeing of cotton fabrics. The developed methodology is suitable for salt free dyeing of cotton fabrics for a wide range of shades and depths.

SITRA has granted a license to M/s. MAK India Ltd. (MIL) to use this technology for commercial manufacture of the salt-free dyeing chemical. MIL has traveled along with SITRA in this journey by establishing and standardizing the enrichment process that would be suitable for commercial production by fabricating pilot vessel and carrying out pilot industrial trials and providing necessary support towards incorporating various modifications as and when necessary. The licence would be for a period of 10 years of which the

initial 5 year would be an exclusive one and the next 5 year will be non-exclusive.

VISITORS

Important dignitaries who visited SITRA during the year include Shri Piyush Goyal, Honourable Textile Minister, MoT, Govt. of India; Mr. R.Gandhi, Hon'ble Minister of Handlooms and Textiles, Govt. of Tamil Nadu; Mr V K Singh, Special Secretary, MoT, Govt. of India; Smt. Roop Rashi, Textile Commissioner, MoT, Govt. of India; Shri Rajeev Saxena, IAS, Joint Secretary, Ministry of Textiles, Govt. of India; Mr. Dharmendra Pratap Yadav, IAS, Principal Secretary Handloom, Handicrafts and textiles Govt of Tamil Nadu; Dr. M. Vallalar, IAS, Commissioner, Commisionerate of Textile, Govt. of Tamil Nadu. Mr. Senthilrajan, Scientist and Mr. Anshat, Head, Naval Physical & Oceanographic Laboratory. A list of visitors to SITRA is provided in Annexure II.

PUBLICATIONS

SITRA brought out during the year, 20 publications which included 12 online reports, 6 focus and 1 Etech letter (SITRA news publication) (Annexure III).

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SITRA scientists published 6 research papers in technical journals and presented 16 papers in conferences and seminars (Annexure V).

MEMBERSHIP

SITRA's reoriented multiple services on the basis of need to the hour, continued to be in good demand, despite the volatile nature of the textile industry right through the year. Eleven (11) mills, comprising of 8 Full members and 3 Associate members enrolled newly as members during the year. However, poor operating profits had led to 4 mills opting out of STRA's membership, while SITRA had to take the decision of terminating the membership of 7 other mills due to persistant defaults in payment of arrears. The total membership of SITRA during the year, hence, remained practically the same as last year at 147, comprising of 187 units (Table 1).

SITRA is pleased to extend a warm welcome to the following mills which enrolled as a full members during the year:

1. Top Light Textiles Pvt Ltd., Tirupur
2. Annapoorani Textiles Pvt Ltd., Erode
3. Suriya Spinning Mills Unit -B, Pollachi
4. V.Thangavel and Sons Pvt Ltd., Komarapalayam
5. Sachin Textiles, Coimbatore
6. Sri Murugar Spinning Mills, Coimbatore
7. Bannari Amman Spinning Mills Ltd - Coimbatore
8. S.N.N.Tulasi Narayana Spinners Pvt. Ltd., Annur

The following mills enrolled an Associate members:

1. Vaardhman Yarns, Raisen, MP
2. Vaibhav Laxmi Spg Mills ltd., Mehsana, Gujarat
3. Cheviot Company Ltd., Kolkatta

Apart from the above, 44 mills utilised SITRA's services under the Technical Support Scheme. In all, 231 units had access to SITRA's services, apart from many units in the decentralised sector which utilised the services offered by 7 Powerloom Service Centres, one Textile Service Centre and 4 CAD Centres.

FINANCE

The financial position of SITRA continued to be satisfactory during the year that ended with a surplus of income. The total recurring expenditure of SITRA during the year after depreciation and before appropriation from reserves was Rs 16.22 crores. The total income, including the grants from the Ministry of Textiles, Govt. of India was Rs 15.88 crores.

SPONSORED PROJECTS

During the year under review, SITRA was involved in 7 sponsored research projects, 2 of which were sponsored by the Ministry of Textiles (MoT), Government of India and rest of the projects by agencies such DST, BRNS, KVIC and Biorad.

Work relating to the following project, sponsored by MoT, was completed during the year :

*. Development of facile high throughput needleless electrospinning set-up

Work on the following 4 projects, sponsored by other sponsoring agencies/industry and initiated last year, have also been completed :

* Field dissemination of technology of high productivity hand operated Charka (KVIC)

* Development of breathable reusable and oxo-biodegradable coverall using biocidal polyester (Board of Research in Nuclear Sciences [BRNS])

Table 1 Region-wise membership during the year 2022-23

Region	Spinning mills	Composite mills	Fibre manufacturers, Machinery manufacturers and others	Total
SITRA zone	115	4	4	123
Other States	18	3	2	23
Overseas	1	0	-	1
Total members	134	7	6	147
Total units	162	19	6	187

* Methodology for PCM (CRODA India Co. Pvt. Ltd.)

* Chitosan Nano particles (Biorad Medisys Pvt. Ltd.)

Work relating to the following project sponsored by DST has made good progress during the year and is on the verge of completion :

* Antioxidant cosmetotextiles : Durable nano encapsulate vitamin E finishes on textile fabrics and its controlled release study.

The following project sponsored by MoT, under the National Technical Textiles Mission (NTTM) is an ongoing project and has made significant progress during the year.

* Development of total comfort index paradigm for textile structures

MACHINERY AND EQUIPMENT

SITRA has made significant capital investments during the last decade to equip its laboratories/pilot mills with state-of-the-art machinery/instruments. During 2022-23, as much as 2.60 crores were invested to procure important machinery/ equipment to modernise its testing laboratories, pilot mill and the incubation centre of CoE- Meditex. The major machinery /equipment purchased during the year include ULM 600E Machine, Fourier Transform Infra red Spectrophotometer (FTIR), Thermal Analysis System STA300, TECAN Multimode plate reader, Constant tension transport electronic (CTT-E), Color Matching Cabinet-Nanovision lite, Rotatory vaccum evaporator, Nestling PIV System, Flame Photo meter, Bale Pressing Machine, AATCC Manograph washing machine and Trash separator (TCT-04ED). SITRA also upgraded its AFIS Pro 2 and refurbished the LR6 Ring Frame.

REPRESENTATION IN COMMITTEES

Two senior staff of SITRA, Mr. S. Sivakumar, Head, Textile Chemistry division and Dr. E.Santhini, Head In-charge of CoE Medical Textile division were nominated by BIS and voted by the ISO / TC 338 committee members to be the Conveners for ISO/TC 338 / WG1 (working group on General requirements of menstrual products) to define the terms related to menstrual products and to discuss the scope of ISO/TC 338 and Strategic Business plan.

Dr. E. Santhini was also nominated as the Convenor for the revision of IS standard 17334: Surgical gowns and drapes.

STAFF

The staff strength of SITRA was practically the same as last year at 85 as against 86 last year. The number at the PSCs has marginally came down to 27during the year, as against 30 last year.

VISIT TO ITME 2022

SITRA takes the initiative of updating/providing exposure to its staff members on the latest developments in the field of textiles on a regular basis by enabling their participation in conference /development programmes. The ITME-2022 exhibition of textile machinery and accessories, held in December 2022 at Greater Noida, India provided an opportunity fo the staff to get to know of some of the latest developments in textile machinery by national and international players. Eleven scientific staff of various divisions participated in the exhibition.

CONVERSION OF FIBRE TO YARN

YARN FAULT CLASSIFICATION USING OPTICAL PRINCIPLE

Yarn clearing is one of the important objectives of a winding machine. Electronic yarn clearer (EYC) is one among the basic requirement of spinning mills and EYCs working on both capacitance and optical principles are available in the market. Though both type of yarn clearers have a significant presence in the industry, the capacitance yarn clearing has an edge over the optical counterpart due to the availability of an established off line fault classification. It is claimed by the manufacturers of instruments using the optical principle that yarns cleared using these instruments are closest to the visual assessment by the user and yarn faults are directly determined unlike the clearers using the capacitive measurement of mass for determining faults.

The off-line yarn fault classifying helps in determining the

i. faults in cop yarn
ii. the clearing curve to be set and
iii. clearing efficiency of the yarn clearing system.

Using these, a spinner can set the optimum clearing curve for a better yarn fault removal and also avoid unnecessary cuts. By way of optimum clearing of yarn, improvement in the machine efficiency can be achieved.

With a view to establish an off-line optical yarn fault classification system, along with the existing capacitance type yarn fault measuring, an additional optical measuring head has been fixed in the same yarn path. Simultaneous measurement of yarn fault both in the capacitance and optical measuring were carried out under identical testing conditions like speed, tension and atmospheric conditions.

About 300 yarn samples of varying counts were tested and the results were analyzed. Following are the observations made.

1. Faults measured by the Optical clearer are relatively lower and % reduction varies between counts for different yarn fault types. In some fault classes, the faults measured in the capacitance clearer are not measured by the optical clearer.
2. Since most of the samples studied are auto coned electronically cleared yarns, the faults in long thick and long thin classes are low and in most of the samples, no such faults were observed.
3. 'A' type faults measured in the Optical clearer are lower by 30% to 70% compared to faults measured in CMT – V using the capacitance method.
4. 'B' type faults measured in the Optical clearer are lower by 70% to 90% compared to faults measured in capacitance based clearer.
5. With 'C' type faults, C1 faults are observed in most of the samples and the remaining C2, C3 and C4 are not present in the samples tested. The ratio of 'C1' type faults measured by the Optical clearer is lower by 70% to 90% compared to faults measured in capacitance based clearer.
6. Extended faults in short thick class (A0, B0, C0), these faults are found to be lower by about 70% to 90% in the optical type clearers.
7. In some cases, long thin faults were observed in optical measuring only and they were not measured by capacitance measuring head.

Being the seldom occurring faults in the yarn, yarn faults measured by a single measuring head may not be the representative samples for comparison. A relatively higher volume of material may be tested for comparison.

It is planned to fix optical clearers in all the 6 drums of the CMT V winder in addition to the existing capacitance based measuring sensor and further studies are to be carried out to validate the above observations. Fabric appearance will also be studied.

STUDY ON LINT CONTENT IN BLOW ROOM LINES

Now a days, cotton is available with higher quantum of trash particles with seed coat fragments. For extracting this type of trash, the mill has to extract the trash with lint content. If trash particles contain full seeds, it is possible to maintain the lint content less than 30% in blow room lines, provided the process and settings of the blow room lines are maintained properly. Otherwise, the lint content will be higher than that of the above limit.

Objectives of the study

1. To formulate and standardize a method to measure the lint content in blow room lines for each and every beater.
2. To find ways to optimize the lint content in the trash collected in various beaters in blow room lines.

Materials and methods

1. Collection of raw material, feed material and delivery material for each and individual beater and test them in AFIS and trash separator at SITRA

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2. Collection of the waste in each and every beater and test them in trash separator in the respective mill itself

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3. Optimise the lint content by varying the settings and speeds and once again repeat the same tests to reconfirm the Lint content.

The above project has been carried out in two mills.

Summary of the findings

1. A new approach has been arrived at to estimate the lint content, beater-wise and the evaluation is done with the help of AFIS and Trash Separator.

2. By optimising the lint content in blow room lines, the mills would be able to improve the yarn realisation without affecting the yarn quality.

3. During our studies it was also found that mills are not effectively utilising `Seed trap` in Blow room lines which helps to improve lint content by eliminating full seeds before they are fragmented. Fragmentation causes the lint to be dragged into the waste along with fragmented seeds.

STUDIES ON COMBING EFFICIENCY IN MODERN COMBERS

The role of comber is to improve the quality of raw material by removing selective short fibers, trash particles and neps in it. Hence, the assessment of performance of comber is very much necessary for better raw material utilization. SITRA had arrived at a guideline to judge combing performance in the year 1975 and revised it up to the year 2010, in line with the changes in comber technology. The method of assessment was using Digital fibro-graph, which measures fiber length based on the span length concept.

Need for the study

The method used for calculating the combing efficiency using the 50% span length in comber sliver and lap used a Digital fibro-graph, which is almost obsolete in the industry. Even though the HVI instrument measures the fibre length using a similar span length concept, with the use of automated fibre sampler, Uster is not recommending HVI for testing well paralleled fibres like comber lap, combed sliver, etc. When the well paralleled fibre is tested using HVI, the results are not accurate, reliable and repeatable due to problems in the method of sample preparation. Because of the above reasons, many a times, the efficiency values are very low when the combing efficiency is calculated based on the HVI measured 50% span length for the modern combers. Based on those values, it would not be possible to decide on the performance of a comber.

SITRA Combing Index (SCI) =

$$\frac{\Delta L(w) * \Delta SFC(w) * \Delta Nep \text{--- (1)}}{GFC * Noil\%}$$

Where,

ΔL (w)	-% improvement in mean length by weight
ΔSFC (w)	-% reduction in SFC(w) from lap
ΔNep	% reduction in neps in sliver from lap
GFC	% good fibre content in noil
Noil%	% noil extracted from feed

New Combing index (S&L) =

$$\frac{L(n)\ \text{Sliver} - L(n)\ (\text{Lap}) \times (SFC(n)\ \text{Lap} - SFC(n)\ \text{Sliver}) \times 100}{L(n)\ \text{Lap} \qquad SFC\ (n)\ \text{Lap Noil\%}} \text{--- (2)}$$

Experimental plan

Ongoing study on combing efficiency evaluation using single fibre test results requires validation of the formula with different variables in a controlled study. In this connection, we collected combed sliver, lap and noils samples from different make/model of combers

and the process parameters were varied as per the trial plan given below.

Variables influencing waste extraction considered are,

Detaching distance	-	(Index/mm)	(8 to 11)
Feed per nip	-	(mm/nip)	(4.3 to 5.2)
Top comb penetration	-	(mm)	(51.5 to 53.5)

Box-Behnken design of experiment for the above independent variables requires 15 trials at three levels (-1, 0,+1). The experimental plan is given in Table 2.

Table 2 Experimental Plan

Trial no.	Detaching distance	Feed per nip (mm)	Top comb penetration
1	-1	-1	0
2	+1	-1	0
3	-1	+1	0
4	+1	+1	0
5	-1	0	-1
6	+1	0	-1
7	-1	0	+1
8	+1	0	+1
9	0	-1	-1
10	0	+1	-1
11	0	-1	+1
12	0	+1	+1
13	0	0	0
14	0	0	0
15	0	0	0

The variables level were selected as per the minimum setting possibile at mills and the initial trials were conducted to fix the variables. Process parameters maintained by the mills in comber and its preparation are given in Table 3.

Table 3 Process Parameters

Description	Parameter
PC draw frame draft	4.65
Lap preparation draft	1.54
Pre comber draft	7.2
Lap weight in grams per meter	68.5
Comber speed (npm)	410
Needles per cm	26
Comber draft	13.5

Variables selected for the trial are,

Levels	-	(-1,0 , +1)	
Detaching distance	-	(Index/mm)	(8.0, 8.5, 9.0)
Feed per nip	-	(mm/nip)	(4.3, 4.7, 5.2)
Top comb penetration	-	(mm)	(52.5, 53.0, 53.5)

Based on the noil% obtained and the AFIS tests for the trials conducted as per the experimental plan given in Table2 , the combing indices calculated using Formula (1) and (2) are given in Table 4.

Table 4 Parameters used in various trials

Trial no.	Feed per nip (mm)	Top comb depth (mm)	Waste index	Noil%	New Combing index	SCI
1	4.3	53 (0.5)	8	16.5	0.46	45.2
2	4.3	53 (0.5)	9	17.9	0.46	41.0
3	4.3	52.5(0)	8.5	14.7	0.36	29.3
4	4.3	53.5(+1.0)	8.5	17.5	0.49	41.8
5	4.7	53.5(+1.0)	8	15.6	0.42	33.5
6	4.7	53.5(+1.0)	9	18.2	0.51	39.7
7	4.7	52.5(0)	8	12.6	0.31	26.0
8	4.7	52.5(0)	9	15.5	0.39	28.3
9	4.7	53(0.5)	8.5	15.9	0.39	30.9
10	4.7	53(0.5)	8.5	16.3	0.40	29.3
11	4.7	53(0.5)	8.5	16.4	0.45	35.5
12	5.2	53(0.5)	8	16.1	0.40	36.1
13	5.2	53(0.5)	9	17.4	0.50	51.1
14	5.2	52.5(0)	8.5	14.9	0.31	23.9
15	5.2	53.5(+1.0)	8.5	17.3	0.48	40.3
Avg.				16.2	0.42	35.5

Table 4 shows that the average New combing index recorded at 0.42 ranges from 0.31 to 0.51 between various trials. Similarly, average SCI recorded at 35.5 ranges from 23.9 to 51.1 between trials.

Further analysis reveals that average combing index increases as average noil % increases in the various trials as given in Table 5.

Table 5 Average Noil% Vs Average combing index

Noil% group	New combing index	SCI
12.0 – 15.0	0.33	26.4
15.1 – 17.0	0.42	34.1
17.1 – 19.0	0.48	42.8

Based on the design of experiment data, an expression was arrived at on the selected variables and the Combing Index was calculated using SPSS software with r^2 Value of 0.781, as given below.

Combing Index = (-7.082)+(-0.0192*FPN)+(0.133*TCD) +(0.0673*WI)

Where,

FPN - Feed per nip in mm
TCD - Top comb depth of penetration in mm
WI - Detaching distance in mm or waste index

Further analysis reveals that all the indices increase as the % noil extracted increases in the various trials as given in Table 6.

Table 6 Noil% Vs Combing indices

Noil% group	New combing index
12.0 - 15.0	0.33
15.1 - 17.0	0.42
17.1 - 19.0	0.48

Key Findings

From the above, it is clear that combing performance (combing index) of comber depends on

- Ø Combination of process variables selected.
- Ø Feed per nip influences up to 8% to the combing index, increase in feed per nip results in the reduction in the value of combing index.
- Ø Depth of penetration of top comb influences the combing index by up to 77%; higher the depth of penetration, higher will be the index.
- Ø Waste index influences the combing index by about 2.5 times (136%). Higher the detaching distance, higher will be the combing index.
- Ø In most of the cases, with a lower level of top comb depth yields a lower combing index.
- Ø Increase in average comber noil will increase the average indices also.

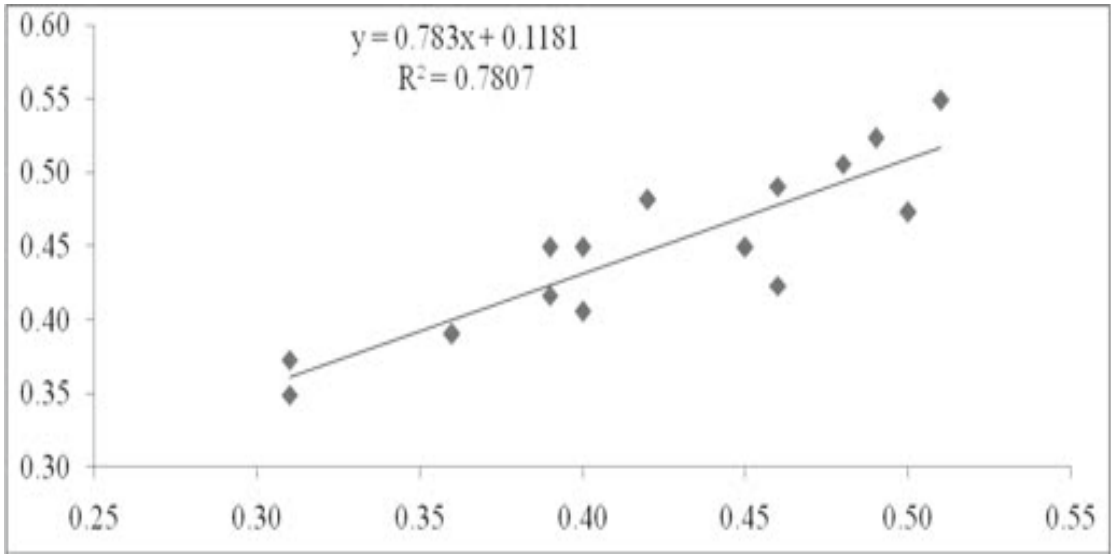


Figure 1 Correlation co-efficient R^2 Values

Further work proposed

Further studies are planned with other variables that can influence the combing index.

EFFECT OF PICKING INTERVALS ON FIBRE QUALITY AND NEPPING BEHAVIOUR IN COTTON

Agricultural and climatic conditions including sowing season and watering frequency during their growth are known to influence the cotton fibre properties. Generally, first harvest cotton is known to give lower level of seed coat fragments than a second harvest from the same field. Further, cotton from first picking contains fewer neps than cotton from second picking.

Nep formation is caused by various factors. Some neps form during hair growth, the others during primary processing (ginning and spinning). The initial nep number in unginned cotton is relatively small and successive stages of processing change the nep number.

Increase in the nep number occurs during the preliminary cleaning and ginning process and then during the opening and cleaning processes. Cotton fibre maturity is regarded as an important factor influencing the tendency of nep creation. Additionally finer cottons tend to nep more than coarser ones independent of maturity.

As per ASTM book (1978) a “fibre or mechanical nep” is defined as one or more fibres occurring in a tangled and unorganized mass and is distinct from impurities including seed or trash particles apart from fibres.

Previously SITRA had carried out a study on the relationship between the fibre properties and processed fibre properties by means of nepping propensity with respect to fibre length, fibre fineness and fibre maturity. In continuation of the above work on nepping potential with respect to fibre properties, an attempt has been made to relate fibre properties of cotton pick-wise and nepping propensity of the fibre and its nep size distribution for the same.

Materials and methods

Two varieties of cotton samples SIMA-5 (Long staple cotton – 2 picks) and Suvin (Extra long staple cotton – 2 picks) were taken for this study. All the samples were tested using high volume instrument (HVI-1000) for length, uniformity ratio, strength, elongation, micronaire and maturity ratio.

The fibre quality of each sample was also evaluated using AFIS PRO2, for the cotton samples with five replicates of 3000 fibres each.

Key findings

1. In SIMA 5 cotton, there are no significant differences in fibre properties between pickings, except for maturity coefficient and length. However, in SUVIN cotton, there are significant differences in fibre properties such as fineness, elongation, maturity and nep count per gram.

2. SIMA 5 cotton maintains a consistent nep count per gram across different nep sizes, while SUVIN cotton shows increased neps in the second picking.

3. The slenderness ratio remains unchanged in SIMA 5 cotton, but varies in SUVIN cotton. This confirms the statement that nepping propensity increases when the slenderness ratio increases.

IMPACT OF PLANT HORMONES ON FIBER PROPERTIES OF COTTON

Cotton is the main source of renewable fibers in the world and is primarily used for textile production. Cotton fibers are single cells differentiated from the ovule epidermis and are an excellent model system for studying cell elongation, polyploidization, and cell wall biosynthesis. Plant hormones, which are present in relatively low concentrations, play important roles in various developmental processes, and recently, multiple reports have revealed the pivotal roles of hormones in regulating cotton fiber development.

One of the major challenges faced by cotton growers is obtaining high-quality fibre with desirable properties. Plant hormones or phytohormones are known to play a crucial role in regulating plant growth and development, including fibre development in cotton. Thus, foliar application of phytohormones on cotton has been explored as a means to enhance fibre properties. Indole acetic acid (IAA) and gibberellins (GAs) are plant hormones that play important roles in the development

and growth of cotton fibers. IAA is involved in the initiation of cotton fiber development. It is synthesized in the ovules and accumulates in the developing fibers, where it promotes cell elongation and differentiation. IAA stimulates the elongation of the fiber cells, which results in longer fibers. Gibberellins, on the other hand, are involved in the elongation of cotton fibers. They promote cell division and elongation by increasing the expression of genes involved in cell growth and expansion. GA3 also enhance the activity of cellulose synthase, an enzyme that is responsible for synthesizing the cellulose that makes up the cotton fibers. The combined effects of IAA and GAs on cotton fiber development result in longer and thicker fibers with improved quality. This is important for the production of high-quality cotton products, such as textiles, because longer fibers are stronger and more durable, and they produce smoother and more even yarns.

Objectives

The proposed project will have the following objectives:

- Ø Selecting the appropriate phytohormones for foliar application based on their role in regulating cotton growth and development.
- Ø Conducting field trials to evaluate the effect of foliar spray of phytohormones on cotton growth, fibre yield and quality.
- Ø Assessing the fibre properties of the cotton plants treated with phytohormones compared to untreated control plants, using international and National standards
- Ø Conducting statistical analysis of the data obtained from the field trials and fibre analysis to determine the effect of phytohormone treatment on cotton fibre properties.

Summary of the initial study findings

- The results of the cotton in the first and second pick has shown a consistently good result in terms of matured fibres, length, elongation and strength while there were reduced neps, short fibres and immature fibres.

The proposed project on the effect of phytohormones as foliar spray on cotton for enhanced fibre properties has significant potential for improving cotton fibre quality and yield, leading to economic benefits for cotton growers. The findings of this study could contribute to the development of sustainable and efficient strategies for enhancing cotton production.

OPERATIONAL STUDIES

ONLINE SURVEY OF YARN SELLING PRICE AND RAW MATERIAL COST

SITRA launched the Monthly online survey on raw material cost (RMC) and yarn selling price (YSP) in April 2013. The objective of this survey is to help the mills to compare their RMC, YSP, Net output value (NOV), as well as yarn quality, production rate & yarn realization (pertaining to 10 counts in each mill) with other mills every month. This survey gives vital information about the trend in the movement of count-wise YSP and RMC between months of popular counts. For this survey, SITRA has created a dedicated web portal www.rmcysp.sitraonline.org.in, where the mills can register with SITRA to participate in this unique survey. SITRA has stuck to the timelines in all these surveys where the analysis report is uploaded on the website on the 21st of every month.

The participant mills enter their data on count-wise average RMC, YSP, yarn realisation and production per spindle pertaining up to 10 major counts in the web portal "www.rmcysp.sitraonline.org.in" between 1st and 7th of every month. Between 8th and 20th of every month, the entered data is critically scrutinized and analyzed. On 21st of every month, a survey report covering the data of all the participating mills on count-wise YSP and corresponding RMC, NOV, yarn quality, yarn realisation and production per spindle is being uploaded in the above web portal along with data base supported queries. Apart from the above, trend in the movement of average YSP, RMC and NOV of popular

counts are being uploaded every month. The participant mills can access this survey through user name and password.

The findings of this survey report help the mills to compare their RMC, YSP, net out-put value (NOV) as well as their yarn quality and productivity level with other mills every month. This unique survey covers almost 250 different counts and varieties of yarns in which the following parameters are being covered.

Market Performance Evaluation Index (MPEI)

To suitably reflect the fluctuations/volatility in the commercial efficiency of spinning mills over a period, SITRA has developed a new index by name MPEI (Market Performance Evaluation Index) which clearly portrays the commercial trend of the cotton spinning industry. MPEI is an arithmetic index that is derived by having April 2013 as the base month and the base index set to 100 for that month. The calculation of MPEI is based on the average net output value (yarn selling price – clean raw material cost) in terms of Rs per kg of yarn for 10 popular counts which occupies a considerable proportion in the market share with a wide range. The popular counts that have been assumed to arrive at the MPEI are 40s K, 40s C, 60s C, 80s C, 40s C-Comp., 50s C-Comp., 60s C-Comp., 80s C-Comp., 30s CH and 40s CH.

Yarn selling price index (YSPI) and raw material cost index (RMCI)

The trend in the movement of MPEI is influenced by two major factors viz., yarn selling price and raw material cost. Hence, it is very much important to know about the trend in the movement of yarn selling price and raw material cost for the 10 popular counts that have been considered for MPEI calculation. Like MPEI, the average yarn selling price and the average clean raw material cost for the above counts is set at the index level of 100 in April 2013.

Trend in the movement of MPEI and its influencing parameters during the period April 2022 – March 2023

The trend in the movement of MPEI for the period April 2022 – March 2023 is shown in Figure 2. Similarly, the trend in the movement of yarn selling price index and raw material cost index during the period April 2022 – March 2023 is shown in Figure 3.

MPEI during the first quarter (April – June 2022) had started with a healthy value of 112 index points. However, in the subsequent two-month period it had witnessed a huge reduction and remained at 89 index points in June 2022. This huge reduction in the quarter is entirely due to increase in the raw material cost

Ex-mill yarn selling price (YSP) (Rs/kg)	Yarn quality
Raw material cost (RMC) (clean material cost) (Rs/kg of yarn)	- Count CV%
Net output value (NOV) (Rs/kg of yarn & Rs/spl./8 hrs.)	- Strength CV%
TCI (techno-commercial index)	- CSP
OTCI (overall techno -commercial index)	- U%
RMC as a % of YSP	- Imperfections/1000 m
Yarn realisation (%)	- Hairiness Index
Production/spindle (rotor)/8 hours (g)	

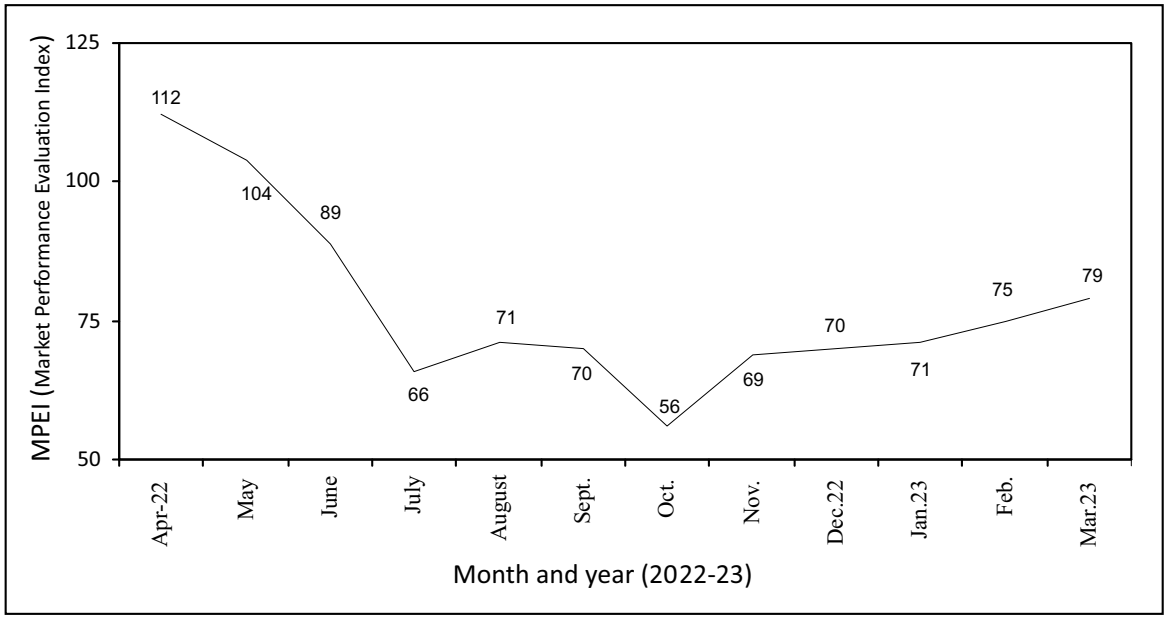


Figure 2 Market Performance Evaluation Index (MPEI)

during the 3 months period. The yarn selling price index (YSPI) remained almost at the stagnant level at 163, 167 and 167 index points during April, May & June 2022 respectively, whereas the raw material cost index (RMCI) had registered at 213, 227 and 234 index points respectively during the above 3 months (Figure 3).

The second quarter of the financial year (July – September 2022) was so critical in which the MPEI had further reduced to 66 index points in July 2022, which is 23 points lower than that prevailed in June2022. This was mainly due to reduction in the yarn selling price (YSPI: 153) with a contradictory increase in the raw material cost (RMCI: 237). By the end of this quarter, the YSPI further witnessed a reduction and remained at 147 index points with RMCI at 224 index points. Due to the above, the MPEI registered at 70 index points in September 2022.

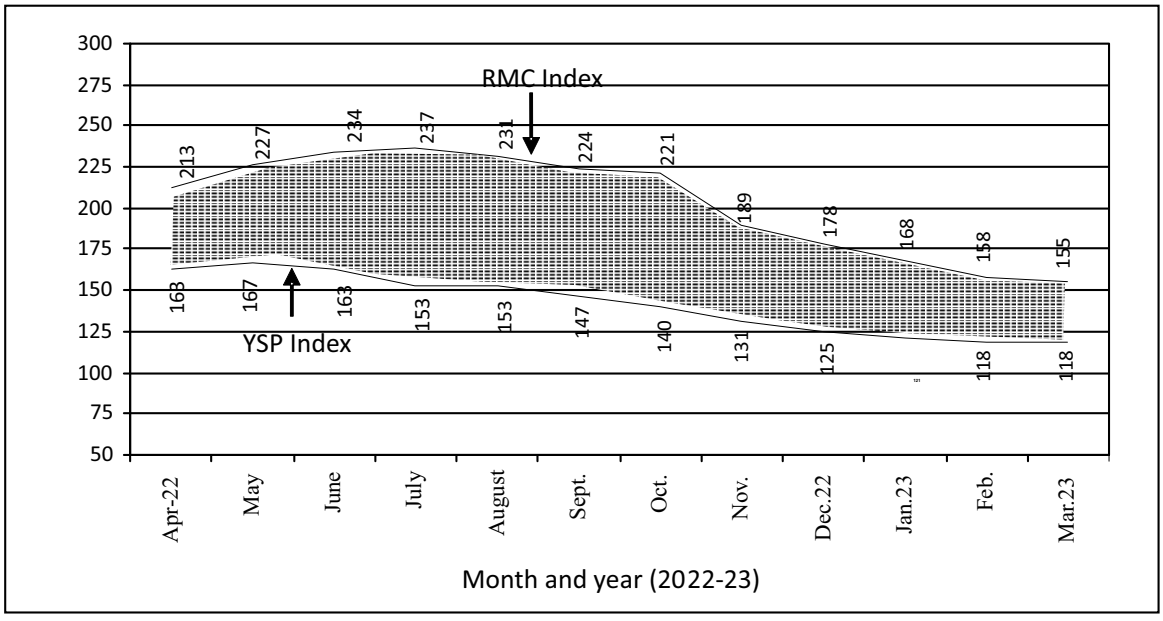


Figure 3 Yarn selling price index (YSPI) and Raw material cost index (RMCI)

In October 2022, the MPEI had registered for a record low value of 56 index points which was mainly due to low yarn selling price (YSPI: 140). In the subsequent months also, the YSPI has witnessed further reduction and registered at 131 and 125 index points in November and December 2022 respectively. At the same time, the RMCI also followed a reduction and recorded at 189 and 178 index points in the above two months. In effect of the above, the MPEI had ended with 70 index points in December 2022.

During the last quarter, MPEI started showing an increasing trend of 71, 75 ad 79 index points for the month January, February and March 2023 respectively. This increasing trend was mainly due to substantial reduction in the raw material cost which offsets the marginal reduction in the yarn selling price during the quarter.

Raw material cost (RMC), yarn selling price (YSP) and net out-put value (NOV) of a few popular counts during the past 10 years (April 2013 – March 2023)

The trend in the movement of RMC, YSP and NOV of a few popular counts during the past 118 months (April 2013 to March 2023) is shown in Figures 4 to 11.

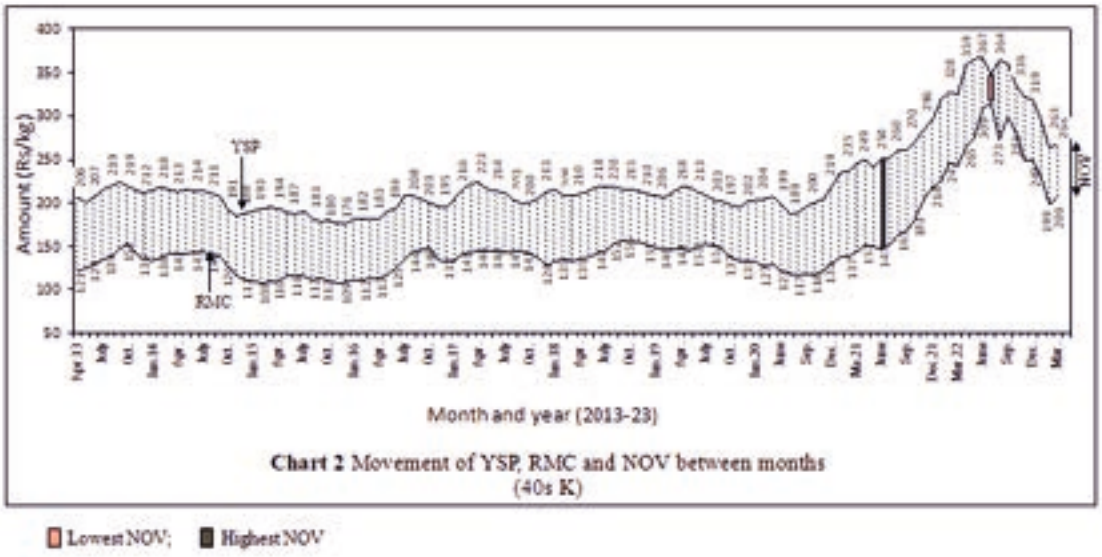


Figure 4 Movement of YSP, RMC and NOV between months (40s K)

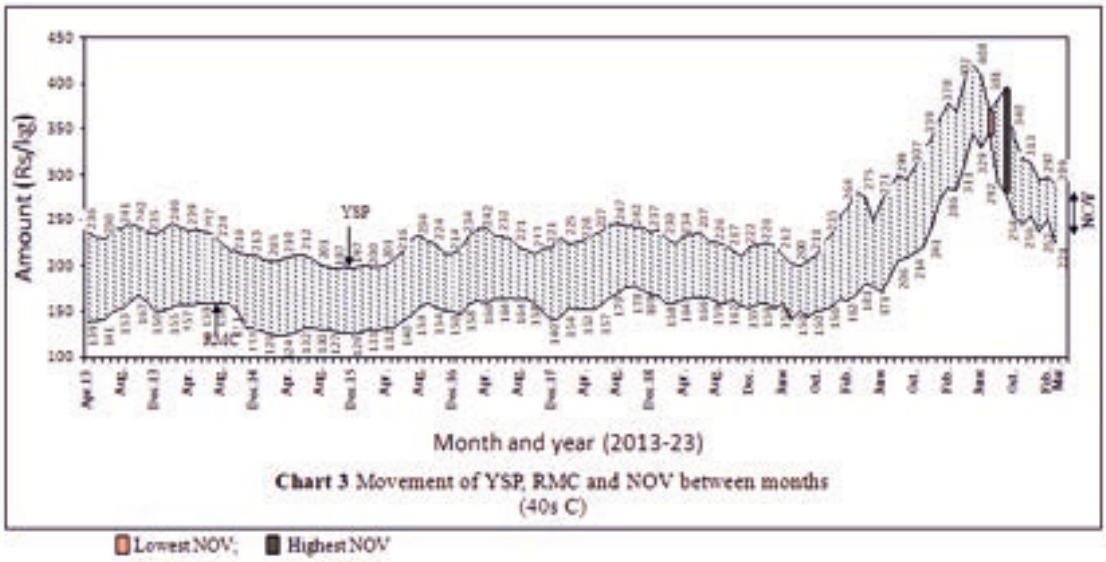


Figure 5 Movement of YSP, RMC and NOV between months (40s C)

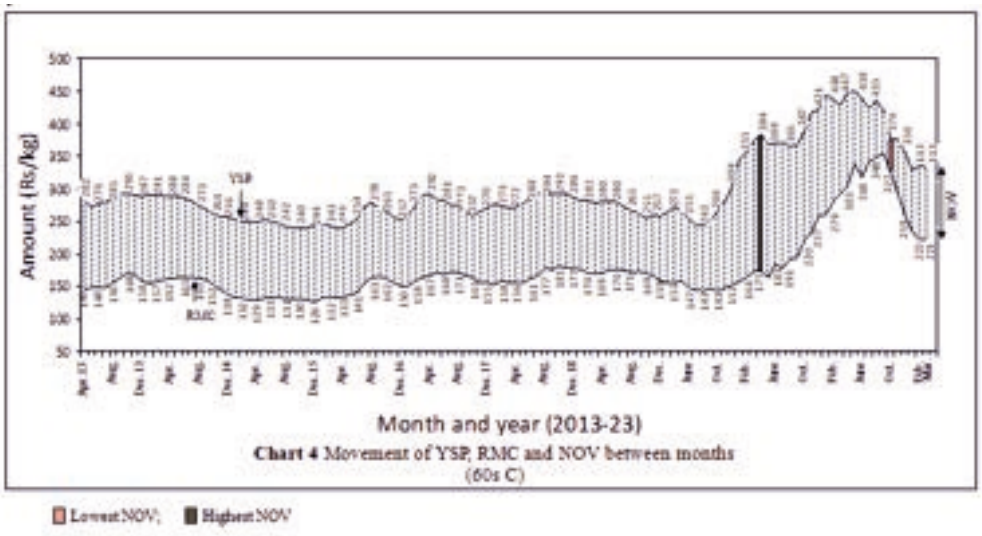


Figure 6 Movement of YSP, RMC and NOV between months (60s C)

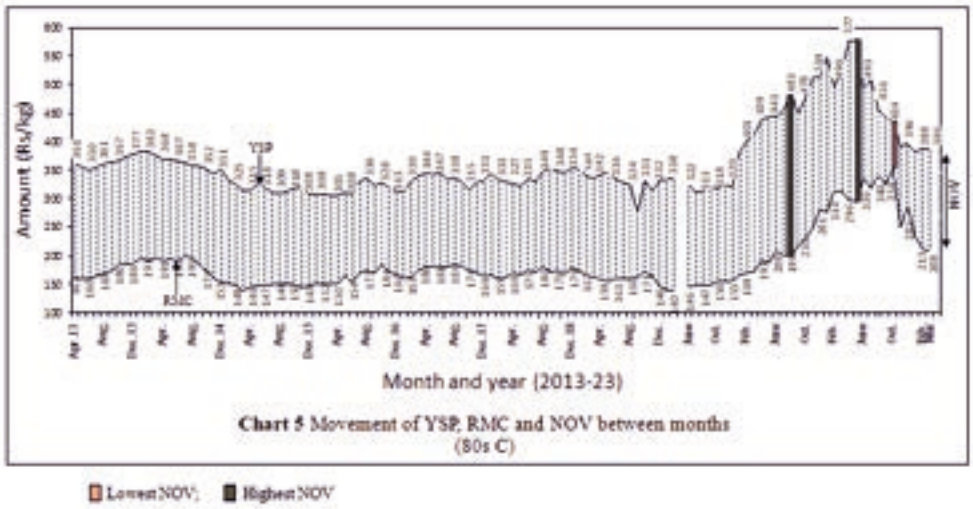


Figure 7 Movement of YSP, RMC and NOV between months (80s C)

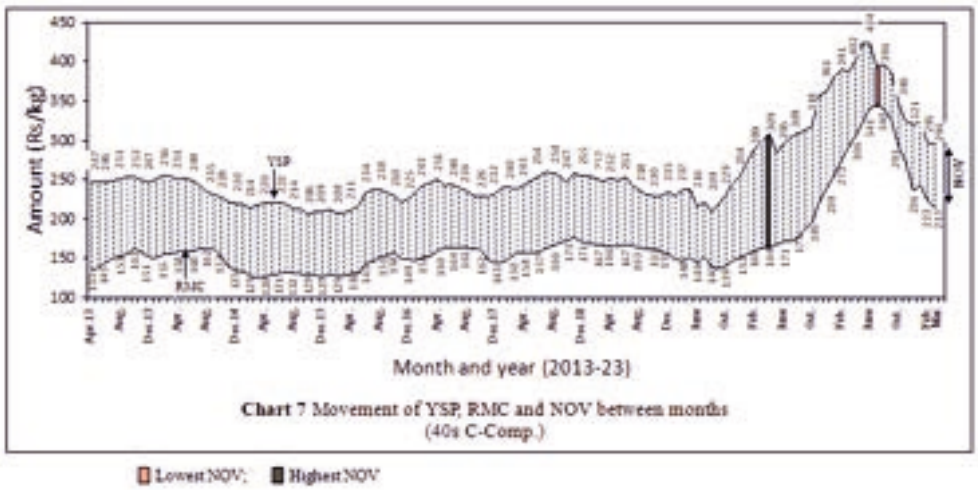


Figure 8 Movement of YSP, RMC and NOV between months (40s C - Comp.)

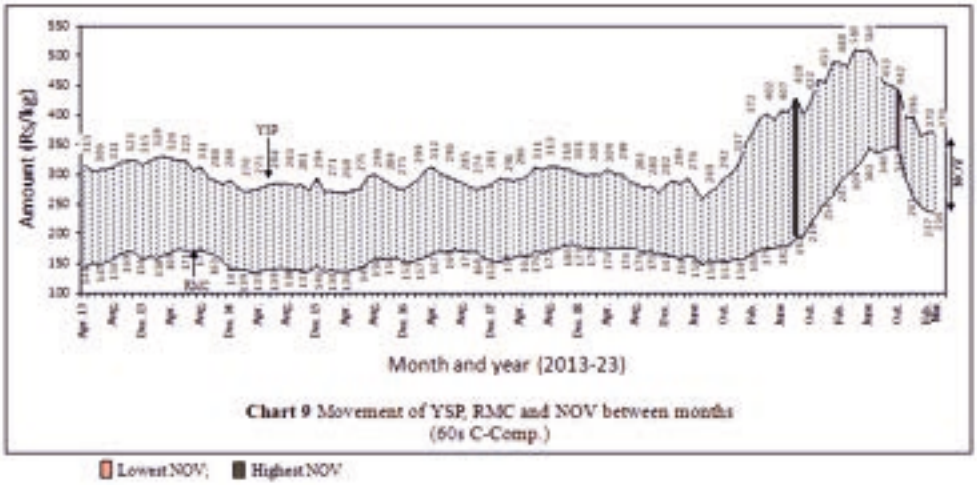


Figure 9 Movement of YSP, RMC and NOV between months (60sC - Comp.)

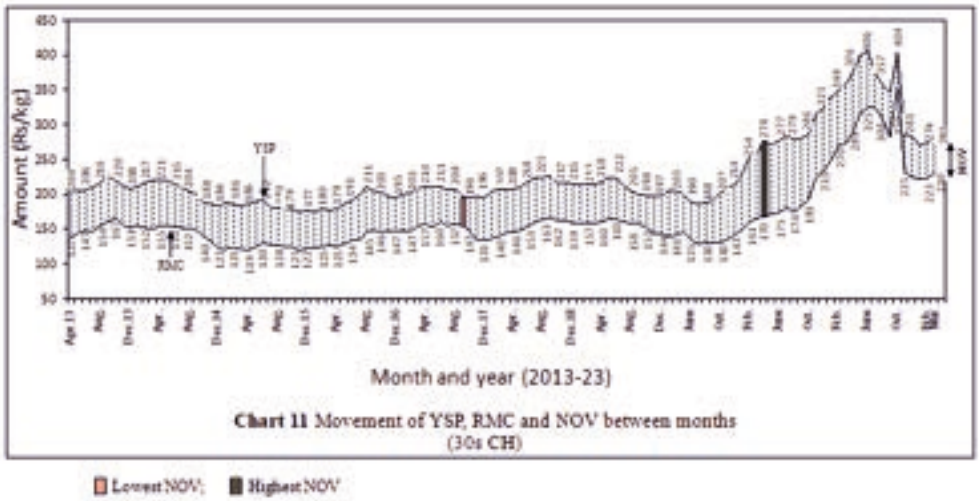


Figure 10 Movement of YSP, RMC and NOV between months (30s CH)

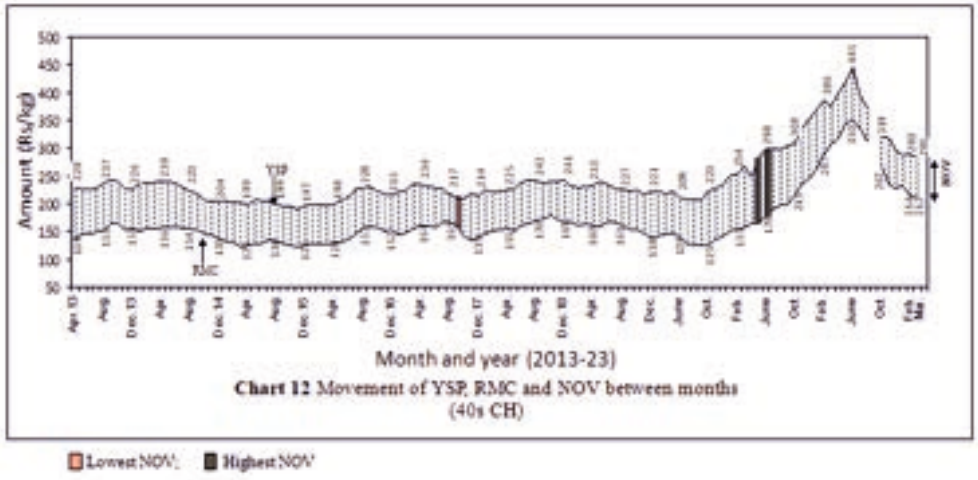


Figure 11 Movement of YSP, RMC and NOV between months (40s CH)

ENERGY MANAGEMENT

AN INTELLIGENT CONTROLLER FOR IMPROVING THE "OEE" OF OHTCs

The project has been conceived to be carried out focusing on 2 aspects namely, software and hardware. The parameters to be measured and the functions of the OHTCs that need to be tracked have been finalized. Wire framing and designing the layout and structure of the"app" (application software) have been done and the "app" architecture is well prepared in MS PPT for explaining the project and its requirements in an efficient way to the project developers. Few OEMs have been approached for a partnership in the development of the project. An "app' for tracking and tracing of OEE (Overall Equipment Effectiveness) and SEC (Specific Energy Consumption) on a real time basis using state of the art technologies is planned. The ROI for an OHTC after incorporating the software, has been worked out and the OHTC manufacturers would be persuaded to incorporate this software while selling their product as a package.

The project blueprint is ready and SITRA is exploring for an industrial partner to carry out the industrial trials and take up the work in real earnest.

A STUDY TO DEVELOP COUNT-WISE POWER CONSUMPTION STANDARDS IN TERMS OF kW PER 1000 SPINDLES FOR"G1G2G3" MACHINES OF RING SPINNING PROCESS PcS"GPA" (Power consumption Standards Generative Pre-trained App)

Energy (electricity, LPG, HSD and HFO, coal and firewood etc.,) being a costly input, has a definite say on deciding the selling cost of the Textile products. In spinning mills, electrical energy has a major share in the energy pie. There are challenges to mills in identifying and understanding the core issues responsible for higher energy consumption and the part or section of machines responsible for higher power use. By a systematic addition of energy efficient equipment, it would be possible to realize sizable reduction in the cost of production. For doing this, it is essential to have benchmarks for power consumption of each ancillary.

It is planned to conduct an elaborate power study in spinning mills to develop standards for power consumption of machines. The machines/system of ring spun single yarn manufacturing process will be segregated into 3 sub-groups namely "G1, G2 and G3"conveniently for the purpose of analyzing energy efficiency in detail. The"G1,G2 & G3" groups will be analysed individually up to the last detail from energy efficiency front.

Aim of the project

Improving energy efficiency of textile sector.

Objectives of the project

- To study count-wise power consumption of yarn manufacturing process
- To measure power consumption of the machines
- To develop power consumption standards in terms of power use per 1000 spindle basis (PTS)
- To evaluate the standards with the actual consumption of the industry.
- To develop an application software for power consumption standards

PTS (Power use per 1000 spindle)

The sample view of"PTS" chart proposed to be developed for energy consumption standards is shown below.

Table PTS

MACHINE GROUP	PROCESS TYPE	SECTION	POWER (kW) CONSUMPTION STANDARDS POWER CONSUMPTION OF 1000 SPINDLE (PTS) IS GIVEN BELOW									
			COUNT									
			20	25	30	35	40	50	60	80	100	120
G1	MACHINES MAIN PROCESS	BR										
		CRD										
		CBR										
		DRW										
		S/F										
		R/F										
		WDR										
	S-TOT											
G2	AWES	BR										
		CRD										
		CBR										
	PMF	BDRW										
	PMF	FDRW										
	PMF	S/F										
	OHC											
	PMF	R/F										
	OHC											
	COM											
	SUC	WDR										
	S-TOT											
G3	RY ANCILLA	H.P										
		A-C										
		LIG										
		S-TOT										
G		TOTAL										

CHEMICAL PROCESSING

ANTIOXIDANT COSMETOTEXTILES: DURABLE NANO-ENCAPSULATED VITAMIN E FINISHES ON TEXTILE FABRICS AND ITS CONTROLLED RELEASE STUDY (Funded by DST-WOSA)

An attempt has been made to develop Antioxidant Cosmeto textiles for controlled release of Vitamin E for the welfare of pre-term infants, patients having vitamin and immune deficiencies. This project is funded by DST-WOS A for the period of three years.

During this year, some of the characterization studies such as FT-IR analysis, zeta potential, absorbency, air permeability, moisture regain, antioxidant activity, durability and *in-vitro* and *in-vivo* release studies were performed for the vitamin E nano-formulation finished fabric and the results are discussed below.

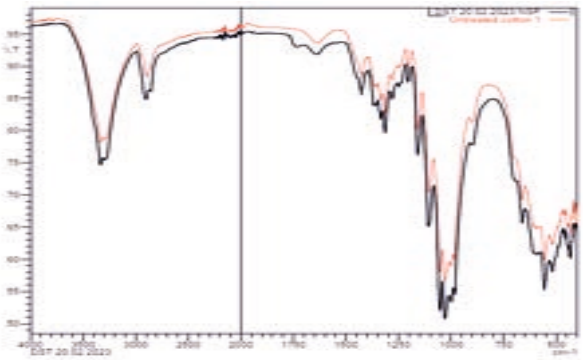


Figure 12. The overlay FT-IR spectra of untreated and treated fabric

Physical characterization of the fabric

The physical characteristics of the untreated and Vitamin E nano-formulation treated fabric were evaluated as per the standard test methods and the

results are given below. There is a considerable reduction in the air permeability through the treated fabric due to the finishing applied on the fabric. The zeta potential of the treated and untreated cotton fabric was determined by SURPASS Zeta potential analyzer. The decrease in the zeta potential value confirms the presence of vitamin E nano-formulation on the fabric.

Table 7 Physical properties of untreated and treated fabric

S. No.	Parameter	Untreated	Treated
1.	Absorbency (seconds)	0	0
2.	Moisture regain (%)	7	6
3.	Air permeability ($cm^3/cm^2/s$)	52.4	13.1
4.	Zeta potential ζ (mV)	-18.13	-3.44

Antioxidant activity nano-formulation and finished fabric

Trolox Equivalent Antioxidant Capacity (TEAC) was evaluated for the prepared nano-formulation and nano-formulation treated fabric. The Scavenging activity of nano-formulation was 78.62 % at the concentration of 100 mg/L whereas for the Trolox standard it is 96.05 %.

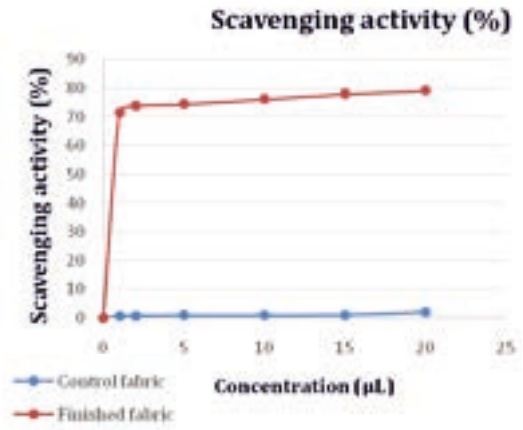


Figure 13 Free radical scavenging activity of control and treated fabric

Durability of the finished fabric

The durability of the vitamin E nano-formulation treated fabric was evaluated as per AATCC Test Method 61(2A)-1996 using a standard accelerated laundering machine (Model: SDL ATLAS). In this method, one cycle of laundering is equal to five launderings of medium or warm washing at 38 ± 3 ºC. Each cycle lasted 45 min at 50 ºC with non-ionic detergent. The fabric size used was 5 cm × 15 cm. In this study, all treated fabrics were subjected to 5 and 10 consecutive launderings. All fabrics were finally rinsed with distilled water thoroughly and dried at room temperature and then the HPLC analysis was performed for the qualification of vitamin E on the washed fabric. The vitamin E nano-formulation treated fabric is durable upto 10 washes.

In-vitro and In-vivo release study

In-vitro release study was examined using Franz-diffusion cell apparatus using cellulose nitrate as membrane. The formulation treated fabric with ethanol was kept as a donor phase and pure ethanol was used as receptor phase. The in-vitro release study was performed for the duration of 24 h and the released vitamin E was quantified by HPLC.

In-vivo release study was conducted using twenty four adult male albino Wistar rats (6-non treated, 18 – treated) (6 –weeks), weighing 200 to 250 g were used for the present study. All animals were purchased from Biogen animal facility, Bangalore.

On experimental day the rats were anaesthetized by ether anaesthesia prior to study, the dorsal fur of the animal was shaved with an electric clipper, the test samples wrapped around the shaved area and the blood was collected from Retro-orbital sinus by using capillary tube by 6 time points (for example 0 h initial, 2, 4, 6, 12, and 24 h and to prepare blood plasma samples) for the quantification of vitamin E by HPLC. The release of vitamin E from the fabric was observed at various time intervals. The preparation of final report is in progress.

Summary

- The vitamin E nano-formulation was prepared and all proposed characterization studies were completed for the prepared formulation.
- The stability of the prepared formulation was examined by HPLC.
- The prepared vitamin E nano-formulation was applied on the cotton fabric by pad-dry-cure method with better add-on% by optimizing the crosslinking agent, curing time and temperature.
- The proposed physical and characterization parameters were completed for the finished fabric.

- The antioxidant activity of prepared formulation and vitamin E nano-formulation treated fabric were studied by Trolox Equivalent Antioxidant Capacity (TEAC).

- The durability and vitamin E release study (in-vitro and in-vivo) were completed for the finished fabric.

PILOT PROJECT ON "SUPPLY OF PRE-DYED AND STARCHED COTTON YARN IN CONE FORM USING CHEESE DYEING MACHINES" TO HANDLOOM WEAVERS IN TAMIL NADU
(Sponsored by the Government of Tamil Nadu)

Tamil Nadu possesses a number of Handloom weavers' co-operative societies for manufacturing of fine quality sarees, dhoties, bed sheets, curtains, shirting, etc., primarily by using yarns and materials from co-operative mills and other organised sector mills. Many of the handloom weavers' societies consume small quantity of yarn say in the range of 100 to 500 kg per month only. Hence, in the present scenario, these societies procure yarn in hank form, get them sized by primitive techniques viz., cistern dyeing & sizing methods, open vat dyeing process, etc, and finally converts the yarn into warp sheet or weft pirn as the case may be. In this regard, the National Handloom Development Corporation offers a subsidy of upto 20% for manufacturing and supply of yarn in hank form to the Handloom sector. However, the processing of yarn in hank form has certain disadvantages.

With the advent of latest technologies, it is possible to carry out the dyeing and sizing of yarns in the cheese form using cheese dyeing machines. SITRA has conducted a preliminary comparative study between dyeing and sizing of yarn in hank form vis-à-vis in cone form. In the recent study conducted by SITRA, a low add-on, low viscous solution was used to size the yarn in cheese form. The preliminary study has shown that dyeing and sizing of yarn in cheese could lead to the following advantages:

- Ø Quality of yarn dyed and sized in cheese form in terms of CSP, Hairiness count, imperfections, uniformity of size, etc is better than that of yarn dyed and sized in hank form. Hairiness reduction to the tune of 20% to 50% was observed in this process.
- Ø No additional process is involved (separate sizing process not required)
- Ø Yarn wastages are less when compared with hank form dyeing and sizing
- Ø Fastness properties are good when compared to dyeing in hank form
- Ø The method is suitable for the lots ranging from smaller to larger.
- Ø Does not require skilled artisans to do the job and the overall manpower requirement is less.
- Ø As the dyeing and sizing would be done in organized dyeing units, the effluent arising out of this process can be handled properly in a Zero Liquid Discharge system (ZLD) as per pollution control board norms.
- Ø Cost effective when compared to hank dyeing and sizing process for all sizes of lots. A cost saving to the tune of 15% to 20% can be expected by dyeing and sizing in cheese form over dyeing and sizing in hank form.

Based on the above mentioned study, SITRA approached the department of Handlooms, Government of Tamil Nadu for a pilot project titled "Supply of Pre-dyed and starched cotton yarn in cone form using cheese dyeing machines to the Handloom weavers. The project was sanctioned by the Government of Tamil Nadu in the 12th state level project approval committee through the TN Handloom Development Corporation in handloom weaving at Chinnapampatti cluster (Tiruchengode circle).

Objectives and Methodology of the study:

- Ø To carry out dyeing and sizing of about 450 Kg. of 80s Combed yarn in cheese form using cheese dyeing machine.
- Ø To carryout dyeing and sizing of about 20 Kg. of 80s combed yarn in hank form using traditional dyeing method.
- Ø To test the quality parameters of hank and cheese sized yarn and compare the obtained results in terms of strength.
- Ø To test the quality parameters of process effluent and to compare the pollution control norms.
- Ø To analyze the cost viability of starching process.
- Ø To co-ordinate with the Chinnapampatti, Omsakthi and R. Pudupalayam Handloom weavers' Co-operative societies for

conducting the assessment of performance of the above dyed and sized yarns in their weaving sheds respectively.

- Ø To study the incidence of waste, breakage rates, etc on the quality of fabric and submit a detailed report to the Department of Handlooms.

Pilot Project on Dyeing and sizing of yarn in Cheese form

Based on the above preliminary study, SITRA has planned to take trials on pilot scale machines (above 25 kg). Based on the suggestions given by Department of Handlooms, six different shades have been identified for the project and total quantity is about 450 Kg. of 80s combed cotton yarn in cone form which is equivalent to the 3 months consumption of 2 weavers' societies as prepared. The 2 weavers societies included for the pilot scale study are a) S.902 Chinnappampatti HWCS, Chinnappampatti b) S.924 R. Pudupalayam HWCS, Rasipuram. Another 20 Kg. of 80s Combed cotton yarn in cone form is needed for SITRA to co-ordinate and arrange for a comparative study between dyeing and sizing of yarn in cheese form vis-a-vis in cone form is also procured. The project is intended to be carried out in two phases and Phase 1 is currently in progress.

A STUDY ON FIXING OF INLET QUALITY STANDARDS FOR THE CETPs IN TAMIL NADU (Sponsored by TNPCB)

M/s.Tamil Nadu Pollution Control Board (TNPCB) retained SITRA to study the inlet effluent water quality from the CETPs of Tamil Nadu for fixing the inlet quality standards. The idea behind the survey is to explore the possibilities of fixing the quality standards for inlet effluent water. In the view of different diversities in the manufacturing process involved in the textile bleaching and dyeing units, a detailed study was planned in order to arrive the inlet characteristics to the individual CETPs. Subsequently, SITRA had formed a team of officials to carry out the study by visiting all the CETPs which are in working condition, collecting necessary information and testing of Inlet effluent samples collected from each of these CETPs.

Objective and methodology of the study

- Ø The technical team members of SITRA to visit all the 20 CETPs individually and collect the inlet effluent water.
- Ø Collect the details of nature of processing units covered, capacity of CETP, treatment techniques followed and also collect inlet effluent quality as recorded by the CETPs.
- Ø Testing of the inlet effluent water samples collected from all CETPs.
- Ø Analyze and compare the test result data's with the previous results.
- Ø Prepare the report based on the data analysis, followed by team discussion.

Details of CETPs in which the study was conducted

In all 20 CETPs were covered out of which 18 CETPs are in Tirupur, CETP in Perundurai and ECTP in Muthialpet. Since the M/s Ayyampet, Muthialpet Bleaching and Dyeing Effluent Treatment Company Limited, Kancheepuram CETP was in closed condition, the study could not be conducted in this CETP. The Study was conducted in the remaining 19 CETPs.

Findings of the study

SITRA has fixed the common norms for inlet quality standards for 17 CETPs and the individual norms for Vettuvapalayam CETP and Perundurai CETP. Because the Vettuvapalayam CETP only receives effluent from bleaching units, and the Perundurai CETP has a separate treatment sequence for wash water and dye bath effluent. SITRA recommended values were arrived based on the SITRA's test reports on effluent samples collected from the CETPs, CETP In-house report (1 year average), DOE or TNPCB old report (if any) and local conditions & recommendations from the CETPs. Total Dissolved Solids (TDS) is the major parameter which can directly influence the cost of effluent treatment and also impact the scaling potential of the effluent. Hence, CETPs and their member units may take measures to minimize the TDS in inlet effluent. Further, as requested by the Board, additional quality parameters like total hardness, total alkalinity, colour and turbidity have also been included in the report.

Earlier, the water consumption per kg of knit fabric while using soft flow dyeing machines was around 65-70 litres with a Material to Liquor ration (MLR) was in the range of 1:6.5 to 1:7. With advent of low liquor ratio soft flow / air flow dyeing machines (with MLR say 1:3 to 1:4) and various measures taken by the units in reducing the no. of baths employed for the whole processing cycle, the water consumption has come down

significantly to 30 to 40 litres / kg. of material. However, it may also be noted that while the quantity of effluent has come down drastically due to the above reasons, the quality / effluent load in the given volume has only increased in terms of TDS, BOD, COD, Colour, Turbidity, etc. This has necessitated that the CETPs to adopt newer effluent treatment methods viz., decolourisation with Chlorine, use of Cationic Polymer for precipitation, use of electro coagulation methods, use of ultra and nano-filtration, etc. Due to the constant efforts by the CETPs and the dyeing units, the cost of effluent treatment at CETPs has also come down in the recent past to as low as 16 paise per litre of inlet effluent from 25 to 30 paise per litre.

Due to the above reasons, different chemicals used and the varying nature of member mills among the CETPs, it is difficult to fix norms for quality of inlet effluents. The test results of samples collected from various CETPs also varied between from one CETP to another CETP.

SITRA has recommended common norms for inlet quality standards for 17 CETPs and the individual norms for Vettuvapalayam CETP and Perundurai CETP. The details are summarized in the below table. It may be noted that these values were arrived at based on the current level of technology being used by the respective member mills and their CETPs, test results obtained and the data given by these CETPs during the study. Any change in the technology adopted, dyes and chemicals used by the units, type of treatment processes adopted by the CETPs is likely to affect the quality of inlet effluents and may necessitate the revision of the norms.

S. No.	General Parameters	Units	Common Norms for 17 CETPs	Vettuva-palayam CETP	Perundurai CETP (Washing)	Perundurai CETP (Dyeing)
1	pH		8.0 - 10.0	8.5-9.5	7.5.-8.5	12
2	BOD (3 days)	mg/l	250 - 500	150-220	300-400	400-800
3	COD	mg/l	550-2000	500-700	800-1000	800-1200
4	TSS (Total Suspended Solids)	mg/l	100-600	100-200	150-200	300-800
5	FDS (Fixed Dissolved Solids)	mg/l	7000 - 12500	7500-10600	2756	24000
6	TDS (Total Dissolved Solids)	mg/l	8000 - 12000	4000-4800	2500-4000	28000 55000
7	Oil & grease (Maximum)	mg/l	15	10	10	10
8	Ammoniacal - Nitrogen (Maximum)	mg/l	12	0.5	10	1
9	TKN (Total Kjeldahl Nitrogen) (Maximum)	mg/l	16	20	50	11
10	Nitrate (Maximum)	mg/l	10	5	10	5
11	Nitrogen (Maximum)	mg/l	10	1	10	6
12	Phosphates as P	mg/l	25	1	2	2
13	Chlorides	mg/l	1000 - 5300	1500-1600	800-1000	7500-8000
14	Sulphates as SO_4	mg/l	1000- 6000	400-500	800-1000	9100-9500
15	Fluoride F (Maximum)	mg/l	2	2	2	1

S. No.	General Parameters	Units	Common Norms for 17 CETPs	Vettuva-palayam CETP	Perundurai CETP (Washing)	Perundurai CETP (Dyeing)
16	Sulphide as S2 (Maximum)	mg/l	2	2	25	1
17	Phenolic compounds (as C_6H_5OH) (Maximum)	mg/l	5	5	5	2
18	Total Residual Chlorine (Maximum)	mg/l	2	0.5	1	1
19	Zinc (Maximum)	mg/l	1	1	1	1
20	Iron (Maximum)	mg/l	1	1	2	1
21	Copper (Maximum)	mg/l	3	3	3	3
22	Trivalent chromium (Maximum)	mg/l	2	2	2	2
23	Manganese (Maximum)	mg/l	2	2	0.1	2
24	Nickel (Maximum)	mg/l	1	1	1	1
25	Arsenic (Maximum)	mg/l	0.05	0.05	0.05	0.05
26	Cyanide as CN (Maximum)	mg/l	0.05	0.05	0.05	0.05
27	Vanadium (Maximum)	mg/l	0.05	0.05	0.05	0.05
28	Lead	mg/l	0.3	0.3	0.3	0.3
29	Hexavalent chromium	mg/l	0.2	0.2	0.2	0.2
30	Selenium	mg/l	0.05	0.05	0.04	0.05
31	Cadmium	mg/l	0.2	0.2	0.2	0.2
32	Mercury	mg/l	0.01	0.01	0.01	0.01
33	Total Hardness	mg/l	100-500	400-500	115-300	400-500
34	Total Alkalinity	mg/l	800-2000	1000-1200	1500	1800-2000
35	Colour (Maximum)	Hazen	6000	500	_	-
36	Turbidity (Maximum)	NTU	130	60-70	200-400	-
37	Silica SiO_2 (Maximum)	mg/l	50	-	15	-
38	Temperature (Maximum)	degree	35	35	35	35

DEVELOPMENT OF NATURAL HERBAL EXTRACT COATED SEED PROTECTION BAG USING NATURAL FIBRES WITH LONG LASTING MECHANICAL AND INSECTICIDAL PROPERTIES (Funded by NTTM, Ministry of Textiles, Govt. of India)

In India, annual storage losses have been estimated at 14 million tons of food grain worth of Rs. 7,000 crore every year in which insects alone account for the loss of nearly Rs. 1,300 crores. Storage loss in our country is relatively high due to improper storage structure, lack of knowledge about storage to the farmers and traders and improper management during storage period. Among all the biotic factors, insect pests are considered most important and cause huge loss of grains (30%–40%). According to a World Bank Report, post-harvest losses in India amount to 12 to 16 million metric tons of food grains each year. In another survey, the Seed loss (28.9%) in India was reported to be the highest among developing countries.

Seed and grain storage loss is a major concern to post-harvest losses, which is considered as an important cause of food insecurity for farmers towards retaining the quality of the seeds from processing time to planting time. Major insect pests of stored grains include lesser grain borer (*Rhizoperthadominica*), Rice weevil (*Sitophilusoryzae*), Khapra beetle (*Trogodermagranarium*), Rust red flour beetle (T*riboliumcastaneum*), Long headed flour beetle (*Latheticusoryzae*), Saw toothed beetle (*Oryzaephilussurinamensis*), Rice moth (*Corcyra cephalonica*), Almond moth (*Cadracautella*), Angoumois grain moth (*Sitotroga cerealella) and* Pulse beetles : *Callosobruchuschinensis, C. maculates, C. analis. The non-insect pests include rodents, mites and fungi.*

Current practices

Proper seed and grain storage conditions are required to reduce grain and seed losses. In the conventional method of storage, woven bags or crips are used for the storage of seeds and grains. However, these materials are ineffective against molds and insects which are likely to be there in the seed and grain before storage stage. In order to improve seed and grain storability, different chemicals are being used in these bags and eventually they seem to mix with the grains and possibly add hazardous compounds to the plant. The hermetic storage without any chemicals is effective, as they have minimal storage losses; however, they are prone to damage and costlier. The factors that render a crucial role in storage loss can be classified as physical, biological and socio economic. The physical factors are temperature, moisture and oxygen; biological factors are insects / pests and rodents which affect grain quality and grain losses. Mold formation and their growth leads to production of different mycotoxins, considered as toxic chemicals and unsuitable for human consumption. The usage of different protection bags depends on socio economic factors such as farmer's family size; land holding size, grain storage period, income from farm, accessibility to road, seed and grain's market price and seed, grain safety during storage.

Proposed concept

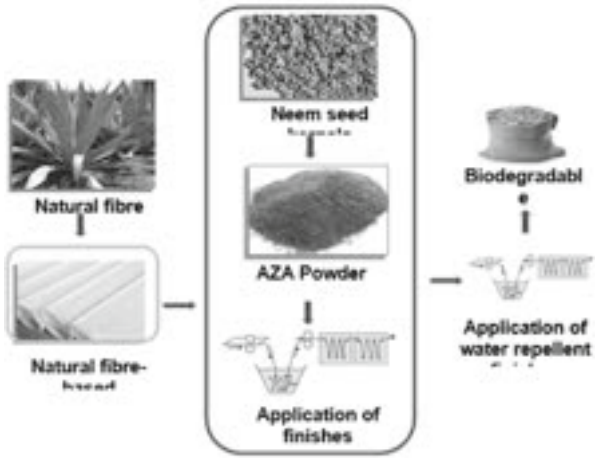
The vegetable fibres such as Agave Americana, sisal, Jute and pineapple leaf have been explored in technical textile applications such as reinforced composite materials, paper making, non-woven fabrics, geotextiles, etc. These fibres are known for their long lasting mechanical properties and eco-friendliness. This project aims to make use of the long lasting mechanical properties of these natural fibres to develop seed protection / grain storage bags.

Objectives

- Ø To extract natural fibre from Agave family of fibres, collect Jute fibres of suitable quality and evaluate the properties these fibres
- Ø To prepare yarns made of these fibres either alone or in combination with different blend ratios in order to achieve optimal properties as required for the production of seed protection bags
- Ø To convert the prepared yarn into fabric with long lasting mechanical properties using suitable weaving or other methods.
- Ø To extract the active matter (ie.) Azadirachtin (AZA) from a plant or tree belonging to Mahogany family by solvent extraction / extraction by using super critical carbon dioxide.
- Ø To apply the extracted matter along with a water proofing chemical such as natural wax, silica sols and / or a few other cross linking agents on the developed fabric by padding / coating methods to make it water repellent and to give necessary protection from insects.

To develop prototype seed protection / grain storage bags and evaluate the prepared product for mechanical & insecticidal properties, other desired qualities as required for a seed protection bag and its durability.

Methodology



With these insecticides coated protection bags, the mortality rates for insects, pests and rodents can be increased, oviposition (number of eggs laid on the seed) rates can be reduced, damages to the stored seeds can be reduced with the decreased number of emerging insects (dead and living) and the weevil (the larvae of which typically develop inside seeds) perforation index (evaluating value of infestation) can be calculated.

DEVELOPMENT OF SCOURING PROCESS CHEMICALS FOR REDUCTION OF TDS & COD IN THE RESULTANT EFFLUENT

Water pollution is a major threat across the world due to the release of toxic and hazardous substances into the water bodies. Anthropogenic influence of water resource is a global problem. The major pollutants such as dye and other contaminants from the textile industries are said to affect the aquatic life. The discharge of textile effluent into water bodies adversely affects water resources, soil fertility, aquatic organisms and ecosystem integrity. Textile industry wastewater carries the contaminants responsible for the continuous pollution of the environment. Textile wastewater contains substantial pollution loads in terms of total dissolved solids (TDS).

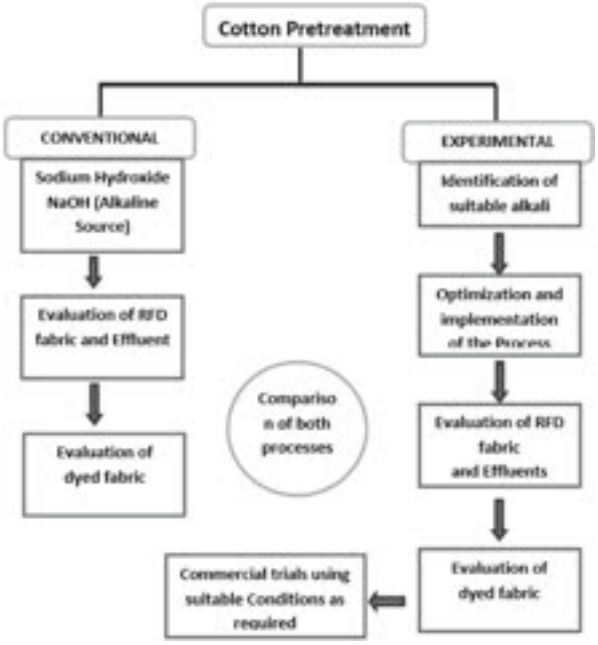
Many wastewater treatment plants are facing significant challenge of treating the high level of total dissolved solids (TDS) in plant influent. TDS can dramatically affect plant operation and can decide effluent operation cost.

In order to overcome these issues, SITRA has intended to develop a pre-treatment process for reduction of TDS & COD in the effluent.

Objectives of the study

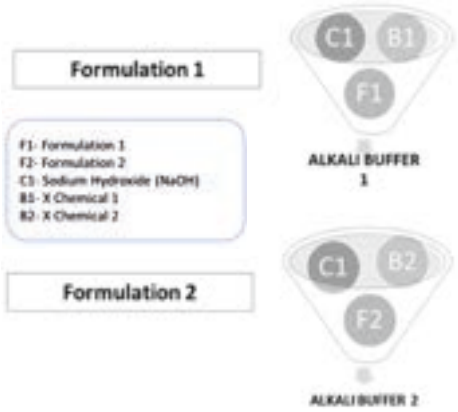
- To develop a process for the reduction of TDS in textile processing effluent.
- To identify suitable alkali buffer source for reducing the use of strong alkali like Caustic Soda
- To carry out the combined scouring & bleaching of cotton materials using the developed recipes
- To evaluate the cotton materials thus bleached using the developed pretreatment process for quality parameters viz., Whiteness Index, Degree of polymerization, Copper Number, Absorbency, Vertical wicking, etc.
- To assess the effluent from the conventional pre-treatment process and the SITRA developed pre-treatment process for TDS, TSS, COD, BOD

Methodology and work plan



Identification of suitable alkali buffer

During this study, an attempt has been made to develop a suitable processing methodology for scouring process chemicals for reduction of TDS & COD in the resultant effluent. Different permutations and combinations were tried for the scouring process and the process parameters were optimized accordingly. SITRA has developed the scouring process recipes and initially applied in lab scale machine at SITRA and after confirmation the recipes, selective of 2 recipes were taken into trials at pilot scale HTHP dyeing machine. The optimized chemical formulation and scouring process recipe used for each of the processes are listed below in detail :



Results and discussions

Physical and chemical analysis

S. No.	Parameters	Conventional	Recipe 1	Recipe 2
01	Whiteness Index	64.6	61.2	64.3
02	Yellowness Index	8.5	9.3	8.3
03	Absorbency in sec	Below 1	Below 1	Below 1
04	Weight Loss due to pre- treatment (%)	1.2	1.54	1.81
05	Degree of Polymerisation	1623	2044	2865
05A	Cuprammonium Fluidity, Poise Inverse	6.74	4.04	1.54
05B	Copper number	0.15	0.13	0.15

Effluent Water Analysis

S. No.	Parameters	Conventio nal	Recipe 1	Recipe 2
01	pH Value Total	11.72	11.27	10.9
02	Dissolved Solids (TDS)	8144	5284	4872
03	COD	6076	4481	4162

Findings

- Ø From the evaluation of RFD fabrics obtained by the use of different recipes, it was noted that the fabric processed with recipe No. 2 was found to have a high degree of polymerization compared to that of conventional fabric and also there is 40% increase in strength was observed while using recipe 2.
- Ø The effluent water analysis revealed that Total Dissolved Solids (TDS) was reduced by 40 % compared to the conventional pre-treatment method.
- Ø There is a reduction in COD by about 30 % in recipe No.2 when compared with the conventional method.

Future work to be done

- Ø As per lab trial, recipe number 2 is selected for pilot scale trials.
- Ø Dyeing trials are to be taken with recipe number 2 to assess depth of shades against conventional dyeing.
- Ø To carryout commercial trials and to disseminate the technical know-how to prospective industries

DECOLOURIZATION OF DYE EFFLUENT WATER USING ECO-FRIENDLY NANOCOMPOSITE

This in-house project was started during the year 2021-22. The dye effluents from textile industries contain hydrolyzed dyes, heavy metals and suspended particles which are considered as major sources of environmental pollution. There are numerous chemical and physical techniques available for the removal of such contaminants. An attempt has been made to use nano- composites with the biopolymer support to act as a photo catalyst to remove colour from the textile industry dye effluents.

The initial trials on the preparation of CuO-ZnO Nanocomposites using a bio-polymer by co-precipitation method and decolourization of prepared dye solution were discussed earlier. The various parameters such as time, nanoparticle concentration, and Blue MR dye concentration were optimized for the effective decolourisation. The nanocomposites were

used as photo catalysts and added to the dye effluent, then irradiated by direct sun light. The reduction in BOD, COD of the treated dye effluent were also observed using the nanocomposite as a photocatalyst. Some of the characterization studies such as PSA (Particle Size Analysis), FTIR (Fourier Transform Infrared Spectrophotometry) were performed for the prepared nano-composite during this year. 15mg of the prepared nano-composite was found to be an effective concentration for the decolourization textile industry dye effluent with 300 CU. In addition to colour removal, chemical oxygen demand (COD) and biological oxygen demand (BOD) reduction were also investigated for the industrial dye effluent.

The work done during this year is as follows:

PSA and zeta potential analysis

The particle size and zeta potential of the prepared nano-composite were evaluated using Malvern particle size analyzer and Malvern Zetasizer. The measured particle size was 312.9 nm and the zeta potential of the prepared nanocomposite was -26.8 mV.

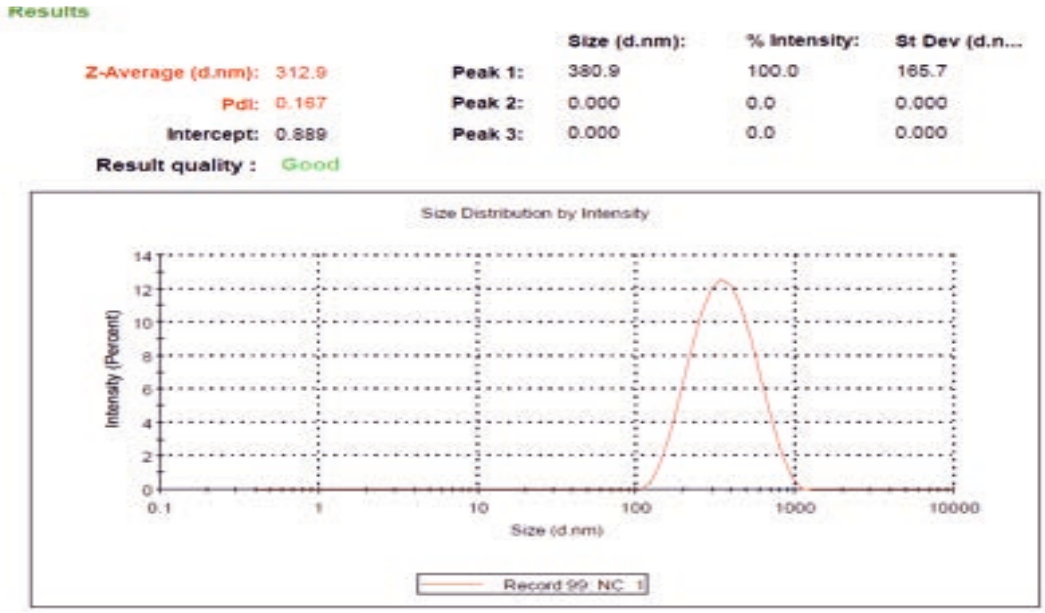


Figure 14. Particle size analysis of prepared nanocomposite

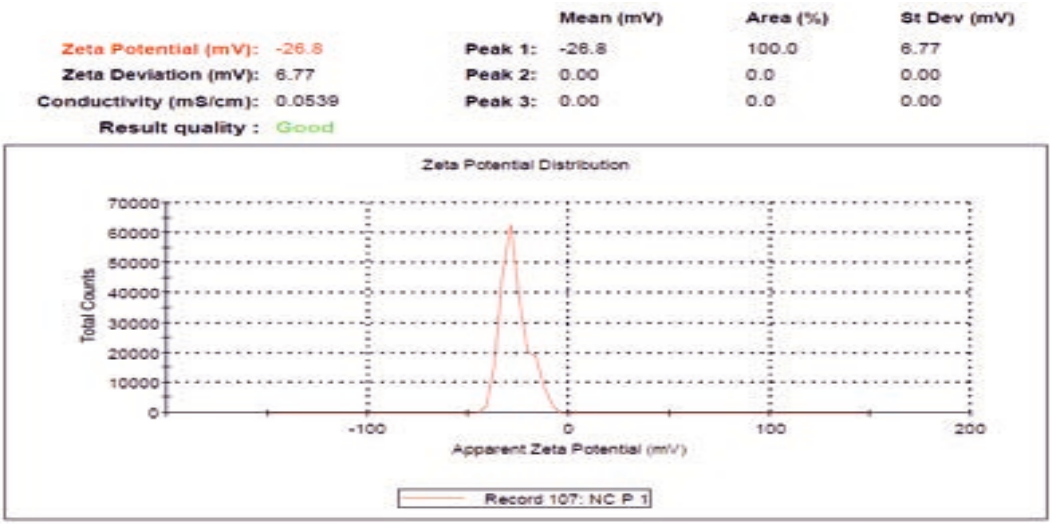


Figure 15. Zeta potential analysis of prepared nano-composite

FE-SEM analysis of nano-composite

The surface morphology of the prepared nano-composite was investigated by FE-SEM and illustrated in Figure 3. The diameter of the particles is in nm which is clearly shown in the FE-SEM image.

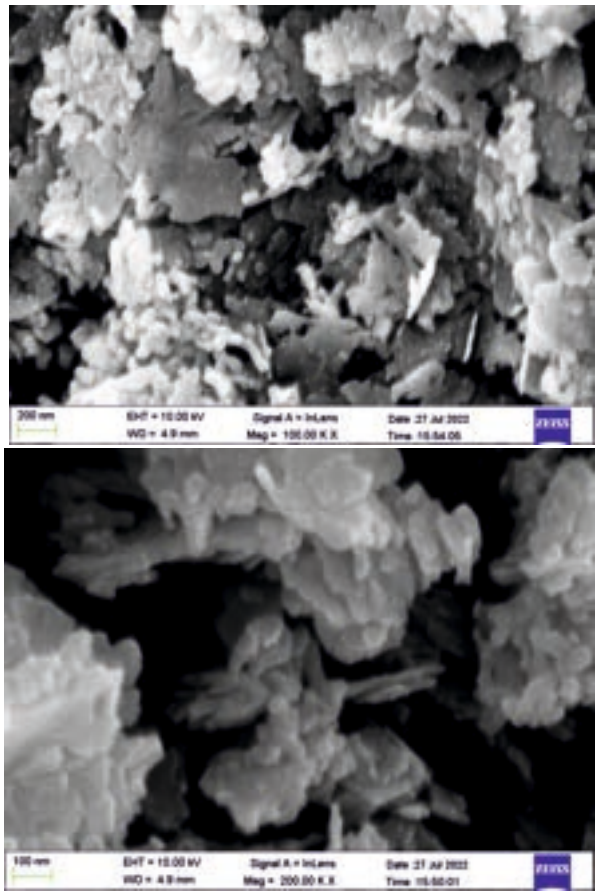


Figure 16 FE-SEM image of prepared nano-composite magnification a) 100 KX b) 200 KX

FT-IR spectra of prepared nanocomposite

FTIR analysis of the prepared composite was carried out using Shimadzu IRspirit instrument to detect the potential intermolecular interaction among various components of the nanocomposites (Figure. 4). The FTIR spectrum of the nano-composite shows characteristic absorption bands at 3363 cm^{1} attributed to the stretching vibration of the –OH groups, bands at 2922 cm^{1} attributed to asymmetric stretching of –CH. The broad peak below 500 cm^{1} corresponds to the Cu-O and Zn-O stretching.

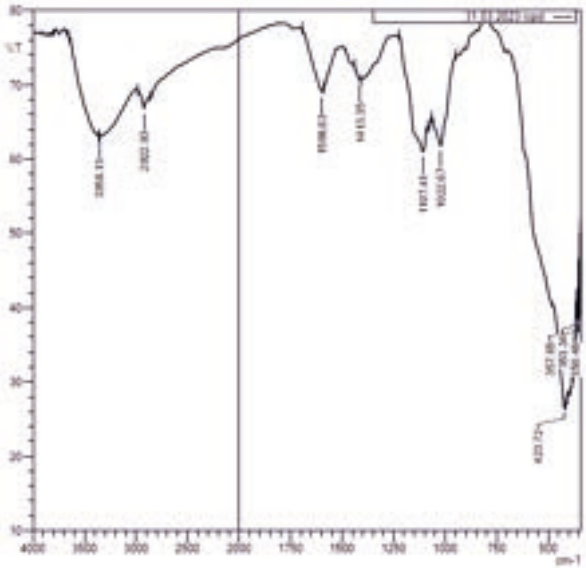


Figure 17 FT-IR spectra of prepared nano-composite

Decolourization of industrial dye effluent using prepared nanocomposite

The dye effluent received from the textile industry ETP was used for the decolourization study in the presence of the synthesized nano-composite as photocatalyst.

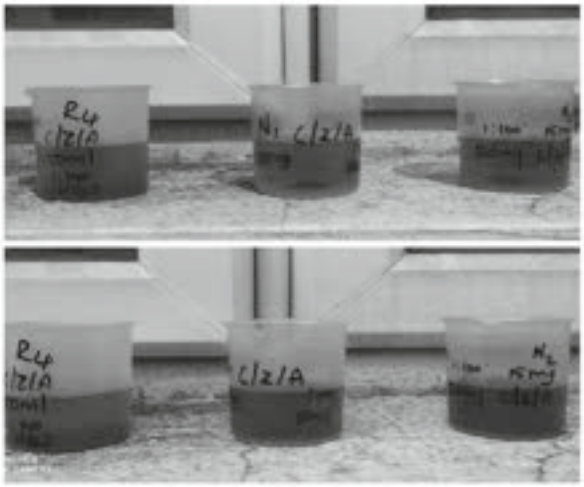


Figure 18 Image of control sample and industrial dye effluent with prepared nano-composite

The colour of the received industrial dye effluent was green, hence the colour was measured at the wavelength of 456 nm which corresponds to green colour.

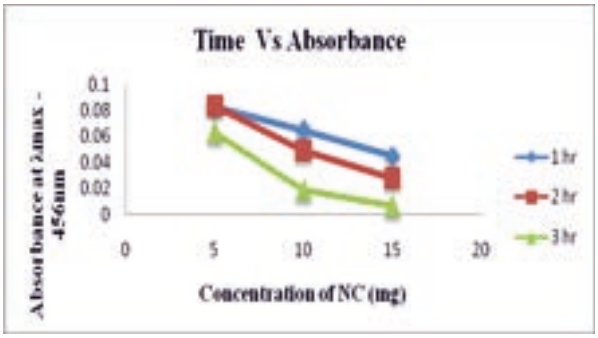


Figure 19 Absorbance of treated dye effluent at different time interval

There was also a reasonable reduction in the COD and BOD value of the treated effluent after 3h. The initial COD value was 309.8 mg/L and after treatment it was reduced to 102.3 mg/L. The initial BOD value was 97.7 mg/L and after photo catalytic degradation it was reduced to 43.1 mg/L.

Summary

- The nano-composite was prepared using bio-polymer support and characterized by PSA, FT-IR and FE-SEM.
- Initial trials were conducted with the prepared dye solution for the photocatalytic degradation of dye.
- The concentration of nano-composite was optimized for the known concentration of Blue MR and Procion Red MX-5B dye solution.
- The optimized concentration was used for the decolourization of industrial dye effluent to study the efficacy of prepared nano-composite.
- Reasonable reduction in the colour value, COD and BOD were observed for the industrial dye effluent.

MEDICAL TEXTILES

DESIGN AND DEVELOPMENT OF FACILE HIGH THROUGHPUT NEEDLE LESS ELECTROSPINNING SET UP

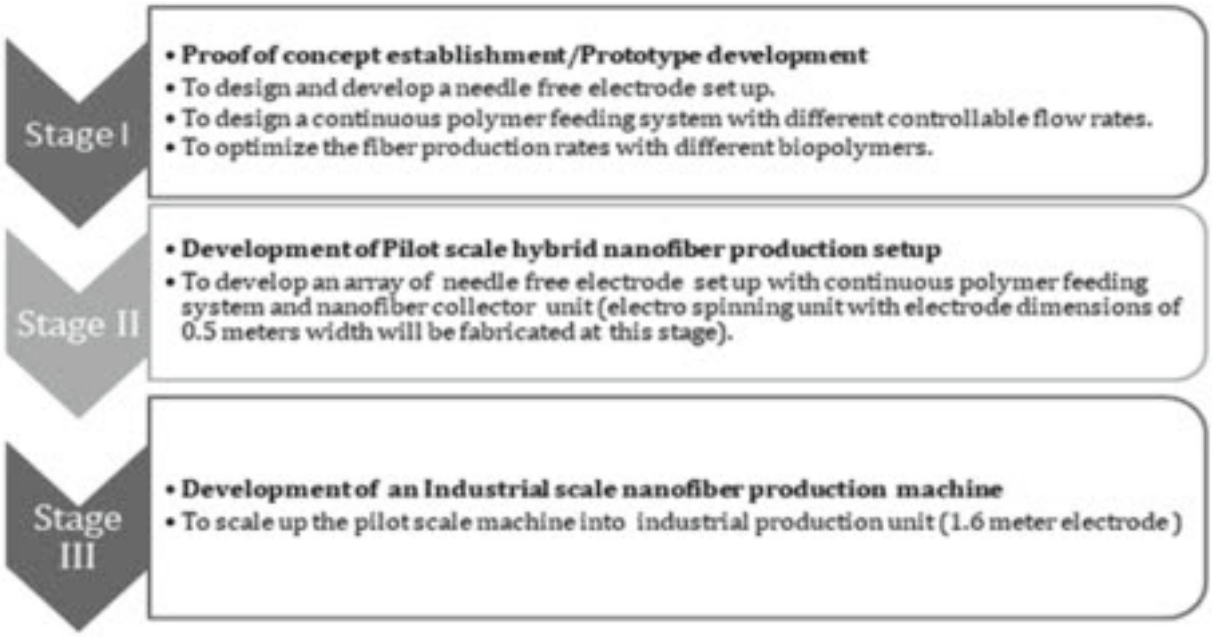
(Funded by National Technical Textile Mission – MoT)

Rationale

Electrospinning is a widely used spinning technique which utilizes electrical forces to produce polymeric nano fibers. Owing to the salient features of nanofibers such as high surface area to volume ratio, smaller pore size with high porosity, strong mechanical property, malleability, and biomimetic nature of Extra Cellular Matrix (ECM), it is used in various applications such as nanocatalysis, tissue engineering scaffolds, protective clothing, filtration, optical, electronics, healthcare, defense & security and environmental engineering. Though electrospinning is a well-established and versatile technique, its utilization in industry is limited by low production rate. The production rate of conventional single needle electrospinning systems being very less, researchers have focused on multiple needle electrospinning and needle-less electrospinning mechanisms. With multiple needle electrospinning intrinsic problems including mutual interference of electric field and clogging of needles with polymer solution, focus is on needless electrospinning. In spite of enormous research work carried out in electrospinning, achieving an electrode with continuous jet stability, high throughput and nanofibers with precisely controlled diameter remains a challenge. Keeping the above-mentioned facts in mind, the present project proposal is aimed to develop a needless high throughput electrospinning step up.The Major advantage of the proposed set up is high productivity, Versatility (applicable for both solvent as well as melt spinning), hybrid nanofibrous coating on single substrate and the set up is easy to construct.

Objectives

Objectives of the project was divided into three stages and illustrated below



Work under progress and Findings

- Proto type machine has been successfully developed and trails have been conducted with different polymers such as PVA, PAN, PCL and PVDF.
- Defect free nanofibers with the fiber diameter of 100nm-700nm were produced.
- TiO2 nanoparticles incorporated PCL nanofibers were produced.
- Nanofibers were uniformly deposited on various textile substrates such as meltblownpolypropylene , viscose, viscose/polyester blended fabric.
- Fabrication of Pilot scale machine with 500mm electrode width and two polymer feeding module is in progress.

Future work

Commercial machine with 1.6 Meter width will be fabricated for hybrid nanofiber production.

DESIGN AND VALIDATION OF VIRAL FILTRATION EFFICIENCY (VFE) TEST METHOD USING BFE TESTER

Rationale

Community settings often recommend the use of face masks as a preventive measure to reduce the transmission of respiratory viruses or bacteria through the air. However, existing National and International standards only focus on testing the bacterial filtration efficiency but they do not specifically address the filtration of viruses. In reality, viruses and bacteria differ in size, with viruses being significantly smaller. Therefore, to ensure optimal protection against viral transmission, it is crucial to determine the viral filtration efficiency (VFE) of face masks. Unfortunately, there is currently a lack of validated standards available for conducting specific tests to measure VFE accurately.

We recently received an inquiry from an Industry regarding the viral filtration efficiency of HME filters. They specifically requested results up to the fourth decimal place, indicating a need for highly precise

measurements. Achieving such accuracy would require subjecting the masks to a higher aerosol concentration of approximately 10^7 particles. In light of this request and the absence of established standards for measuring VFE, our study aimed to develop a reliable method to assess the viral filtration efficiency of HME filter and surgical face masks under both normal and higher challenge conditions, with longer exposure time and validated it through laboratory studies with a BFE tester. While the BFE tester is not specifically intended for viral filtration assessment, we adapted and modified it to simulate viral aerosols and measured the filtration performance of the masks with reference to ASTM F 2101.

Through these comprehensive laboratory experiments, a method for the assessment of viral filtration efficiency of health care materials at normal and higher challenge conditions has been optimized.

Objective

- To measure the filtration efficiency by comparing the viral particle counts upstream (before filtration) and downstream (after filtration) of the test article.
- To optimize the viral filtration efficiency of face mask by changing the concentration of inoculum, media to collect aerosols and by varying the exposure time

Summary and findings

- This study examined two categories of viral challenges. The first category represents a typical challenge rate according to ASTM F 2101 standards. The second category involves a more rigorous challenge (10^7 particles), allowing manufacturers to obtain a certification of 99.9999% efficiency.
- With additional refinements and in comparison to Nelson labs (ILC), this methodology will be taken forward as an in house method for ISO/IEC 17025 (NABL) accreditation.

ESTABLISHMENT OF CORRELATION BETWEEN VIRAL AND BACTERIAL PENETRATION RESISTANCE EFFICIENCY OF SURGICAL GOWN AND DRAPES – A REQUIREMENT OF IS 17334.

Rationale

Establishing a direct correlation between viral and bacterial penetration resistance efficiency of surgical gowns and drapes requires scientific research and testing. While it is generally expected that a surgical gown or drape that offers high resistance to viral penetration would also provide effective bacterial protection, establishing a precise correlation requires specific studies. Micro-organisms are a very heterogeneous group of organisms as to their size, shape, living conditions, infective dose, survival abilities and many other parameters. Their size alone can vary from 30 nm (poliovirus) to 5 µm to 10 µm (bacteria) and even larger (most fungi). Due to the heterogeneity of micro-organisms, it is not possible to define performance criteria on the basis of risk groups, nor on the type of micro-organism. Also it may not be possible to define exactly the organisms the health care practitioner is exposed to. Hence the standard (IS 17334) included the possible ways and forms of microbes that might infect the health care practitioners and the patient and made suggestion on the level of surgical gowns/drapes to be used by them during surgery. However, the inclusion of both bacterial and viral penetration resistance efficiency test methods to categorize the material with superior level of protection has invited discussions / arguments as it was presumed that the inclusion of viral test would suffice to confirm the performance characteristics of surgical gown and drapes. Hence, an attempt has been taken by SITRA to evaluate the microbial penetration resistance efficiency of surgical gown/drapes which resisted the penetration of virus.

Objectives

- To assess the bacterial penetration resistance efficiency of surgical gown which have shown resistance to viral penetration under simulated conditions of a surgery.

Summary and findings

- On assessing the results of wet, dry and viral penetration efficiencies of the surgical gown, if the garment is claimed to be used in operation theatres, ICU or for providing protection against infectious disease, then it may be tested for its ability to resist the penetration of microbes from blood, body fluids, airborne, solid dust particles and aerosol.

- Hence, the inclusion of both bacterial and viral penetration resistance efficiency test methods to categorize the material with superior level of protection would be recommendable.

ASSESSMENT OF RELATIONSHIP BETWEEN COMPRESSIONAL PROPERTIES OF TIGHT WEAR PANT (LEGGINGS) & ITS IMPLICATIONS

Rationale:

Leggings have become a popular fashion choice for women, with many wearing them for both exercise and daily activities due to their comfort and versatility. While leggings can be comfortable and stylish, there have been concerns raised about potential health problems associated with their use such as tightness, itching, and chafing. While some people may find leggings comfortable, others may experience discomfort, which can affect their daily activities. This project aims to study the relationship between compressional properties of leggings and its possible side effects when used on a regular basis.

Objectives:

The objectives of this project are as follows:

- To identify the common types of discomfort experienced by women when wearing leggings.
- To determine the factors that contribute to discomfort in wearing leggings, such as fabric, fit, and style.
- To collect the market sample and analyse its various properties such as compression behaviour and its breathability.
- To conduct wear trials to understand the blood flow in leg portion.
- To relate the fabric constructional properties and compression properties.
- To provide recommendations for selecting and wearing leggings to minimize discomfort.

Summary and findings

- The survey was conducted among 251 participants in the age group of 19 to 25 years girls.
- Itching and irritation, pressure / red marks, restricted movements, sensation of feeling too warm and sweaty while wearing tight-fitting leggings were reported by the user.
- Study identified the need of usage suitable size of the leggings to minimize the wrong size mediated ill effects.

Studies on the constructional and compression properties of the leggings are under progress.

TRANSFER OF TECHNOLOGY AND RESEARCH UTILISATION

SERVICES TO MILLS

Nothwithsanding the turbulent nature of the industry, many mills had sought SITRA's services during the year. The increase was noticeable on all the services offered. The services availed by the mills during 2022 - 23 are given in Table 8.

Table 8 SITRA's services availed by textile mills during 2022 - 23

Type of service	Member units	Non members
Fibre, yarn and fabric testing (including PPE)	152	2613
Consultancy services	17	108
Surveys and Online studies	28	47
Training: Executives, supervisors and operatives	50	107
Accessories testing & instrument calibration	36	319

As in the previous years, testing of fibres, yarns and fabrics was highly utilised by mills during this year as well, with as many as 152 member mills, representing 81% of SITRA's membership, sending their samples for analyses (Table XX). Also, 2613 non-member units, availed this service. This included a number of units seeking special tests under medical textiles. The total number of tests carried out during the year, including those under medical textiles, was 102752 (Table 9).

Many mills have started using SITRA's rapid conditioning facility that enables quick test reporting through fast conditioning of the samples.

The monthly online survey of raw material cost and yarn selling price, initiated by SITRA almost a decade back in April 2013, has been receiving good response from mills and during this year, totally 75 mills participated across the 12 surveys.

The training programmes offered on various functional topics of textiles were well received by the industry. The utilisation of this service by the members mills was also appreciable (26%). Details regarding training programmes are given in the section under 'Training and development programmes and labour training.

The lackluster performance of the industry during the year saw a related dip in it seeking SITRA's consultancy services. The services offered by different departments of SITRA for various operational and other technical/techno-economic problems were utilised by 17 (9%) member units and 107 non-member mills. Some of the important assignments that were handled by SITRA during the year, are listed below.

- Quality audit
- Performance audit
- Compressor study
- Technical audit of spinning mills
- Water consumption audit
- Process optimization and technical study
- Energy Audit

Table 9 Testing services offered by SITRA during 2022 - 23

Material	Commercial		Project and Others	
	Samples	Tests	Samples	Tests
Fibres	30244	39294	460	1615
Yarns	14682	32886	459	751
Fabrics	1997	2999	82	143
Chemical testing	13092	17350	141	341
CoE tests	3008	5520	-	-
Knitting	3632	4703	-	-
Total	66655	102752	1142	2850

- Process optimisation and trouble shooting of dyeing units
- Working performance studies in weaving

POWERLOOM SERVICE CENTRES

With an aim to address the requirements of the decentralised powerloom sector, SITRA has established 7 powerloom service centres (PSCs) at various places of powerloom concentration over the years since the first one which was set up in Somanur 3 decades ago. Six more centres have been established with the support of the Ministry of Textiles, Government of India at Karur, Komarapalayam, Palladam, Rajapalayam, Salem, and Tiruchengode.

Table 10 Services rendered by the powerloom service centres (2022 - 23)

S. No.	Type of service	No. of services
1.	Consultations	18
2.	New designs development	106
3.	Yarn / cloth / chemical samples testing	42,517
4.	Training programmes (persons trained)	28 (341)
5.	Liaison / request visits	3135
6.	Number of looms inspected	20,254
7.	Number of special works *	54

** Seminars / TUF meetings / Talks*

The PSCs offer varied services to the powerloom community. Entrepreneurs benefit under the TUF scheme and cluster development programmes. The centers offer various machinery buyer-seller meets whch are ideal forums for manufacturers to market their wares. They have also contributed to the huge volume of Indian poplin and cambric fabrics exported from these units. Exposure visits with Association & Society members enable entrepreneurs to expand their awareness on the best practices being followed at units at various places in India. Entrepreneur development programmes are also conducted on-demand basis. Under the credit linked capital subsidy scheme, many machinery inspections have been carried out. Weaving units are also continuously getting the service of the centes for various aspects like new project report preparation, machinery valuation, techno-economic viability study, project appraisal, etc.

Four PSCs of SITRA also have the CAD centres which function under SITRA's control without any financial assistance from the Ministry. The facility at these centres ensure creation of numerous designs quickly which can be varied or changed instantly depending upon the requirement of the customers. Computerised card punching, an intermediate technology, which will reduce the cost in both handloom and powerloom sectors, is also offered by the CAD centres. Table 11 depicts the various services of these centres that were utilised by the decentralised weaving sector.

Table 11 Services offered by the CAD centres during 2022 - 23

S.No.	Type of service	No. of services
1.	Designs development /graph printouts	542
2.	Card punching	315
3.	Training programmes (persons trained)	7 (52)

KNITTING DIVISION

The division renders several major services like testing the knitted fabric, technical consultations, identification of the causes for the defects, sample development, machinery valuation, taking knitting trials and suitably advising the spinning mills to produce the required quality yarns, etc. In addition, the department also conducts seminars on recent trends in the knitting industry. Various training programmes are also offered to different levels of personnel in the knitting industry. Karl Mayer warp knitting and warping machines are available at SITRA for mills/parties to develop samples as well as specific products in technical textile applications. Some of the testing carried out by the division during the year include Yarn count (103), Ends per inch/Picks per inch (39), Design (28), GSM (17), Loop length (17), Yarn diameter (16) and Others (69).

The various services offered by the division in the year under review are given in Table 12.

Table 12 Services offered by the knitting division (2022 - 23)

S. No.	Type of service	No. of services
1	Testing	4703
2	Samples knitting on FAK machine	1013
3	Knitting performance of yarn	261
4	Other testing services	289
5	Fabric observation	1384
6	Defect Analysis	1756
7	Consultancy	75

DEFECT ANALYSIS WING

A separate wing for "Defect Analysis" was established in the year 2016 at SITRA to enable mills to send their yarn and fabric (woven and knitted) samples for analysis of defects. Physical faults in fabrics like weave/knit faults as well as wet processing faults can be analysed. Based on the analyses carried out, mills receive reports indicating the maximum possible evidences for the root cause of the problem in the sample(s) sent for analyses.

Ø Defects analyses

The various defects that can be assessed include contamination, stain, shade variation- barre or bands in knitted and woven fabrics or patches, colouration effects, blend irregularities, stress failure, holes due to chemical, mechanical or biological damage, etc.

Ø Re-engineering and design evaluation

Mills can guided on re-engineering and design evaluation of woven and knitted fabrics (Both warp and weft knitted fabrics).

Ø Sewability

Samples sent by mills would be evaluated for the performance of sewing threads / needles on different sewing machines that are available with SITRA.

Ø Appearance / Performance of woven and knitted fabrics

Details of the running performance of the yarns during knitting and details of grey fabric appearance like thick places, thin places, long thin and long thick places, slubs and contaminations using SITRA method as well as on a 4 Point System of inspection method.

During the year, 1,756 samples were tested for various parameters.

WEAVING CENTRE

The weaving centre at SITRA is equipped with a range of shuttleless weaving machines like Sulzer Projectile P700 HP, Picanol GTX Plus Rapier, Toyota JAT 710 Air-jet and Dornier LWV 4/E Air-jet machines. The objective is to provide the following services to the textile industry so as to make them competitive to meet the global competition.

- Preparation of project proposals, model project reports and technical feasibility study reports for weaving units.
- Entrepreneur Development Programme for new entrepreneur to start weaving units.
- Conducting weavers and maintenance training programmes on shuttleless weaving machines
- Consultancy services and liaison visits
- Product development and sample weaving
- Yarn performance study in shuttleless weaving machines
- Woven fabric defect analysis
- Management development programmes & Supervisory development programmes
- Training programme on fabric quality inspection and cloth analysis

The division was involved in offering technical consultancies to 8 mills, carrying out 29 sample weavings/product development and conducting 2 different training programmes wherein 35 entrepreneurs were trained.

TEXTILE CHEMISTRY DIVISION

SITRA 's Textile Chemistry division, with nearly 4 decades of experience, has the skilled manpower and expertise in chemical processing, effluent treatment, chemical testing, consultancy, training, etc., to meet the ever increasing demands of today's industries. The laboratory is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL) and meets the requirements of ISO / IEC **17025:2017** and its test reports are valid across the globe. The department's eco testing, water analysis and fibre & wet processing laboratories are equipped with State-of

the-art testing equipment to carry out testing on various aspects namely,

- Ø Textiles (Fibre, yarn and fabric)
- Ø Textile accessories
- Ø Technical textiles
- Ø Medical textiles
- Ø Bio-degradability of chemicals
- Ø Packing materials
- Ø Water (Drinking water, construction water, bore well water, mineral water, etc)
- Ø Waste water / Effluent (general and as per TNPCB and CPCB norms)
- Ø Industrial water

The lab has increased the no. of parameters in the scope of accreditation by more than 52 % compared to the previous cycle of accreditation which means increased range of testing of the products and improved recognition in the global market. Now, majority of the quality control tests required by buyers are included in the NABL scope of accreditation. Water testing to test drinking water, construction water, bore-well water, surface/river/ground water, water from purifiers, water from treatment plants, sewage water, effluent water, industrial water, etc. have also received NABL Accreditation in the year 2020 & 2022. The lab is also equipped with facilities required to carry out the tests required for organic certifications like Eco mark in India, Global Organic Textile Standard (GOTS), Global Recycling Standard (GRS), etc. and pre-requisite testing for Oeko Tex certification. The lab also has facilities for carrying out testing of oils, wax rolls, packing materials, sizing ingredients, etc as per the requirements of the respective standards. The pre-requisite testing was done on fibre, yarn, fabric and garment samples for different mills/exporters to meet regulations for OEKO TEX certification.

The water lab has now facilities required to test most of the testing requirements of,

- Ø Potable drinking water as per IS 10500: 2012
- Ø Packaged drinking water as per IS 14543: 2016
- Ø Water for textile industry as per IS 201:1992
- Ø Laboratory grade water as per ISO 3696
- Ø Packaged Natural Mineral Water as per IS 13428, etc.

Analytical Instruments

The lab is equipped with state-of the art instruments to test the harmful substances in the textile, residues in water, etc. The following are the major instruments available with the laboratory:

- Ø High Performance Liquid Chromatography (HPLC – DAD / FLD)
- Ø Liquid Chromatography with Mass Spectrometer Triple Quadrapole (LC-MS/MS)
- Ø Gas Chromatography with Mass Spectrometer (GC-MS)
- Ø High Performance Thin Layer Chromatography (HPTLC)
- Ø Fourier Transform Infra Red Spectroscopy (FTIR)
- Ø Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
- Ø Gas Chromatography mass spectrometer – Triple Quadrapole (GC-MS/MS)
- Ø Ion chromatography (IC)
- Ø Simultaneous Thermal Analyzer (STA)

Further, the lab is equipped with state-of-the art instruments viz., UV-Vis spectrometer, Atomic Absorption Spectrometer (AAS), Total Organic Carbon analyser (TOC), etc. for testing of eco parameters. The lab carries out testing of various samples as per national and international standard test methods such as AATCC, ASTM, IS, ISO, BS EN ISO, DIN, APHA, OECD, EN, etc.

SITRA's textile chemistry with skilled manpower and expertise, has offered consultancy services to processing mills on various areas such as water consumption audits, technical troubleshooting, process optimization, technical feasibility study, dyeing with natural dyes, etc. Tamil Nadu Pollution Control Board (TNPCB) has recognized SITRA's textile chemistry department for carrying out water consumption studies at processing units. During the year, the department has offered a wide range of consultancy services to textile mills, Government bodies and chemical suppliers. The details of the services offeed for the year 2022-23 are given below.

S. no.	Nature of consultancy service	No. of services
1	Water consumption audits	75
2	Process optimization and technical study	12
3	Process optimization and trouble shooting at Tirupur dyeing units	12
4	Training Programmers (no. of persons trained)	13 (119)

Staff of SITRA are also empanelled as the Lead assessors by NABL to carry out the assessment of laboratories as per ISO / IEC 17025:2017. During the year, 10 assessments were conducted.

Water consumption audits

Textile Processing industries are the largest water consumer in India. Tamil Nadu Pollution Control Board (TNPCB) has recognized SITRA's textile chemistry department for carrying out water consumption studies at processing units. The actual consumption of water and process time can be identified by the industries through the water consumption audits. It leads to optimization of the sequence of processes and parameters. SITRA has audited about 75 dyeing units in 2022-2023. The audit report helps in applying for increasing the production capacity and increasing the consent quantity to TNPCB.

SITRA TEXTILE TESTING AND SERVICE CENTRE, TIRUPUR CENTRE

In order to cater for the requirements of the knitting industry, textile processing units, export houses etc., in the region, SITRA had established a sample collection centre at Tirupur in the year 2005. Samples collected at the centre are brought to SITRA the same day. In many cases, results are reported to the customers within 24 hours, thus reducing considerably the turnaround time. Based on customers' feedback, SITRA has upgraded the centre into an extension service centre and has completed the process of setting up a laboratory with essential instruments for physical and chemical testing of knitted fabric / garments, water effluent, chemicals etc. During the year 2015, the centre had moved to a spacious building to accommodate more instruments. With additional instruments added during the year, the centre has been able to reduce the turnaround time of sending samples to SITRA and carry out testing for water / effluent testing, fibre identification & blend analysis, etc. During 2023, the centre has moved to a even more spacious building and increased our testing instruments. The number of tests carried out by the centre during the year (2022-2023) was 3936 which was about 30% higher than that of the previous year (3027) tests and the number of samples transferred to SITRA was 2006 which was about 104% higher compared to that of the previous year (984) tests.

SITRA TEXTILE TESTING AND SERVICE CENTRE, CHENNIMALAI CENTRE

In order to cater for the requirements of the handloom and power loom weavers, textile processing units in SIPCOT, Perundurai and erode, etc., in the region, SITRA had established a Testing and Service Centre at Chennimalai. Samples collected at the centre are brought to SITRA the same day. In many cases, results are reported to the customers within 24 hours. The Centre carries out testing of testing Yarn CSP, fabric analysis for design, identification of fibre, blend analysis, etc. In total, about 758 samples were tested by this centre during the year.

CENTRE OF EXCELLENCE FOR MEDICAL TEXTILES

The Centre of Excellence for medical textiles was established at SITRA under Mini Mission I of Technology Mission on Technical Textiles (TMTT), promoted by Office of the Textile Commissioner, Ministry of Textiles, Government of India during the year 2010. The centre is actively involved in various activities such as prototype development, pilot scale production, testing and evaluation, training and seminars, standards formulation, incubation services, information resources, research and development, technical consultancy and Detailed Project Reports for new ventures. It has technical collaboration with various reputed institutes in India and abroad.

The centre has been equipped with several high-tech testing instruments for measuring various parameters for medical textile products. It has also developed many equipment on its own like the Synthetic Blood Penetration Resistance Tester (SBPRT), Bacterial Filtration Efficiency tester, compression bandage pressure measurement system and Particulate Filtration Efficiency tester. SITRA was involved in the testing of PPE since Feb, 2020 to assist the Government of India and the manufacturers with the selection of right fabric for the development of PPE to combat COVID 19. In the initial stages of the pandemic, SITRA was the only lab approved by Ministry of Textiles, Govt. of India for testing and certification of PPE. During the year, the Coe-Physics laboratory tested 5521 samples.

The centre's activities also include development of many medical textile products like Bifurcated vascular graft, 3D compression bandages for Lymphedema, spunlace non-woven wound dressings for malodour wounds, breathable surgical gowns treated with nano finishes, barbed - bi-directional surgical sutures, hospital bed linens with enhanced thermal properties for coma patients, hernia mesh, clinical heart patch fabrics, insole liner for diabetic shoes, etc.

The department had prepared several DPRs as part of its activity to help new entrepreneurs in setting up of

technical textile units. It was involved in the development of specifications / standards, apart from the development of prototypes. During the year, 26 such prototypes were developed. The department also offered consultancies on 3 different assignments.

Another activity of the department includes training of personnel from industry as well as fresh entrepreneurs on avenues in medical textiles. During the year, the department trained 279 persons under 11 different programmes.

Formulation of standards for various medical textile products in another mandate of the division. The division is actively in collaboration with the Bureau of Indian Standards,(BIS) in the formulation of many standards of medical textile products. During the year, the division drafted/offered inputs to BIS/ISO for development of standards for Barrier face coverings and Medical Respirator. Moreover, 12 standards were reviewed and updated.

Staff of the department are also registered with the Bharathiar University, Coimbatore to guide students for their M.Phil and Ph.D. in Medical Textiles.

SITRA participated in conferences organized by various associations towards dissemination of the services offered by the division and to encourage entrepreneurs in both Medical and Technical Textiles fields.

The department has witnessed addition of the following instruments during the year :

- Multimode microplate reader, an instrument which can measure antimicrobial, biocompatibility and other biological tests of 96 textiles/medical textile samples within 2 minutes.
- Differential pressure instrument lab has been upgraded to measure the pressure of face mask in a single instrument.
- Simultaneous Thermal Analyzer (STA), an instrument which can measure the degradation temperature, melting point and phase transition of polymers, ceramics, textile substrates etc., in the temperature range of RT-1300°C.

Microbiology and Bio-tech Laboratories

Towards providing diversified services under chemical testing, SITRA had started the microbiology testing facilities as an extension of its chemical laboratory in the year 2009. This NABL accredited laboratory is now under the CoE-Meditech and is well equipped to test samples as per international test standard of ASTM, AATCC,APHA and IS and has the facility to test samples for bacterial filtration efficiency, anti-bacterial activity assessment of textile materials : parallel streak method, anti-bacterial finishes on textile materials: assessment of testing for antibacterial activity and efficacy on textile products, anti-fungal activity, assessment on textile materials: mildew and rot resistance of textile materials, anti-microbial activity assessment of carpets, determining the anti-microbial activity of immobilized anti-microbial agents under dynamic contact conditions, anti-microbial susceptibility tests, methods of sampling and microbiological examination of water, heterotrophic plate count, ETO Sterilization, resistance of materials used in protective clothing to penetration by blood-borne pathogens using Phi X174 bacteriophage penetration as a test system, textile fabrics-determination of antibacterial activity-Agar diffusion plate test and determining the activity of incorporated anti-microbial agent(s) in polymeric or hydrophobic materials.

During the year 2022-23, a total of 690 samples (including food) were tested by the microbiology laboratory , 908 samples by the biotech laboratory and 2154 samples by the Polymer laboratory.

TEXTILE ACCESSORIES TESTING

SITRA offers testing service to evaluate the quality of spinning and weaving accessories / spares as per BIS standards. Moreover, training is imparted to the mill technicians on aspects like evaluation of quality characteristics, sampling procedures, etc. A total of 1,863 samples from 275 units covering various accessories like carton boxes, paper cones, rings & travellers, tubes, paper cores and kraft papers, etc., were tested during the year under review as per BIS standards. The numbers tested during the year has shown a drop compared to the previous year.

CALIBRATION AND PERFORMANCE CERTIFICATION FOR INSTRUMENTS

Calibrating testing equipment and maintaining their reports is a requirement as per quality systems like ISO and TQM. Many mills are seeking SITRA's help to get a "Calibration Certificate" for their textile testing and quality control instruments. SITRA also undertakes the tasks of testing the performance of instruments developed by SITRA and manufactured by its licensees. During the year under review, as many as 312 spinning, weaving and knitting units availed the service of SITRA to receive calibration certificates for 13540 textile testing and quality control instruments.

SITRA CALIBRATION COTTONS

SITRA's physical testing laboratory has been helping mills in calibrating their High Volume Testing equipment by making available calibration cottons for different staple lengths. Currently available cottons include LL5 (Long), SL5 (Short), LM4 (Low Mic) & HM4 (High Mic). During the year, there was a substantial increase in the number of calibration cottons packets procured by the industry, with as many as 553 units being sold.

TRAINING SERVICES

1. STAFF TRAINING

The year 2022-23 witnessed a slight slack in the training activities of SITRA which primarily because of the fact that the industry was highly volatile. However, to serve the industry in these times, some of the programmes were offered in the online webinar mode. Nine different training programmes were offeed duing the year which include 6 functional programmes, an international training programme and some batches under medical textiles. In all, 661 persons were trained during the year. The details of the various programmes are given in Table 13.

A. Functional Programmes

Training Programme on Spinning Mill Management

The management development programme organised

Table 13 SITRA's training and development programmes (2022-23)

S.no.	Name of the programme	Duration (in days)	Number of		
			A	B	C
1.	Training Programme on 'Spinning Mill Management'	15	1	4	4
2.	Technical Training for Sales Employees of Grasim Industriess	15	1	1	20
3.	Training Programme on Maintenance Management in Modern Spinning Machinery	3	1	28	34
4.	Training Programme on "Cost auditing in spinning mills" for Tamil Nadu Co.op Spinning Mills	2	2	5	54
5.	Training Programme on "Defect Analysis - Woven & Knitted Fabric"	2	1	32	43
6.	Webinar on "Optimising yarn clearers for quality and cost benefits"	1	1	78	130
7.	In-house Orientation Training programmes for Supervisory Personnel	2	2	2	110
8.	Training programmes in medical textiles	1-10	24	119	241
9.	International Training Programme on Textile Testing and Quality Control	6 weeks	1	11	25
	Total	**-**	**34**	**-**	**661**

Note: *A - Batches B - Organisations C - Participants*

every year by SITRA, attracts young entrepreneurs interested in understanding the various aspects of textile mill management. This intensive two week programme covers all the major aspects of mill management - material management, financial management and cost control, production and productivity, statistics and quality control, energy management and maintenance, personnel management, etc. Four young executives attended this programme which was held during 18 to 28 April 2022.

Technical Training for Sales Employees of Grasim Industriess

At the request of M/s. Grasim Industries,Mumbai, SITRA conducted a one-week online training programme for their technical sales employees towards sensitizing them on the various technical issues in spinning mills and the trouble shooting mechanisms for the same. Twenty sales executives attended the programme that was conducted as 3 hour sessions spanning across 15 days.

Training Programme on Maintenance Management in Modern Spinning Machinery

SITRA conducted a three day training programme on maintenance management in modern spinning machinery. The topics covered maintenance cost-burden or blessing, facets of maintenance in spinning mills,maintenance of critical areas from blow room to winding, impact of maintenance on energy conservation, machinery audit and compressed air quality and its usage in machines. Thirty four participants attended the programme which was held during 20th – 22^{n}d July, 2022.

Training Programme on "Cost auditing in spinning mills" for Tamil Nadu Co.op Spg Mills

At the request from **Tamilnadu Co.operative Spinning Mills, Chennai** SITRA conducted 2 batches of a two day training programme on "**Cost auditing in spinning mills"** for their staff members. The topics covered in the programme included process control in spinning, quality aspects, production and productivity etc. Fifty four executives attended the programmes, which were held during 29th – 30th April and 2^{n}d -3rd May, 2022.

Training Programme on Defect Analysis - Woven & Knitted Fabric"

SITRA conducted a two day training programme on Defect analysis – Woven & Knitted Fabric. The topics coverd in the programme included the different types of defects and their mode of occurrence, causes and remedies for defects in yarn and fabrics and case studies of defects in industry. Forty three participants attended the programme which was held during 6-7 July, 2022.

Webinar on "Optimising yarn clearers for quality and cost benefits"

SITRA organised a Webinar on yarn clearers on 3rd March, 2023. The technical sessions were handled by Mr. K.Ramakrishnan, Senior Manager & Mr. Sandeep A.Sen, Manager Product Application from USTER Technologies, India Ltd. Topics like operating principle and means of handling data from yarn clearers, setting optimisation for different material and the latest developments in yarn clearers were covered in the Webinar. As many as 130 participants participated in the the online sessions and many of them shared positive feedbacks regarding the contents that were discussed.

In-house Orientation Training programmes for Supervisory Personnel

SITRA organised 2 two-day orientation programmes for supervisory personnel of two different units, one in Coimbatore during June 2022 and and other at Tanuku in February 2023. The participants were trained on both technical and behavioural aspects required for effective supervisory functioning in a spinning mill. The major topics covered during the programme include spinning processes from blowroom to winding, production calculations, maintenance of machinery and quality control in spinning. A total of 110 (20+90) supervisors attended the programme.

B. International Training Programme

SITRA has been organising the International Training programmes since 1974, and more than 1700 participants from 69 countries have so far been benefited out of SITRA's expertise in textiles. The programme is organised under sponsorship from the Ministry of External Affairs, Govt. of India, under the scheme of international coopeation viz., ITEC (Indian Technical and Economic Co-operation Plan).

After a 3 year gap due to COVID-19 pandemic, the 69th batch of this programme was held this year under direct participation mode during October-November, 2022. The programme was inaugurated by Dr. Prakash Vasudevan, Director, SITRA on 5th October, 2022. Twenty five participants from 11 different countries namely Eritrea, Egypt, Jordon, Kenya, Phillippines, Malawi, Sudan, Srilanka, Tanzania, Trinidad & Tobago and Vietnam atteneded the Programme. Valedictory function was held on November 10, 2022. Participants received their course completion certificates during the valedictory function.

2. LABOUR TRAINING

For more than 3 decades, SITRA's labour research and training division has been taking the initiatie of training operatives in textile mills. Mills utilize SITRA's services to train fresh workers a well as those already working the units on the right methods of working in the various departments. During the year, as many as 53 shop floor workers wee trained. All the training programmes (6 batches) were organized at mills' premises in the respective regional languages (Table XX).

Pre-employment training and retraining programmes for textile workers

One local and one out-station mill availed SITRA's services to train 53 operatives of their spinning and OE departments. The training programme was conducted in Tamil and significant improvement was reported to be achieved in key departments, in timings, incidence of waste and production rate.

ANCILLARY SERVICES FOR OPERATIVES' TRAINING

1.Assessment of Trainers/Assessors

The Textile Sector Skill Council (TSC) under the National Skill Development Council (NSDC) has recognized and certified training personnel of SITRA as Master Trainers eligible to conduct TOTs for trainers who train persons in textile mills for various job roles. Master trainers are also eligible to conduct assessment of the trainers. Post-COVID-19, TSC has created protocols and guidelines for carrying out online assessment of trainer on both domain and other skills. Under request from TSC, SITRA conducted in person assessments this year for 82 assessors on the job roles of spinning, weaving, knitting and processing. Moreover, 54 UGC B.Voc. students, who underwent training in Printing Machine Operator process, were also assessed.

2. Aptitude tests for selection of operatives

Selecting the right person for the job involves assessing their skill as well as aptitude as per the requirements of the job. Textile mill operations being repetitive and monotonous in nature require assessment of the psycho-physical attributes of the individuals and exlude those not possessing them. By doing so, mills can not only ensure that they have the right men to man the various departments efficiently.

SITRA has developed a battery of tests in its Aptitude test kit to assess the aptitude of employees to do the expected activities in the various departments of a textile mill. These tests are being effectively used by moe than 200 mills for the selection of employees and they are appreciative of the effectiveness of these tests. The use of aptitude tests is advisable for fresh applicants who have little or no experience and may be used by the mills interested in selecting employees for whom training will result in greater performance. Most of the jobs in these departments involve I) Visual acuity eg., ability to note end breakages, ii) Two hand coordination for working at machines eg., operations like piecing and knotting, iii) Finger dexterity eg., operations like piecing and knotting iv) Eye and hand coordination for operating the state-of-the-art machines and v) quick reaction time to respond to emergencies at the work place. All these psychophysical attributes are measured by using the three tests in the SITRA Aptitude Test Kit.

SITRA has included another sub-test to the Kit in the last decade namley, colour blindness test which ensures that person with colour deficiencies are identified. Distinguishing the subtle differences in colour variations and identifying the basic colour combinations are integral for operations in textile mills, which is achieve by using this test. During the year 2022-23, 12 aptitude test kits were purchased by the textile mills.

3. Multimedia DVDs on work methods

SITRA had earlier come out with a CD, for the benefit of spinning mill operatives, providing the work methods for spinning mill operatives. Modernisation has brought in many new machinery in the industry and it was pertinent that SITRA, has some years back come out with a revised version of multimedia as a tool to help operatives in spinning mills to learn the right methods of working in various departments. The revised version

takes into account the evolution of spinning machinery in line modenisation and have duly included them in the content. Brought in DVD format, the multmedia tool serves as a handy tool for spinning mills to educate operatives on the right ways and means of working in spinning mills. All departments from mixing to reeling are covered. Users have the option to select any of the 5 languages voice-over namely, Tamil, Telugu, Malayalam, Kannada and Hindi. An English version of the DVD is also available separately.

Departments covered: Mixing, blowroom, carding, combing, drawing, speedframe, ring spinning, open end spinning, manual cone winding, auto cone winding, ring doubling, two for one twisting and reeling.

During the year 2022-23, 6 DVDs were purchased by the textile mills.

CONFERENCES & SEMINARS

SITRA's 60th Joint Technological Conference

The 60th Joint Technological Conference of ATIRA, BTRA, NITRA and SITRA was held at SITRA on 11th and 12th November, 2022. Shri R.Gandhi, Hon'ble Minister for Handlooms & Textiles, Govt. of Tamil Nadu inaugurated the Conference.

Dr. Prakash Vasudevan, Director, SITRA welcomed the delegates. The Presidential address was delivered by Dr. K.V.Srinivasan, Former Chairman, Council of Administration, SITRA and the Keynote address was given by Dr. S.K.Sundararaman, Deputy Chairman, SIMA, Coimbatore. Felicitaitons were offered by Shri T. Rajkumar, Chairman, Confederation of Indian Textile Industry (CITI), Smt. Roop Rashi, IA&AS, Textile Commissioner, Ministry of Textiles, Govt. of India, Shri Dharmendra Pratap Yadav, IAS, Principal Secretary (Handlooms, Handicrafts, Textiles and Khadi), Govt. of Tamil Nadu, Dr. Sameeran, District Collector, Coimbatore and Dr. M.Vallalar, IAS, Commissioner-Textiles, Govt. of Tamil Nadu.

The JTC had 5 technical sessions wherein 17 technical papers were presented by scientists from SITRA, BTRA, NITRA and ATIRA.

Session 1 on Circularity & Sustainability in Textiles Manufacturing was chaired by Dr.N.N.Mahapatra, Business Head (Dyes), Shree Pushkar Chemicals & Fertilizers Ltd., Mumbai.

Session 2 on Mechanical Processing was chaired by, Dr. A.N.Desai, Former Director, BTRA, Mumbai.

Session 3 on Mechanical Processing, Engineering & Energy conservation was chaired by Dr. V.Chandrasekaran, Vice-President, Adwaith Textiles Limited, Coimbatore.

Session 4 on Technical Textiles (Parallel) was chaired by Dr.A.Shanmugavasan, Managing Director, KOB Medical Textiles, Palladam.

Session 5 on Textile Processing (Parallel) was chaired by Mr. Suresh Manoharan, Executive Director, Best Colour Solutions(I) Pvt. Ltd., Tirupur.

The following 8 papers were presented by SITRA scientists.

1. Development of breathable, reusable and oxo-biodegradable coverall using biocidal polyester
2. Synthesis of a novel cationising agent and its application for salt free dyeing of textile Materials
3. A novel approach to evaluate nep removal in cards
4. Manpower retention strategies for spinning mills
5. Nepping potential of present Indian cotton
6. How to improve yarn realization in spinning mills – a case study
7. Strategies for minimising power cost in spinning mills
8. Development of surface-active E-spin nanofibrous scaffolds for hard to heal wounds

Exhibition on Circularity & Sustainability in Textile Manufacturing

An exhibition, on the focal theme, 'Circularity & Sustainability in Textile Manufacturing" was held as a three-day event, concurrently with the 60th Joint Technological Conference. The exhibition provided ample scope for exhibitors to interact with industry personnel at a single point and fulfil their requirements.

It also served as a platform for business promotion opportunities on current technologies, products and services on unconventional, recyclable and sustainable

solutions. The exhibition witnessed around 1000 visitors representing the industry, students and process houses.

Exhibitors who showcased there products in the 3-day exhibition include Manufacturers / Dealers / Agents/ Suppliers of Alternate textile solutions, Unconventional fibre, yarn and fabric (Jute, Hemp, Sisal, flax, Ramie, PALF etc.), sustainable and green processing solution provides, effluent treatment plants dealers, Waterless & Saltless dyeing solutions, Global certification for sustainable and ECO friendly solutions, Textile testing instruments Textile ancillaries Green energy solutions, ECO solutions, Energy efficient equipment and Recycled textile materials.

MOUs SIGNED

During the year, Memorandums of Understanding / Agreement were signed with the following organisations/ Institutions/agencies:

1) GCL International Limited, India a certifying body has entered into a memorandum of understanding with SITRA for utilizing its services for testing and certification purposes.

2) WWF, India has renewed its memorandum of agreement with SITRA towards utilizing SITRA's expertise and testing services for their ongoing projects on water conservation & abatement of pollution.

3) Kratu Scientific Solutions, Chennai, a non-woven fabric manufacturing across all verticals, for utilizing the services of SITRA's NABL accredited laboratories for testing of their PPE suits.

4) Loyal Textile Mills Ltd, Cuddalore a textile manufacturing across all verticals, for utilizing the services of SITRA's NABL accredited laboratories for testing of their materials covering fibres to finished materials

COMMERCIAL AGREEMENT SIGNED

a) Agreement with M/s. MAK India Ltd., for commercialization of SITRA's development

SITRA has synthesised a cationising chemical and has successfully developed a single step pre-treatment cum cationisation process methodology for dyeing of cotton fabrics. The developed methodology is suitable for salt free dyeing of cotton fabrics for a wide range of shades and depths.

SITRA has granted a license to M/s. MAK India Ltd. (MIL) to use this technology for commercial manufacture of the salt-free dyeing chemical. MIL has traveled along with SITRA in this journey by establishing and standardizing the enrichment process that would be suitable for commercial production by fabricating pilot vessel and carrying out pilot industrial trials and providing necessary support towards incorporating various modifications as and when necessary. The licence would be for a period of 10 years of which the initial 5 year would be an exclusive one and the next 5 year will be non-exclusive.

COMMUNICATION

Library

SITRA library with its large collection of books and periodicals continued to attract many technicians from member mills as well as students from colleges and universities. During the year, more than 2500 technicians, about 1200 students and 200 outside specialists visited SITRA for utilising its rich collection of books and journals. About 150 books have been added to the existing bank of more than 25,000 publications on various technical subjects, apart from textiles and management. SITRA also receives nearly 200 Journals on varied aspects of textiles.

Visitors

Important dignitaries who visited SITRA during the year include Shri Piyush Goyal, Honourable Textile Minister, MoT, Govt. of India; Mr. R.Gandhi, Hon'ble Minister of Handlooms and Textiles, Govt. of Tamil Nadu; Mr V K Singh, Special Secretary, MoT, Govt. of India; Smt. Roop Rashi, Textile Commissioner, MoT, Govt. of India; Shri Rajeev Saxena, IAS, Joint Secretary, Ministry of Textiles, Govt. of India; Mr. Dharmendra Pratap Yadav, IAS, Principal Secretary Handloom, Handicrafts and textiles Govt of Tamil Nadu; Dr. M. Vallalar, IAS, Commissioner, Commisionerate of Textile, Govt. of Tamil Nadu. Mr. Senthilrajan, Scientist and Mr. Anshat, Head, Naval Physical & Oceanographic Laboratory. Details of other visitors to SITRA is provided in Annexure II.

Publications

SITRA brought out during the year, 20 publications which included 12 online reports, 6 focus and 1 Etech letter (SITRA news publication) (Annexure III).

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SITRA scientists published 6 research papers in technical journals and presented 16 papers in conferences and seminars (Annexure V).

ANNEXURE I

THE STAFF

DIRECTOR
Dr.Prakash Vasudevan, M.Sc. (Textile Engineering), Ph.D (Leeds)

SPINNING

Senior Scientific Officer & Head-In-charge of Division:
Mr. N.K.Nagarajan, M.Tech., MBA.

Senior Scientific Officer:
Mr. S.Balamurugan, M.Tech.

Scientific Officer:
Mr. V.Vijayajothi, M.Tech.

WEAVING AND KNITTING

Senior Scientific Officer & Head-In-charge of Division:
Mr. S.Sounderraj, M.Tech.

Scientific Officers:
Ms.C.Vanithamani, B.Tech.
Mr.B.Nandhagopal, B.Tech.

LIAISON AND CONSULTATION

Principal Scientific Officer & Head of Division:
Mr. J.Sreenivasan, M.Tech.

Senior Scientific Officers:
Mr. P.Subash, M.Tech.
Mr. N.Ravichandran, M.Tech.

Scientific Officers:
Mr. G.Santhana Krishnan, M.Tech.
Ms. S.Kowsalya, M.Tech.

TEXTILE PHYSICS

Principal Scientific Officer &
Head-in-Charge of Division:
Dr. V.Thanabal, M.Tech., Ph.D.

Scientific Officers:
Mr. M.Kumaran, M.Tech.
Mr. G.Selvaraj, B.Sc.

TEXTILE CHEMISTRY

Principal Scientific Officer & Head of Division :
Mr. S.Sivakumar, M.Tech., D.T.P

Senior Scientific Officer:
Dr. N.Sudhapriya, M.Sc. Ph.D.

Scientific Officer:
Mr. T.Ravi, M.Sc.

TRAINING

Scientific Officer:
Mr. K.V.Vaidhyanathan, B.Tech.

TEXTILE ENGINEERING & INSTRUMENTATION

Principal Scientific Officer & Head of Division:
Mr. M.Muthukumaran, B.E.

Senior Scientific Officer:
Mr. M.Muthuvelan, B.E., PGDBA., M.B.A., M.Phil (Mgmt).

Scientific Officers:
Mr. G.Ilango, DME.
Mr. S.Chandirasoodan, M.Tech.

CENTRE OF EXCELLENCE FOR MEDICAL TEXTILES

Senior Scientific Officer & Head-In-Charge of Division
Dr. E.Santhini, M.Sc., M.Phil., Ph.D.

Senior Scientific Officer
Dr. R.Radhai, M.Sc., M.Phil., Ph.D.

Scientific Officers:
Mr. D.Veerasubramanian, M.Tech.
Dr. L. Amalorpava Mary, Ph.D.

BUSINESS DEVELOPMENT MANAGER
Mr. R.Indrajith. M.Tech.

ADMINISTRATION

Principal Scientific Officer & Administrative Officer :
(Addl. incharge of Training division)
Dr. K.Sajjan Rao, M.Sc., Ph.D.

Principal Officer & Head - Finance and Cost Accounts:
Ms. K.Vadivazhaki, B.Com., A.C.A.

Principal Scientific Officer - IT:
Ms. R.Suganthi, M.Sc., M.C.A., M.C.S.D., Net 07, OCA & OCP.

Senior Officer - Purchase/Stores:
Mr. M.Babu, B.E.

Officer & Secretary to Director:
Ms. N.Saradha Jayalakshmi, M.Sc., M.B.A.

Officer - Accounts:
Ms. K.Prabha, M.Com., PGDCA

Special Officers:
Dr. R.Pasupathy, M.Tech., M.B.A., A.M.I.E, Ph.D
Mr. N.Vasanthakumar, B.Sc., A.T.I.
Mr. R.Soundararajan, B.E.

Consultants/Mentors:
Dr.S.LakshmiSubramanian, M.Sc., Ph.D.
Mr.A.Kanthimathinathan, M.Tech.
Mr.K.Sivashankar, D.T.T..
Mr.Cyril Lourdes, B.Com.

ANNEXURE I (Contd..)

THE STAFF

Total staff strength as on 31st March 2023

Officers	*:.....33*
Scientific/Technical assistants	*:.....27*
Administrative staff	*:.....12*
Skilled/Semi skilled & maintenance services	*:.....11*
Technical assistants on contract	*:.....2*
Total	***:.....85***

Powerloom service centres (Govt. sponsored)

Officers	*:.....3*
Scientific/Technical assistants	*:.....23*
Skilled/Semi skilled	*:.....1*
Total..:	***.....27***

ANNEXURE II VISITORS

Shri Piyush Goyal, Honourable Textile Minister, MoT, Govt. of India.

Mr. R.Gandhi, Hon'ble Minister of Handlooms and Textiles, Govt. of Tamil Nadu.

Mr V K Singh, Special Secretary, MoT, Govt. of India.

Smt. Roop Rashi, Textile Commissioner, MoT, Govt. of India

Shri Rajeev Saxena, IAS, Joint Secretary, Ministry of Textiles, Govt. of India

Mr. Dharmendra Pratap Yadav, IAS, Principal Secretary Handloom, Handicrafts & Textiles, Govt of Tamil Nadu.

Dr. M. Vallalar, IAS, Commissioner, Commisionerate of Textile, Govt. of Tamil Nadu.

Mr. Prasad Pant, Director, Zero Discharge of Hazardous Chemicals, (ZDHC).

Prof Manian, Former VC of Annamalai University

Mr. Senthilrajan, Scientist and **Mr. Anshat**, Head, Naval Physical & Oceanographic Laboratory

Dr. Seshadri Ramkumar, PhD, CText, FTI (UK), FTA (*Honorary*), Professor, Nonwovens & Advanced Materials Laboratory, Texas Tech University, Lubbock, TX, USA.

Mr Andre Michalon, Director, ANDRITZ, Non woven France.

ANNEXURE III

SITRA PUBLICATIONS DURING 2022 - 2023

1. Focus:

An overview of global cotton trends 2020 - 2021 - *R.Pasupathi & V.Thanabal*

An evaluation of the quality of commercial spun polyester dyed sewing yarns - *R.Pasupathi, V.Thanabal & P.Suganthi.*

Micro dust and trash analyser - MDTA-4 A tool to evaluate the micro dust and opining process of textile fibers - *D.Jayaraman, S.Balamurugan & V.Vijayajothi.*

Worker management in spinning mills - *J.Srinivasan & N.Ravichandran.*

A noval approach to evaluate NEP removal in cards - *S.Balamurugan & N.K.Nagarajan.*

How commercial efficiency fluctuated in the year 2022-23 for cotton counts? An analysis. - *J.Srinivasan*

2. SITRA eTech letter:

1 Issue

3. Other Publications:

Annual report 2021-22

12 Online Technical Reports

ANNEXURE IV

SITRA DEVELOPMENTS

1. Machinery

Storage positive feed system for knitting machines
High speed reeling machine
High production cutting machine
High speed blending draw frame single delivery machine
"Spinfan" system for fancy yarns
SITRA - VOLKA ring frame
"Enerspin" drive system for ring spinning & doubling frames
SITRA "miniSPIN" - Miniature spinning plant for test runs
SITRA ENERCONER - Energy efficient drive control system for automatic cone winding machines
Energy and production information system for ring spinning frames "SITRA EnerInfosys"
Ener TFO
SITRA CIM
SITRA Microcontrol
Weavability Tester
High performance jute flyer spinning frame - SITRA Jute Flyspin
Micro controller based energy saving & information system for air compressors used in textile mills - SITRA PCRA ENERCOMP
SITRA PCRA Climocontrol

2. Fibre and Yarn Testing Instruments

Fibre bundle strength tester
Trash separator
Electronic twist tester
Electronic lea strength tester
Semi - Automatic twist tester
Motorised twist tester
Nep counter
SITRA motorised multi-board yarn appearance winder
Electronic load indicator for conventional lea strength tester (ELCONLEA)
SITRA rapid sample conditioner
SITRA- ABRATEST - Yarn abrasion resistance tester
Single yarn strength tester
Schnidt model yarn tension meter
Roving strength tester

3. Others

SITRAlised energy saving spindle tapes
SANTIMIT
Weft feeler mechanism to stop the loom for pirn changing
Energy efficient fans - SITRA excel fan
Infra colour dyeing machine
Shore hardness tester
Cyberscan bench top PH meter
Fabric stiffness tester
Drapemeter
Fabric thickness tester
MRG crimp tester
Fabric elongation tester
Fabric roughness/friction tester
UV Photocatalytic reactor
Self anchor suturing machine
CSP system and fabric strength tester
Fabric winding mechanism for powerlooms
Arterial prosthetic graft
SITRA pneuma kit
SITRA motor relay tester
Lab fabric dyeing machine
Soxhlet extraction mantles
Microprocessor based electronic balance
Launderometer
Crease recovery tester
Perspirometer
SITRA Enercool
Fabric compression tester
SITRA's Bacterial Filtration Efficiency Tester
SITRA's blood penetration resistance tester

SITRA may be contacted for the addresses of the Licensees

ANNEXURE V

PAPERS PUBLISHED IN JOURNALS AND PAPERS PRESENTED IN CONFERENCES

PAPERS PUBLISHED IN JOURNALS

E.Santhini et.al	Mitochondrial ATP6 and ND3 genes are associated with type 2 diabetic peripheral neuropathy.	Diabetes & Metabolic Syndrome: Clinical Research & Reviews. 2022, 16(6):102501.
E.Santhini et.al	Development and characterization of gelatin-based herbal hydrogels for managing infected wounds	Indian Journal of Fibre Textile Research, 47(1): 59-69, 2022.
E.Santhini et.al	Development and characterization of triclosan coated heat and moisture exchange filter for ventilation therapy.	Indian Journal of Fibre Textile Research47(1): 87-95, 2022.
E.Santhini Amalorpava Mary et.al	Bio inspired growth factor loaded self-assembling peptide nano hydrogel for chronic wound healing.	International Journal of Biological Macromolecules, 197(1): 77-87, 2022
S.Sivakumar, D.Veerasubramanian, Gopalakrishnan et.al	Application of a comfort index for evaluating tactile and thermo-physiological comfort properties of surgical gowns.	IJIndian Journal of Fibre Textile Research47(1): 146-153.
V.Thanabal et.al	Insight into the effective utilization of cotton spinning wastes from textile mills for the production of bio ethanol	Sustainable Energy Technologies and Assessments Volume 53, part D, October 2022.

PAPERS PRESENTED IN SEMINARS /CONFERENCES

D.Jayaraman	"Moving towards synthetics: Challenges of processing synthetics rich blends"	Textile Association (India) South India Unit foundation day seminar on 21.05.22 at Coindia hall Coimbatore.
E.Santhini	"Recent advancements in Medical Textiles"	Biotechnology department, PSG College of Arts and Science, Coimbatore on 20th Mar, 2023
E.Santhini	Medical Textiles And Its Role In Health Care Sectors	Biomedical engineering department, Coloroda state University, USA on 3rd Mar, 2023.
E.Santhini	Overview of Medical Textile Research and innovation in India	Indo-German Chamber of Commerce (IGCC), Pune on 17th Mar, 2023.
N.K.Nagarajan	"How to improve production and cut costs in MSME spinning mills in challenging times"	SISPA on 22.12.2022.
D. Veerasubramanian	"Standards, Quality, Regulatory & trade aspects of Technical Textiles"	International Exhibition and Conference on Technical Textiles in Technotex 2023" held on 24th Feb, 2023.

ANNEXURE V (Contd.)

PAPERS PUBLISHED IN JOURNALS AND PAPERS PRESENTED IN CONFERENCES

PAPERS PRESENTED IN SEMINARS /CONFERENCES

S.Sivakumar	"Sustainable solutions in creating niche markets for Tirupur"	conference on "Brand Tirupur : Boarding the value horizons in apparel" organized by SDC, India
	"Role of Centre of Excellences in encouraging entrepreneurs"	International conference on technical Textiles organised by Department of Textiles, Government of Tamil Nadu and CII, India.
S.Sivakumar, E. Shanthini & N.Sudhapriya	Development of breathable, reusable and oxo-biodegradable coverall using biocidal polyester	
S.Sivakumar, N.Sudhapriya & P.Arumugam	Synthesis of novel cationising agent and its application for salt free dyeing of textile Materials	
S.Balamurugan &D. Jayaraman	A novel approach to evaluate nep removal in cards	
J.Sreenivasan & N.Ravichandran	Manpower retention strategies for spinning mills	60th Joint Technological Conference of ATIRA, BTRA, NITRA and SITRA was held at SITRA on 11th and 12th November, 2022
V.Vijayajothi & D. Jayaraman	Nepping potential of present Indian cotton	
N.K. Nagarajan	How to improve yarn realization in spinning mills – a case study	
N.Vasanthakumar & S.Chandirasoodan	Strategies for minimising power cost in spinning mills	
E.Shanthini & L.Amalorpava Mary	Development of surface-active E-spin nanofibrous scaffolds for hard to heal wounds	

LECTURES DELIVERED

E. Santhini	Bio inspired growth factor loaded self-assembling peptide nano hydrogel for health care application	Satellite symposium on Physical Sciences, Life Sciences, Chemical Sciences, Mathematical Computational Sciences organized by Bharathiar University, Coimbatore between 13 and 15th Sep, 2022
Amalorpava Mary	"Recent advances in nanofibers and their biomedical applications"	international conference on recent developments in computational and biological sciences organized by Sri Ramakrishna College of arts and science for women on 10th Mar, 2023.

ANNEXURE VI

MEMBERS OF COUNCIL OF ADMINISTRATION

Elected members

1. Mr.Sanjay Jayavarthanavelu, Chairman & MD, Lakshmi Machine Works Ltd., Coimbatore (Chairman)
2. Mr.E.Sathyanarayana, Managing Director, Sree Sathyanarayana Spinning Mills Ltd., Tanuku (Vice-Chairman)
3. Mr. S.Dinakaran, Joint Managing Director, Sambandam Spinning Mills Ltd., Salem.
4. Mr. Durai Palanisamy, Managing Director, Shri Cheran Synthetic India Ltd., Pallipalayam
5. Mr. Gopinath Bala, Managing Director, Sri Venkatalakshmi Spinners (P) Ltd., Udumalpet.
6. Mr. Prashanth Chandran, Managing Director, Precot Ltd., Coimbatore.
7. Dr. K.V.Srinivasan, Managing Director, Premier Mills Pvt. Ltd., Coimbatore.
8. Dr. S.K. Sundararaman, Executive Director, Siva Texyarn Ltd., Coimbatore
9.. Mr. Thyagu Valliappa, Executive Director, Sree Valliappa Textiles, Ltd, Bangaluru.
10. Mr. J.Thulasidharan, Managing Director, The Rajaratna Mills Ltd., Coimbatore.

Permanent Members

11. The Managing Director, National Textile Corporation, Southern Regional Office, Coimbatore.
12. The President, Madura Coats Pvt. Limited, Bengaluru.
13. The Wholetime Director, The Lakshmi Mills Co. Ltd., Coimbatore.

Directors of the Textile Research Associations of India

14. Dr. T.V.Sreekumar, Director, The Bombay Textile Research Association, Mumbai.
15. Dr. Arindam Basu, Director General, Northern India Textile Research Association, Ghaziabad.
16. Shri Pragnesh Shah, Director, The Ahmedabad Textile Industry's Research Association, Ahmedabad.
17. Dr. Prakash Vasudevan, Director, The South India Textile Research Association, Coimbatore.

Scientific / Technical Members

18. Dr. A.N.Desai, Retd. Director, The Bombay Textile Research Association, Mumbai.
19. Dr. J.Srinivasan, Professor and Head, Dept. of Fashion Technology, Kumaraguru College of Technology, Coimbatore.

Representative of the Government of Tamil Nadu

20. The Commissioner of Handlooms, Govt. of Tamil Nadu, Chennai.
21. The Commissioner of Textiles, Govt. of Tamil Nadu, Chennai.

Representative of the Tamil Nadu Handloom Weavers' Co-operative Society Ltd., Chennai.

22. The Managing Director, The Tamil Nadu Handloom Weavers' Co-operative Society Ltd., Chennai.

Representative of the Textile Association

23. Chairman, The Southern India Mills' Association, Coimbatore.
24. The President, Dyers Association of Tirupur, Tirupur.
25. The President, Tirupur Exporters Association, Tirupur

Special invitees

1. The Chairman, Confederation of Indian Textile Industry, New Delhi.
2. The Director, Central Leather Research Institute, Chennai (CSIR representative).
3. Mr. Suresh Manoharan, Executive Director, Best Color Solutions (I) Pvt. Ltd., Tirupur.
4. Sri Harish Kapil Kumar, Technical Director, Sri Kumaran Mills Pvt. Ltd.
5. Mr. Rohit Rajendran, Executive Director, Premier Spg&WvgMills Ltd.
6. The President, Tamilnadu spinning mills Association, Dindigul.
`7. The President, South India Spinners Association, Coimbatore.

ANNEXURE VII

MEMBERS OF SUB-COMMITTEES

(A) Finance and machinery sub-committee

Shri Sanjay Jayavarthanavelu	Lakshmi Machine Works Ltd., Coimbatore.
Shri E.Sathyanarayana	Sree Satyanarayana Spinning Mills Ltd, Tanuku.
Dr. K.V.Srinivasan	Premier Mills Pvt. Ltd., Coimbatore.
Dr. S.K. Sundararaman	Executive Director, Siva Texyarn Ltd., Coimbatore
Dr. Prakash Vasudevan	Director, SITRA, Coimbatore.

(B) Staff and awards sub-committee

Shri Sanjay Jayavarthanavelu	Lakshmi Machine Works Ltd., Coimbatore.
Dr. K.V.Srinivasan	Premier Mills Pvt. Ltd., Coimbatore.
Shri J.Thulasidaran	The Rajaratna Mills Ltd., Palani.
Mr. Gopinath Bala	Managing Director, Sri Venkatalakshmi Spinners (P) Ltd., Udumalpet
Dr. Prakash Vasudevan	Director, SITRA, Coimbatore

ANNEXURE VIII

MEMBERS OF RESEARCH ADVISORY COMMITTEE

Members

1. Shri Sanjay Jayavarthanavelu, Chairman cum Managing Director, Lakshmi Machine Works Limited, Coimbatore (Chairman)
2. Shri E.Sathyanarayana, Managing Director, Sathyanarayna Spinning Mills, Tanuku.
3. Dr. Prakash Vasudevan, SITRA, Coimbatore (Director)
4. Dr. T.V.Sreekumar, Director, The Bombay Textile Research Association, Mumbai.
5. Dr. Arindam Basu, Director General, Northern India Textile Research Association, Ghaziabad.
6. Dr. Pragnesh Shah, Director, The Ahmedabad Textile Industry's Research Association, Ahmedabad.
7. Shri. S. Dinakaran, Joint Managing Director, Sambandam Spinning Mills Ltd., Salem.
8. Shri. Gopinath Bala, Technical Director, Sri Venkatalakshmi Spinners Pvt. Ltd., Udumalpet.
9. Shri J.Harish Chandravel, Executive Director, Ram Narayana Mills Limited, Coimbatore.
10. Shri. M.Muthupalaniappa, Vice President (Technical), representing Mr. T.Kannan, Thiagarajar Mills Ltd., Madurai.
11. Shri.Prashanth Chandran, Joint Managing Director, Precot Ltd, Coimbatore.
12. Dr. K.V.Srinivasan, Premier Mills Private Limited, Coimbatore.
13. The Chairman & Managing Director, National Textile Corporation Ltd., New Delhi.
14. The Chairman, The Southern India Mills Association, Coimbatore.
15. The Commissioner of Handlooms and Textiles, Govt. of Tamil Nadu, Chennai.
16. The Director, Central Leather Research Institute, Chennai.

Invitees

1. Dr. R..Adivarekar, Professor and Head-Department of Fibres and Textile Processing Technology, Institute of Chemical Technology (formerly U.D.C.T), Mumbai.
2. Dr. J.Angayarkanni, Head, Dept, of Microbiology,Bharathiar University, Coimbatore
3. Shri K.Balasanthanam, MD, Kongoor Textile Process, Tirupur.
4. Mr. B.M.Bhoopathi, CEO, DAT, Tirupur.
5. Mr. N.Deivasigamani, Techical Committee member, DAT, Tirupur
6. Mr. C.B.Bhaskaran, MD, Angerialayam CETP,
7. Dr. V.Chandrasekaran, Vice-President (Technical), Adwaith Textiles Limited, Coimbatore.
3. Dr. V.R.Giridev, Professor and Head, Dept. of Textile Technology, AC College of Technology, Anna University, Chennai.
9. Shri Joga Rao, President (Operations), Sree Satyanarayana Spinning Mills (P) Ltd., Tanuku
11. Mr.T.Kumar, Executive Director, Precot Ltd., Coimbatore-18.
12. Dr.N.N. Mahapathra, Business Head(Dyes), Shree PushkarCehmicals & Fertilizers Ltd., Mumbai.
13. Dr.R.Rajendran, Associate Professor, Dept. of Microbiology, PSG College of Arts & Science, Coimbatore.
14. Dr.M.Senthil Kumar, Associate Professor, PSG College of Technology, Coimbatore
15. Shri S.Shyamsundar, Head - Technical, Precot Limited
17. Dr.J.Srinivasan, Professor, Dept of Fashion Technology, Kumaraguru College of Technology, Coimbatore.
18. Mr.K.Sudhakaran, MD< Confident Proessing, Tirupur.
19. Dr.V.Subramaniam, Director, Dept. of Textile Technology, Jaya Engineering College, Chennai.
20. Dr.Uma Krishnan, Associate Dean, SASTRA, School of humanities and sciences .

ANNEXURE IX

COMMITTEES IN WHICH SITRA STAFF REPRESENTED

Chairman, Hosiery Sectional Committee, TXD10, Bureau of Indian Standards, New Delhi.
Chairman, Medical Textiles Committee TxD36, Bureau of Indian Standards, New Delhi.
Member, Advisory Committee for AIC NIFT TEA incubation centre for Textiles and Apparels.
Co-opted member of Governing Committee, NIFT - TEA.
Member, Sub-committee for manpower planning for the textile engineering industry constituted by India ITME Society, Mumbai..
Member, TX 0I & TX 05 Committees, Bureau of Indian Standards, New Delhi.
Expert member, Board of Studies (BoS) in Textile Technology, Bannari Amman Institute of Technology (Autonomous), Sathyamangalam.
Member, Board of Studies in Textile Technology, PSG College of Technology, Coimbatore.
Member, Council of National Jute Board, Kolkata.
Member, All India Powerloom Board, Ministry of Textiles, Government of India, New Delhi.
Member, Advisory Committee & member, Staff Selection Board, Textile Technology Department, Kumaraguru College of Technology, Coimbatore.
Member, Council of Administration and member of Advisory committee for strategic planning and Co-Chairman of technical Committee, SIMA Cotton Development & Research Association.
Member, Cotton Advisory Board, Ministry of Textiles, Govt. of India.
Member, Cotton Development & Research Association, New Delhi.
Member, Board of Examiners of Indian Institute of Handloom Technology, Salem.
Member, CII, Southern Region, Textile Sub-committee.
Member, Confederation of Indian Industries (CII), Coimbatore zone.
Supervisor, Ph.D & M.Phil. Programmes (Textile Technology), Anna University, Chennai.
Member, Board of Studies (BoS) in Textile Technology (TT) Karpagam University, Coimbatore.
Member, Board of Governors, Sardar Vallabhbhai Patel International School of Textiles and Management, Coimbatore.
Member, Cotton Selection/Purchase Committee, KVIC, Chitradurga.
Member, Technical Sectoral Expert Committee of Textile Sector under PAT Scheme of Bureau of Energy Efficiency (BEE), New Delhi.
Member Board of Studies (Bos) in Psychology, Bharathiar University, Coimbatore; PSG College of Arts & Science, Coimbatore; Govt. Arts College, Coimbatore; Sri Krishna College of Arts & Science
Member, Board of Studies (BoS) in Textile Technology and Textile Chemistry departments of Anna University, Chennai.
Member, Textiles Speciality Chemicals and Dyestuffs Sectional Committee, TXD 07, Bureau of Indian Standards, New Delhi.
Member of the Syllabus Sub Committee for Faculty of technology – Master of technology (Textile Chemistry) for Anna University, Chennai.
DST SEED Project advisory committee for Kumaraguru College of Technology, Coimbatore
Technical committee for tender and purchase of Yarn yeing and stenter machinery for Tamilnadu Co-operative Textile Processing Mils, Erode
Technical committee for establishing a new processing unit at Nadukani Kannur by Department of Handlooms and Textiles, Kerala.
Member, Board of Studies in Biochemistry and Bio technology departments, Bharatiar University, Coimbatore.
Member Board of Studies in Department of Biochemistry, Dr. NGP College of Arts and Science, Coimbatore.
Member, Consultative Group of Experts (CGE) for preparation of Best Available Techniques reference document (BREF) for Central Pollution Control Board (CPCB)
Member, BIS TXD 07 Committee for Textile chemicals and dyestuffs
Member of the Syllabus Sub Committee for Faculty of technology – Mater of technology (Textile Chemistry) for Anna University, Chennai.
Member, DST SEED Project advisory committee for Kumaraguru College of Technology, Coimbatore
Member, Technical committee for tender and purchase of Yarn dyeing and stenter machinery for Tamilnadu Co-operative Textile Processing Mils, Erode
Member, Technical committee for establishing a new processing unit at Nadukani, Kannur by Department of Handlooms and Textiles, Kerala.
Member, Technical committee for procurement of an instrument for Bharathiar University

ANNEXURE X

SITRA MEMBER MILLS

Full Members

1 Acsen Tex P. Ltd.
2 Adwaith Textiles Limited
3 Amaravathi Spinning Mills
4 Amarjothi Spg. Mills Ltd.
5 Anna Co-op. Spg. Mills Ltd.
6 Annamalaiar Mills Private Ltd.
7 Annapoorani Textiles Pvt Ltd -Erode
8 B K S Textiles Private Limited
9 B R T Spinnerrs Limited
10 Bannari Amman Spinning Mills Ltd -Coimbatore
11 Best Cotton Mills (P) Ltd
12 Cardwell Spinning Mills Limited
13 Chenniappa Yarn Spinners (P) Ltd
14 Chida Spg. Mills (P) Ltd.
15 Coimbatore Polytex Private Ltd.
16 D B V Cotton Mills (P) Ltd.
17 Eastman Spinning Mills (P) Ltd.
18 Emperor Textiles (P) Ltd
19 Ennar Spinning Mills (P) Ltd
20 G T N Industries Ltd
21 Ganesh Spintex pvt ltd
22 Gopalakrishna Textile Mills Pvt. Ltd
23 Harshini Textiles Ltd
24 Hindustan Cotton Spinning Mills
25 Jai Sakthi Mills
26 Jay Textiles -Unit II (Super Sales India Ltd.)
27 Jayalakshmi Textiles Private Limited
28 Jayavarma Textiles (P) Ltd - Unit 2
29 JVS Exports
30 K K P Spinning Mills Ltd
31 Kaveri Yarns and Fabrics Ltd.
32 Kayaar Exports Private Limited
33 Kesharinandan knit fabrics P Ltd
34 L S Mills Ltd.
35 Lakshmi Machine Works Ltd.
36 Madura Coats Private Limited (4)
37 MAG Solvics (P) Ltd
38 Maris Spinners Ltd.
39 Marudhamalai Sri Dhandapani Spinning Mills
40 Narasu's Spg. Mills
41 National Textile Corporation (TN&P) Ltd. (16)
42 Prabath Spinner India (P) Ltd
43 Prachidhi Spinners Pvt. Ltd,
44 Precot Ltd. (6)
45 Premier Mills Private Ltd.
46 Premier Spg. & Wvg. Mills Ltd.
47 S C M Textile Spinners
48 S P Spinning Mills Ltd.
49 S.A. Aanandan Spinning Mills (P) Ltd
50 S.N.N.Tulasi Narayana Spinners Pvt Ltd -Annur
51 S.P Apparels - Spinning Unit
52 Sachin Textiles-Coimbatore
53 Sahana Textiles
54 Salona Cotspin Limited
55 Sangeeth Textiles Ltd.
56 Saravana Polythreads (P) Ltd
57 Sarmangal Synthetics Limited
58 Selvaraja Mills Pvt. Ltd.
59 Senthilkumar Textile Mills Private Limited, Erode
60 Seyadu Spinning mills
61 Shanmugappriya Textiles Ltd.
62 Shiva Mills Limited
63 Shiva Tex Yarn Limited-Coimbatore
64 Shri Cheran Synthetics India Ltd
65 Shri Govindaraja Mills Ltd,- B Unit
66 Shri Ramalinga Mills Ltd.
67 Shri Santhosh Meenakshi Textiles Private Limited
68 Shri Siddhivinayaga Tex India Pvt Ltd -Dindigul
69 Southern Spinners and Processors Limited
70 Sowmiya Textiles Private Ltd
71 Sree Ayyanar Spg. & Wvg. Mills Ltd - Unit (2) (2)
72 Sree Narasimha Textiles (P) Ltd.
73 Sree Satyanarayana Spg. Mills Ltd.
74 SRG Apparels
75 Sri Gomathy Mills Private Limited
76 Sri Kannapiran Mills Ltd.
77 Sri Kannattal Mills P. Ltd.
78 Sri Karthikeya Spg. & Wvg. Mills Ltd.
79 Sri Kumaraguru Mills Ltd
80 Sri Kumaran Mills Limited.
81 Sri Lakshmi Saraswathi Textiles (Arni) Ltd. (2)
82 Sri Mahasakthi Mills Ltd
83 Sri Muni Pachaiyappan Textiles (P) Ltd.
84 Sri Murugar Spinning Mills-Coimbatore
85 Sri Nachammai Cotton Mills Ltd.
86 Sri Ramakrishna Mills (CBE) Ltd.
87 Sri Ranga Textiles (P) Ltd.
88 Sri Saravana Mills Pvt Ltd-Dindigul
89 Sri Selvabathi Mills Pvt Ltd-Coimbatore
90 Sri Shanmugavel Mills Pvt. Ltd.
91 Sri Sharadhambika Spintex P.Ltd
92 Sri Sivajothi Spg Mills P Ltd
93 Sri Sundhareswara Mills-Pollachi
94 Sri Varadaraja Textiles Ltd.
95 Sri Vasudeva Textiles Limited Unit II
96 Sri Venkatalakshmi Spinners (P)Ltd.
97 Sri Vignesh Yarns (P) Limited
98 Super Spg. Mills Ltd.
99 Suriya Spinning Mills Unit -B-Pollachi
100 T T Limited- (Unit Tirupathi Spinning Mills)
101 The Bharathi Co-op. Spg. Mills Ltd.
102 The Kadri Mills (CBE) Ltd. (8)
103 The Lakshmi Mills Co.Ltd. (3)
104 The Palani Andavar Mills Ltd.
105 The Rajaratna Mills Ltd. (2)
106 The Southern Textile Ltd
107 The Tamilnadu Handloom Weavers' Co-op.Society Ltd
108 The Tamilnadu Textile Corporation Ltd
109 Tirupur Textiles Private Ltd. (3)
110 Top Light Textiles Pvt Ltd-Tirupur
111 V.Thangavel and Sons Pvt Ltd-Komarapalayam
112 Veejay Lakshmi Engineering Works Ltd
113 Veejay Syntex Pvt. Ltd.
114 Vijay Velavan Spinning Mills (P) Ltd
115 Vishnu Lakshmi Mills (P) Ltd

Associate Members

1 Cheviot Company Ltd
2 Eurotex Industries & Exports Ltd.
3 Ginni International Limited
4 Gloster Jute Mills Ltd
5 Gujarat Heavy Chemicals Ltd. Unit : Sree Meenakshi Mills (2)
6 Indocount Industies -Kolhapur
7 JP MODATEX LLP-SILVASSA
8 Kangwal Textile Company Limited,
9 Loyal Textile Mills Ltd.
10 Maharaja Shree Umaid Mlls Ltd
11 Nagammal Mills Ltd.
12 Nagreeka Exports Ltd.
13 P B M Polytex Ltd.(2)
14 Pee Vee Textiles Limited
15 Pratibha Syntex Limited
16 Rajapalayam Mills Ltd.
17 Reliance Industries Ltd.
18 Rieter India (P) Ltd

Note: Figures in brackets indicate number of units

ANNEXURE X (Condt..)

SITRA MEMBER MILLS

19 RSB Cottex
20 Sambandam Spg Mills Ltd.
21 Shetkari Sahakari Soot Girni Ltd.
22 Sree Valliappa Textiles Ltd.
23 Sri Jayajothi & Co Ltd
24 Sudiva Spinners Private Limited
25 Sumicot Limited
26 The Suguna Mills Pvt. Ltd.
27 Thiagarajar Mills Ltd. (2)
28 Vaardhman Yarns -Raisen
29 Vaibhav Laxmi Spg Mills ltd - Mehsana,Gujarat
30 Vardhaman Yarns & Threads Limited
31 Vippy Spinpro Ltd
32 Voltas Ltd.

Technical Service Card Holders

1 A.R.Appasamy
2 Aarthi -A1 Traders
3 Anishkumar Spinning Mill
4 Anithaa Weaving Mills Pvt Ltd
5 Arulkumaran Spinning mills
6 Bizmart Ventures Pvt Ltd
7 Change Mill
8 Dhanalakshme Textiles
9 Golden Fashions India Pvt Ltd
10 J.G. Hosiery Pvt Ltd
11 Jacquard Fabrics India Pvt Ltd
12 Jayanthi Textile Products
13 K G Denim Limted
14 Kanakalakshmi Mills Pvt Ltd
15 Kikani Exports Pvt Ltd
16 Lakshmi Spinners
17 Loom tex exports
18 Muthu Spinning Mills Private Limited
19 Nilgiri Textiles Pvt Ltd
20 Patodia Syntex Ltd
21 Prathishta Weaving and Knitting Co Ltd
22 Precission Fabrics India Private Limited
23 Ramakrishnaa Processing Mills
24 Rangnath Melange
25 Renaissance Incorporations
26 Rimtex Engineering Pvt Ltd
27 S.N.N Textiles Private Limited
28 Selvalakshmi Spintex
29 Shree M.T.K Textiles Private Limtied
30 Shrenic Spinners Pvt Limited
31 Siruvani Yarns
32 Sre Venkatachalapathy Textiles
33 Sreedhara Textiles Private Ltd
34 Sri Amman Textiles
35 Sri Choleeswara Spg Mills
36 Sri Jagannatha Spinners Pvt Ltd
37 Sri Jothi Textiles
38 Sri Murugan Textiles
39 Sri Palani Andavar Textiles
40 Stalwart Sourcing Solutions
41 Techno Electronics and Instruments
42 Veejay Terry Products Ltd
43 Veen Farm and Field Agro Products Pvt Ltd.
44 Victus Dyeing

FINANCIAL STATEMENTS
AS ON
31st MARCH 2023

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

COIMBATORE - 641 014

Independent Auditor's Report

To
The Members of The South India Textile Research Association

Report on the Audit of the Financial Statements

Opinion

1. We have audited the accompanying financial statements of The South India Textile Research Association ("the Association"), which comprise the Balance Sheet as at March 31, 2023 and the Statement of Income and Expenditure for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

2. In our opinion and to the best of our information and according to the explanations given to us the aforesaid financial statements give a true and fair view of the financial position of the Association as at March 31, 2023 in conformity with the accounting principles generally accepted in India:

   (a) in the case of the Balance Sheet, of the state of affairs of the Association as at March 31, 2023; and

   (b) in the case of the Income and Expenditure Account, of the Excess of Income over Expenditure for the year ended on that date.

Basis for Opinion

3. We conducted our audit in accordance with the Standards on Auditing (SAs) issued by ICAI. Our responsibilities under those standards are further described in the Auditor's responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Association in accordance with the Code of Ethics issued by ICAI and we have fulfilled our other ethical responsibilities in accordance with the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

4. Management of the Association is responsible for the preparation of these financial statements that give a true and fair view of the state of affairs and results of operations of the Association in accordance with the accounting principles generally accepted in India. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

5. In preparing the financial statements, management is responsible for assessing the Association's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Association or to cease operations, or has no realistic alternative but to do so.

6. Those charged with governance are responsible for overseeing the Association's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

7. Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

8. As part of an audit in accordance with SAs, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

   (a) Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

   (b) Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Association's internal control.

(c) Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

(d) Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Association's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report.

9. We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Report on Other Requirements

10. Further, we report that:

(a) We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit.

(b) In our opinion, proper books of account have been kept by the Association so far as appears from our examination of those books.

(c) The Balance Sheet and Statement of Income and Expenditure dealt with by this Report are in agreement with the books of account.

Coimbatore
August 04, 2023

For **P N Raghavendra Rao & Co.,**
Chartered Accountants

Sd/ Pon Arul Paraneedharan
Partner
Membership Number: 212860
UDIN: 23212860BGUSGQ4633

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION
BALANCE SHEET AS AT 31ST MARCH 2023

Amount in "Rs."

Particulars	Schedule No.	2022-23	2021-22
LIABILITIES			
Corpus/Capital Fund	1	2,99,23,378	2,92,45,968
Capital Grant from Ministry	2	40,12,91,848	39,78,15,615
Reserves and Surplus	3	81,61,79,752	77,59,84,215
Current Liabilities and Provisions	4	2,73,51,948	3,39,38,659
TOTAL (A)		**1,27,47,46,926**	**1,23,69,84,457**
ASSETS			
Fixed Assets - Net Block	5 & 6	59,12,63,775	56,98,93,760
Investments	7	60,51,47,292	59,70,85,035
Sponsored Projects - Grant Receivable	8	2,87,62,025	1,72,52,165
Current Assets, loans, Advances etc	9	4,95,73,834	5,27,53,497
TOTAL (B)		**1,27,47,46,926**	**1,23,69,84,457**

"Vide our report of even date"

For P.N.Raghavendra Rao & Co.,
Chartered Accountants
Firm Registration No:003328S
Sd/- Pon Arul Paraneedharan
Partner
M.No:212860

Place : Coimbatore
Date : 04-08-2023

Sd/-Shri. Sanjay Jayavarthanavelu (Chairman)
Sd/- Shri. J Thulasidharan (Member)
Sd/- Dr. Prakash Vasudevan (Director)

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2023

Amount in "Rs."

Particulars	Schedule No.	2022-23	2021-22
INCOME			
Income from Services	10	10,64,77,811	8,67,42,555
Membership/Ministry Contribution	11	2,68,90,089	2,65,40,338
Sponsored Projects - Overhead Recoveries	12	17,99,571	10,87,661
Interest Income	13	83,80,512	77,24,736
Other Income	14	1,49,10,148	94,73,584
Changes in Inventories	15	3,69,046	(9,64,804)
TOTAL (A)		**15,88,27,177**	**13,06,04,070**
EXPENDITURE			
Establishment Expenses	16	10,81,39,414	9,28,02,321
Administrative Expenses	17	2,46,32,881	1,74,40,886
Repairs and Maintenance	18	87,66,391	78,02,232
Stores Consumed	19	1,03,42,069	83,11,045
Finance Charges	20	45,375	30,583
Sponsored Projects - SITRA Contribution	21	2,62,223	8,763
Depreciation	22	1,00,45,903	99,67,685
TOTAL (B)		**16,22,34,256**	**13,63,63,516**
Balance being excess of Income over Expenditure for the year		(34,07,079)	(57,59,446)
Appropriated from Research & Development Reserve		16,45,667	64,664
Appropriated from Infrastructure Dev. & Maintenance Reserve		11,59,574	13,79,158
Appropriated from Staff Benefit Reserve (Exgratia and Payment of Terminal Benefits)		61,08,212	50,97,327
Paid from Sitra Employee Gratuity Scheme		12,06,909	29,08,470
Appropriated from Depreciation Reserve		15,24,781	12,55,398
Appropriated from General Reserve		36,205	-
Balance Surplus		**82,74,269**	**49,45,571**
Transfer to Staff Benefit Reserve		50,00,000	22,00,000
Transfer to Depreciation Reserve		28,60,000	-
Transfer to Infrastructure Devel. & Maintenance Reserve		-	24,00,000
Transfer to General Reserve		**4,14,269**	**3,45,571**

"Vide our report of even date"

For P.N.Raghavendra Rao & Co.,
Chartered Accountants
Firm Registration No:003328S

Sd/- Pon Arul Paraneedharan
Partner
M.No:212860

Place : Coimbatore
Date : 04-08-2023

Sd/- Sanjay Jayavarthanavelu (Chairman)
Sd/- Shri. J.Thulasidharan (Member)
Sd/- Dr. Prakash Vasudevan (Director)

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year ended 31.03.2023

Amount in "Rs."

Schedules	2022-23	2021-22
Sch - 1		
Corpus/Capital Fund		
Contribution from Member Mills	2,92,45,968	2,87,92,408
Add: Received during the year	6,77,410	4,53,560
Total	**2,99,23,378**	**2,92,45,968**
Sch - 2		
Capital Grant from Ministry		
Cotton Textile Fund Committee	12,53,791	12,53,791
Council of Scientific and Industrial Research	22,69,513	22,69,513
MOT/DST/DRDO/Others	12,00,24,446	11,65,24,446
Ministry of Textiles - Sponsored CAD Centre	48,82,780	48,82,780
Ministry of Textiles - Centre of Excellence - Meditech	21,40,71,490	21,40,95,257
MOT/Office of the Textile Commissioner - PLSC	5,87,89,828	5,87,89,828
Total	**40,12,91,848**	**39,78,15,615**
Sch - 3		
Reserves & Surplus		
General Reserve	24,98,50,180	24,20,66,394
Asset Stabilisation Reserve	4,67,44,967	5,23,45,679
Research and Development Reserve	14,10,54,728	13,49,49,817
Infrastructure Development and Maintenance Reserve	9,64,68,504	9,16,75,680
Staff Benefit Reserve - SITRA	4,23,66,360	4,06,84,553
Staff Benefit Reserve - PLSC	99,06,003	76,87,012
Depreciation Reserve Invt.Interest	21,76,97,343	19,75,75,859
PLSC/CAD Centre Reserve	1,20,91,666	89,99,221
Total	**81,61,79,752**	**77,59,84,215**
Sch - 4		
Current Liabilities & Provisions		
Current Liabilities		
Unspent grant		
Unspent grant - SITRA	2,40,925	57,10,453
Advance from Debtors	84,79,412	90,90,534
Creditors for Purchases & Capital Goods	28,64,115	9,67,942
Creditors for Expenses	39,09,500	15,05,930
Total (A)	**1,54,93,951**	**1,72,74,859**
Provisions		
Provision for Expenses -SITRA	94,73,224	1,30,36,654
Provision for Expenses - COE	12,05,360	15,93,748
Provision for Expenses - PLSC	11,79,413	20,33,398
Total (B)	**1,18,57,997**	**1,66,63,800**
Total (A + B)	**2,73,51,948**	**3,39,38,659**

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year ended 31.03.2023

Amount in "Rs."

Schedules	2022-23	2021-22
Fixed Assets		
Sch - 5		
Gross Assets		
Lands	7,83,712	7,83,712
Building - SITRA	4,32,22,679	3,87,24,226
Building - COE	8,51,76,526	8,51,76,526
Plant and Machinery	20,84,59,173	18,71,43,249
Furniture & Fittings	90,20,313	80,70,032
Computer & Accessories	1,37,85,106	1,33,31,291
Library	36,19,280	34,96,878
Vehicle	15,89,106	15,89,106
Total	**36,56,55,895**	**33,83,15,020**
Sch - 6		
Fixed Assets under Sponsored Projects		
The South India Textile Research Association	7,77,82,373	7,40,24,073
Integrated Skill Development Scheme	2,42,91,138	2,42,91,138
Centre of Excellence - Meditech	22,73,07,341	22,73,07,341
Powerloom Service Centre	6,01,71,847	5,98,55,104
Total	**38,95,52,699**	**38,54,77,656**
Total Gross Block	**75,52,08,594**	**72,37,92,676**
Accumulated Depreciation		
Depreciation Reserve - Building	2,27,32,872	2,10,33,029
Depreciation Reserve - Plant & Machinery	12,24,01,129	11,54,99,721
Depreciation Reserve - Furniture And Fixtures	39,82,774	37,55,184
Depreciation Reserve - Computer & Accessories	44,36,167	40,84,724
Depreciation Reserve - Library	20,39,312	17,70,443
Depreciation Reserve - Vehicles	7,70,311	7,08,019
Depreciation Reserve - ISDS	75,82,254	70,47,796
Total	**16,39,44,819**	**15,38,98,916**
Net Block	**59,12,63,775**	**56,98,93,760**
Sch - 7		
Investments		
Depreciation Reserve Investment - SITRA	25,91,84,735	24,98,51,474
Research and Development Reserve Investment	10,63,44,748	10,34,92,825
Infrastructure Development & Maintenance Reserve Investment	8,17,32,281	7,94,39,571
Staff Benefit Reserve Investment - SITRA	4,71,45,464	2,58,52,102
Staff Benefit Reserve Investment - PLSC	33,47,697	32,08,272
General Reserve Investment - SITRA	9,99,66,797	12,19,22,946
General Reserve Investment - PLSC	74,25,570	1,33,17,845
Total	**60,51,47,292**	**59,70,85,035**
Sch -8		
Sponsored Projects - Grant Receivable		
As per Schedule	2,87,62,025	1,72,52,165
Total	**2,87,62,025**	**1,72,52,165**

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year ended 31.03.2023

Amount in "Rs."

Schedules	2022-23	2021-22
Sch - 9		
Current Assets, loans, Advances etc		
Sundry Debtors		
Sundry Debtors	49,53,498	51,57,673
Total	**49,53,498**	**51,57,673**
Inventories		
Raw Materials	2,67,305	6,17,089
Finished Goods	5,81,063	2,12,017
Total	**8,48,368**	**8,29,106**
Cash & Bank Balances		
Cash on Hand	1,05,283	65,177
Cash at Bank	19,11,138	19,63,878
Cash at Bank Sponsored Project	20,50,897	68,32,057
Total	**40,67,318**	**88,61,112**
Loans & Advances		
Deposits - Others	33,88,473	46,42,314
Interest Receivable	1,87,64,818	1,71,26,019
Advances for Purchases and Others	40,39,713	33,13,797
Prepaid Expenses	18,13,196	16,49,001
Balance with revenue authorities (GST)	25,28,539	21,75,468
Tax Deducted at Source	91,70,787	89,99,007
Total	**3,97,04,650**	**3,79,05,606**
Grand Total	**4,95,73,834**	**5,27,53,497**

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Income and Expenditure Account for the year ended 31.03.2023

Amount in "Rs"

Schedules	2022-23	2021-22
Sch - 10		
Income from Services		
Testing and Investigation Fee	10,28,78,302	8,42,95,469
HRD Education Receipts	31,38,540	21,76,664
Publication Income	4,60,970	2,70,422
Total	**10,64,77,811**	**8,67,42,555**
Sch - 11		
Membership/Ministry Contribution		
From Ministry of Textiles	2,00,00,000	2,00,00,000
From Membership Contribution	65,08,584	62,19,913
From Technical Service Card Membership Fees	3,81,505	3,20,425
Total	**2,68,90,089**	**2,65,40,338**
Sch - 12		
Sponsored Projects - Overhead Recoveries	17,99,571	10,87,661
Total	**17,99,571**	**10,87,661**
Sch - 13		
Interest Income		
Interest Income from Investment and Advances	83,80,512	77,24,736
Total	**83,80,512**	**77,24,736**
Sch - 14		
Other Income		
Rent Receipts	28,49,539	12,15,719
Miscellaneous Income	63,13,176	55,82,576
Allocation of Expenses incurred by SITRA for PLSC	9,91,512	8,60,438
Allocation of Expenses incurred by SITRA for COE	16,43,799	18,14,851
60th Joint Technological Conference Receipts	31,12,123	-
Total	**1,49,10,148**	**94,73,584**
Sch - 15		
Changes in Inventories		
Closing Stock of Finished Goods	5,81,063	2,12,017
Less:Opening Stock of Finished Goods	2,12,017	11,76,821
Total	**3,69,046**	**(9,64,804)**
Sch - 16		
Establishment Expenses		
Salary and Other Allowances	10,19,24,645	8,38,59,139
Payment towards Terminal benefits	23,15,121	39,05,797
Sitra Contributory PF and other Funds	60,22,657	62,18,608
	11,02,62,423	9,39,83,544
Less: a) Allocated to Ministry Sponsored Projects	13,81,754	11,47,842
b) Allocated to Croda & Biorad Sponsored Projects	7,41,255	33,381
Total	**10,81,39,414**	**9,28,02,321**

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Income and Expenditure Account for the year ended 31.03.2023

Amount in "Rs"

Schedules	2022-23	2021-22
Sch - 17		
Administrative Expenses		
Travelling Expenses	16,20,094	11,07,003
Printing & Stationery	12,50,975	6,75,011
Publication Expenses	1,81,070	1,14,741
Postage, Telegrams and Telephone Charges	14,48,816	13,62,852
Journals and Periodicals	5,91,550	6,00,854
Electricity Charges	84,75,669	63,23,353
Less: Solar Energy Consumption	(15,24,389)	(10,22,596)
Insurance	8,73,920	7,71,634
Rent, Rates and Taxes	9,81,507	7,13,006
Advertisement Charges	96,230	80,385
Training Course Expenses	3,95,480	1,09,658
Conferences, Seminars and Meetings	10,08,021	1,16,838
Professional Charges	10,04,625	16,94,744
Office Expenses	14,97,595	6,96,856
Testing expenses	8,62,352	14,36,487
Inhouse Project Others	19,11,132	8,45,209
Allocation of Expenses incurred by SITRA for COE	16,44,675	18,14,851
60th Joint Technological Conference Expenses	21,60,520	-
Provision for Doubtful Debts & Bad Debts Written off	1,53,040	-
Total	**2,46,32,881**	**1,74,40,886**
Sch - 18		
Repairs & Maintenance		
Maintenance of Motor Cars and Vehicles	78,932	35,783
Maintenance of Machinery	72,89,343	57,81,191
Maintenance of Building & Staff Quarters	12,36,151	17,03,111
Maintenance of Furniture and Office Equipments	1,61,965	2,82,147
Total	**87,66,391**	**78,02,232**
Sch - 19		
Opening Stock of Rawmaterials	6,17,089	14,40,480
Add: Purchase of Consumables	75,39,699	59,72,007
Less: Closing Stock of Rawmaterials	2,67,305	6,17,089
Project Expenses	24,52,585	15,15,647
Total	**1,03,42,069**	**83,11,045**
Sch - 20		
Finance Charges		
Bank Charges and Commission	45,375	30,583
Total	**45,375**	**30,583**
Sch - 21		
Sponsored Projects - SITRA Contribution	2,62,223	8,763
Total	**2,62,223**	**8,763**

Place : Coimbatore

Date : 04-08-2023

"Vide our report of even date"

For P.N.Raghavendra Rao & Co.,

Chartered Accountants

Firm Registration No:003328S

Sd/- Pon Arul Paraneedharan

Partner

M.No:212860

Sd/- Sanjay Jayavarthanavelu (Chairman)

Sd/- Shri. J.Thulasidharan (Member)

Sd/- Dr. Prakash Vasudevan (Director)

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year 2022 -2023

Financial Status of Sponsored Projects : 01/04/2022 - 31/03/2023

Schedule 8 & 21

Amount in "Rs."

Sl. No	Name of Sponsored Project	Opening Balance 2022-23		Receipts			Expenditure as at 31.03.2023			Total Expenditure as at 31/03/2023	Refunded/ Transfer	Balance as at 31/03/2023			
							Recurring & Non Recurring					IA / SITRA		MOT	
		Industry	Ministry	MOT/IA Contribution	Revenue/ Appropriation	Total Receipts	Industry	SITRA	MOT			Unspent	Due	Unspent	Due
1	**Ministry of Textile Sponsored Research Projects**														
a	Development of Special wound care Dressing made of PVA/ chitosan	-	(36,205)	-	-	-	-	-	-	-	36,205	-	-	-	-
b	Design and Fabrication of an Instrument to Evaluate Resistance of Medical Face Masks to Penetration by High Velocity Stream of Blood from a Punctured Wound	-	(14,03,769)	-	7	7	-	-	-	-	261	-	-	-	(14,04,023)
c	Design and fabrication of an instrument to evaluate the characteristics of fluid handling capacity of wound care dressings	-	(15,01,707)	-	3	3	-	-	-	-	101	-	-	-	(15,01,805)
d	Development of a Heat and Moisture Exchange Filter	-	(14,42,446)	-	790	790	-	-	25,315	25,315	33,029	-	-	-	(15,00,000)
e	Development of Indigeneous Viral Barrier Fabric		(11,57,251)	11,57,447	1	11,57,448	-	-	-	-	197	-	-	-	-
f	Development of a Anterior Cruiate Ligaments (ACL) using Textile Matrices	-	(14,62,000)	14,62,251	2	14,62,253	-	-	-	-	253	-	-	-	-
g	Development of Nanoparticle based transdermal patches of selected cardiovascular drugs	-	(13,04,249)	13,04,481	2	13,04,483	-	-	-	-	234	-	-	-	-
h	Polyester Vascular Graft Implant- Process Optimization and Production Scale up	-	(18,22,612)	18,23,500	7	18,23,507	-	-	-	-	895	-	-	-	-
i	Development of Eco Clothing by greener reduction process of Natural Indigo Dye	-	(5,18,271)	5,18,271	-	5,18,271	-	-	-	-	-	-	-	-	-
j	Design and Development of facile high throughput needleless electro spinning set-up	-	39,96,857	2,58,300	1,05,697	3,63,997	-	2,58,300	76,93,723	79,52,023	2,16,941 -	-	-	-	(38,08,110) -
		-	**(66,51,653)**	**65,24,250**	**1,06,509**	**66,30,759**	**-**	**2,58,300**	**77,19,038**	**79,77,338**	**2,88,116**	**-**	**-**	**-**	**(82,13,938)**

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year 2022 -2023

Financial Status of Sponsored Projects : 01/04/2022 - 31/03/2023

Schedule 8 & 21 **Amount in "Rs."**

Sl.No.	Name of Sponsored Project	Opening Balance 2022-2023	Receipts		Expenditure Recurring		Capital -	Total Expenditure As At 31/03/2023	Refunded/ Transfer to Reserve	Balance as at 31/03/2023			
										IA / SITRA		MOT	
			Funds Received during the year	Revenue / Appropriation	IA	MOT	MOT			Unspent	Due	Unspent	Due
1	Ministry sponsored powerloom service centre receipts	-	-	-	96,07,503	1,14,00,000	-	2,10,07,503	-	-	-	-	(1,14,00,000)
2	Samarth - Scheme for capacity building in Textile Sector - Phase I	(12,49,056)	-	-	-	-	-	-	-	-	-	-	(12,49,056)
	Samarth - Scheme for capacity building in Textile Sector - Phase II	7,88,110	-	-	-	29,38,042	-	29,38,042	-	-	-	-	(21,49,932)
3	International Training Programme	-	50,28,463	-	-	50,28,463	-	50,28,463	-	-	-	-	-
4	**CoE Projects**							-	-	-	-	-	-
i	Office of the Textile Commissioner							-	-	-	-	-	-
	a) Development of Collagen coated	(2,40,000)	-	-	-	-	-	-	-	-	-	-	(2,40,000)
	b) Development of Moppings pads using non woven & Woven structure	(2,40,000)	-	-	-	-	-	-	-	-	-	-	(2,40,000)
ii	Dev of Total Comfort Index paradigm for textile structures	(35,99,938)	-	6	-	-	-	-	68	-	-	-	(36,00,000)

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year 2022-2023

Financial Status of Sponsored Projects : 01/04/2022 - 31/03/2023

Schedule 8 & 21 **Amount in "Rs."**

Sl.No.	Name of Sponsored Project	Opening Balance 2022-2023	Receipts		Expenditure Recurring		Capital -	Total Expenditure	Refunded/	Balance as at 31/03/2023			
			Funds Received	Revenue / Appropriation	IA	MOT	MOT	As At	Transfer to	IA / SITRA		MOT	
										Unspent	Due	Unspent	Due
5	**DST & Inhouse Project**												
i	Design & Development of an instrument to assess the puncture resistance of surgical material by using sharp edged puncture probe / syringe needles	(7,62,635)	-	23	-	-	-	-	3,702	-	-	-	(7,66,314)
ii	Development of nanofibrous membrane for wound healing by controlled release of Indian Honey & Curcumin	(2,00,575)	-	-	-		-	-	-	-	-	-	(2,00,575)
iii	Durable Non-Fluorinated Functional Textiles using Fumed Silica Sols	(2,45,550)	-	31	-	-	-	-	11,579	-	-	-	(2,57,098)
iv	High Productivity hand operated charkhas development - KVIC	3,65,261	4,00,000	11,415	7,27,223	-	-	7,27,223	-	49,454	-	-	-
v	Dev of Cost effective and better fastness dyeing methods for production of Kovai Kora Cotton sarees - Dept of Handlooms & Textiles	(40,608)	40,608	-	-	-	-	-	-	-	-	-	-
vi	Antioxidant Cosmetoextiles durable non encapsulated Vitamin E Finishes on Textile fabrics and its controlled release	5,60,225	-	5,704	-	8,97,424	-	8,97,424	5,704	-	-	-	(3,37,200)
vii	Dev of breathable resuable and oxo-biodegradable coverall using biocidal Polyester	(25,293)	-	1,066	-	-	-	-	83,686	-	-	-	(1,07,913)
viii	Evolution of Spinning Machinery		6,50,000	6,50,000	-	4,58,529	-	-	-	1,91,471	-	-	-
		(48,90,059)	**61,19,071**	**6,68,245**	**1,03,34,726**	**2,07,22,458**	**-**	**3,05,98,655**	**1,04,739**	**2,40,925**	**-**	**-**	**(2,05,48,088)**

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year 2022 - 2023

DEPRECIATION FOR THE YEAR 2022- 2023

Schedule 22 — Amount in "Rs."

S.No.	Name of the Asset	COST				DEPRECIATION				WDV	
		Value as on 01.04.2022	Additions During 2022-2023	Deletion During 2022-23	Value as on 31.03.2023	Depreciation As on 01.04.2022	Deletion During 2022-23	Depreciation for the year 2022-23	Depreciation As on 31.03.2023	Closing W.D.V As on 31.03.2023	W.D.V As on 31.03.2022
1	Land	7,83,712	-	-	7,83,712	-	-	-	-	7,83,712	7,83,712
2	**Library**										
	Library	34,17,227	1,22,402	-	35,39,629	17,61,216	-	2,65,242	20,26,458	49,25,830	50,68,670
	ISDS - Library	34,12,659	-	-	34,12,659						
3	**Building**										
	Building	3,65,92,715	44,98,453	-	4,10,91,168	1,17,13,272	-	4,28,634	1,21,41,906	2,99,52,439	2,58,82,620
	ISDS - Building Renovation	10,03,177	-	-	10,03,177						
	Auditorium	18,93,967	-	-	18,93,967	2,67,959	-	26,504	2,94,463	15,99,504	16,26,008
	Dining Shed WIP	-	-	-	-						
	Staff Quarters	2,37,543	-	-	2,37,543	1,22,700	-	1,872	1,24,572	1,12,971	1,14,843
	COE Building	8,51,76,526	-	-	8,51,76,526	89,29,098	-	12,42,833	1,01,71,931	7,50,04,595	7,62,47,428
4	**Furniture**										
	Furniture - Sitra	50,96,331	8,87,684	-	59,84,015	30,89,288	-	1,49,825	32,39,113	51,94,579	44,56,720
	ISDS - Furniture	24,49,677	-	-	24,49,677						
	Sitra Furniture at PLSC	27,685	-	-	27,685	19,008	-	290	19,298	8,387	8,677
	Furniture & Fixtures - SITRA (COE)	26,17,044	-	-	26,17,044	5,70,706	-	68,348	6,39,054	19,77,990	20,46,338
5	**Machinery**										
	Machinery	16,36,71,379	1,97,60,760	-	18,34,32,139	9,15,35,250	-	61,08,336	9,76,43,586	12,63,43,229	11,26,90,805
	Machinery WIP		-	-							
	Sponsored Projects - Assets	4,05,54,676	-	-	4,05,54,676						
	Machinery-SISPA	3,29,632	-		3,29,632	18263	-	16,036	34,299	2,95,333	3,11,369
	Sitra Machinery at PLSC	4,33,949	-	-	4,33,949	2,69,463	-	8,471	2,77,934	1,56,015	1,64,486
	Depreciation Reversal - PLSC	-	-	-	-	1,91,56,113			1,91,56,113	(1,91,56,113)	(1,91,56,113)
	CoE Building Electrical Equipments	1,31,46,233	-	-	1,31,46,233	29,78,097	-	3,39,616	33,17,713	98,28,520	1,01,68,136
6	**ISDS Assets**										
	ISDS - Machinery	1,34,70,102	-	-	1,34,70,102	54,36,326	-	4,13,739	58,50,065	76,20,037	80,33,776
	ISDS-PSC-Machinery	36,00,001	-	-	36,00,001	14,76,851	-	1,09,342	15,86,193	20,13,808	21,23,150
	ISDS - Machinery Phase II	3,55,523	-	-	3,55,523	1,34,619	-	11,377	1,45,996	2,09,527	2,20,904
7	**Computer**										
	Computer - Sitra	1,03,75,152	5,66,615	-	1,09,41,767	40,66,661	-	3,35,664	44,02,325	65,39,442	63,08,491
	ERP WIP	26,31,690	-	1,12,800	25,18,890	-	-	-	-	25,18,890	26,31,690
	Computer-SISPA	3,24,449	-		3,24,449	18,063	-	15,779	33,842	2,90,607	3,06,386
8	**Vehicles**										
	Motor Cars	13,97,619	-	-	13,97,619	6,41,546	-	53,454	6,95,000	7,02,619	7,56,073
	Motor Cycles & Scooters	1,91,487	-	-	1,91,487	66,473	-	8,838	75,311	1,16,176	1,25,014

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Schedules to Balance Sheet for the year 2022 - 2023

DEPRECIATION FOR THE YEAR 2022 - 2023

Schedule 22 Amount in "Rs."

S.No.	Name of the Asset	COST				DEPRECIATION				WDV	
		Value as on 01.04.2022	Additions During 2022-2023	Deletion During 2022-23	Value as on 31.03.2023	Depreciation As on 01.04.2022	Deletion During 2022-23	Depreciation for the year 2022-23	Depreciation As on 31.03.2023	Closing W.D.V As on 31.03.2023	W.D.V As on 31.03.2022
9	**COE Assets**										
	CoE Equipment Electrical General	17,43,877	32,964	-	17,76,842	3,03,593	-	48,760	3,52,353	14,24,489	14,40,284
	Machinery	78,18,179	15,22,200	-	93,40,379	12,38,942	-	3,80,189	16,19,131	77,21,248	65,79,237
	Furniture & Fixtures	3,28,972	62,597	-	3,91,569	76,182	-	9,127	85,309	3,06,260	2,52,790
	Library	79,651	-	-	79,651	9,227	-	3,627	12,854	66,797	70,424
	Sponsored Projects -Assets										
10	UNDP Jute Project Machinery	1,32,01,739	-	-	1,32,01,739	-	-	-	-	1,32,01,739	1,32,01,739
11	Assets under Sponsored Projects - SITRA	2,02,67,658	37,58,300	-	2,40,25,958	-	-	-	-	2,40,25,958	2,02,67,658
12	Assets under Sponsored Projects - COE	22,73,07,341	-	-	22,73,07,341	-	-	-	-	22,73,07,341	22,73,07,341
13	Assets under Sponsored Projects - PLSC	5,98,55,104	3,16,742	-	6,01,71,846	-	-	-	-	6,01,71,846	5,98,55,104
	Total	**72,37,92,676**	**3,15,28,717**	**1,12,800**	**75,52,08,594**	**15,38,98,916**	**-**	**1,00,45,903**	**16,39,44,819**	**59,12,63,775**	**56,98,93,760**

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Centre of Excellence Medical Textiles

Balance Sheet as at 31st March 2023

Amount in "Rs."

As at 31.03.2022	LIABILITIES		As at 31.03.2023	As at 31.03.2022	ASSETS		As at 31.03.2023
	CAPITAL GRANT				**FIXED ASSETS**		
21,40,95,257	Contribution from Ministry-Opening	21,40,95,257		22,73,07,341	- Ministry Grant		22,73,07,341
-	Less: Interest Refunded during the year	23,767	21,40,71,490	99,70,678	- Others	1,15,88,439	
21,40,95,257				16,27,943	Less: Accumulated Depreciation	20,69,646	95,18,793
				23,56,50,076			
	RESERVES & SURPLUS				**CURRENT ASSETS**		
1,84,47,618	Depreciation Reserve	1,89,41,338		5,27,045	Sundry Debtors		4,02,939
1,55,89,378	Appropriation for Capital Expenditure	1,72,07,138		15,100	Loans & Advances		15,100
19,34,985	Staff Benefit Reserve	21,61,187		3,60,328	Advances for Purchases & others		3,48,761
80,00,372	Research & Development Reserve	74,30,281		1,65,158	Bank Balance		21,141
1,15,43,937	Infrastructure Devl. & Maint Reserve	1,14,81,893		22,73,665	Branch and Divisions		
16,75,595	General Reserve	18,86,642	5,91,08,479	9,20,582	Balance with revenue authorities		3,42,195
				2,49,916	Prepaid Expenses		2,42,106
	CURRENT LIABILITIES:			1,35,35,115	Investment		1,79,21,107
17,82,017	Advance from Customers	14,29,419					
1,88,903	Creditors for Purchases & Capital Goods	11,85,914			**INVENTORIES**		
1,450	Creditors for Expenses	4,73,488		6,17,089	Raw Material		2,67,305
15,93,748	Provision for Expenses	12,05,360		2,12,017	Finished Goods		5,81,063
-	Branch and Divisions	9,44,170	52,38,351				
					SITRA - RESERVE ADJUSTMENT		
				1,47,85,821	Asset Stabilization Reserve	1,64,03,581	
				4,98,200	SITRA Group Gratuity Scheme	-	1,64,03,581
				50,43,148	Sponsored Projects - Grant Receivable		50,46,888
27,48,53,260	**Total**		**27,84,18,321**	**27,48,53,260**	**Total**		**27,84,18,321**

"Vide our report of even date"
For P.N.Raghavendra Rao & Co.,
Chartered Accountant
Firm Registeration No: 003328S
Sd/-Pon Arul Paraneedharan
Partner
Membership Number: 212860

Sd/- Shri.Sanjay Jayavarthanavelu
Chairman

Sd/- Shri.J.Thulasidharan
Member

Sd/- Dr. Prakash Vasudevan
Director

Place : Coimbatore
Date : 04.08.2023

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Centre of Excellence Medical Textiles

Income & Expenditure Account for the year ended 31st March 2023

Amount in "Rs."

Year Ended 31.03.2022	EXPENDITURE		Year Ended 31.03.2023	Year Ended 31.03.2022	INCOME		Year Ended 31.03.2023
	Opening stock:			1,59,78,851	Testing & Investigation Fees		1,40,62,216
14,40,480	Consumables	6,17,089		6,83,796	HRD Education Receipts		11,70,417
11,76,821	Finished Goods	2,12,017	8,29,106	30,00,000	Ministry Contribution		30,00,000
20,71,576	Purchases of Consumables		21,54,339	3,44,264	Sponsored Projects - Overhead Recoveries		6,68,882
91,38,655	Establishment Expenses	1,10,61,638		1,97,608	Interest Income		1,49,940
-	Salary for Inhouse Project Expenses	7,34,897			Closing Stock:		
5,91,437	Less : Allocated to Sponsored Projects	12,73,654		6,17,089	Consumables	2,67,305	
85,47,218			1,05,22,881	2,12,017	Finished Goods	5,81,063	8,48,368
6,125	Training Course Expenses		25,205				
48,482	Travelling Expenses		1,09,704				
1,28,356	Building Repairs & Maintenance		62,234				
5,29,420	Maintenance of Machinery		2,97,096				
85,804	Printing & Stationery		88,292				
2,27,812	Office Expenses		3,33,265				
10,57,787	Electriciy Charges		11,87,884				
2,12,270	Insurance		2,49,916				
1,42,116	Postage & Telephone charges		2,44,171				
-	Conference Seminars & Meetings		2,35,862				
73,890	Professional Fees		1,34,170				
11,16,950	Testing Expenses		5,90,712				
18,14,851	Allocation of Expenses incurred by SITRA for COE		16,44,675				
7,286	Inhouse Project Expenses		2,30,875				
4,17,164	Depreciation		4,41,703	-			
19,29,216	Excess of Income over Expenditure Income for the year c/o		5,17,733				
2,10,33,625	**Total**		**1,98,99,822**	**2,10,33,625**	**Total**		**1,98,99,822**
			INCOME & EXPENDITURE APPROPRIATION ACCOUNT				
				19,29,216	Excess of Income over Expenditure for the year b/f		**5,17,733**
2,00,000	Transfer to Staff benefit Reserve		10,00,000	-	Appropriated from Infrastructure Reserve Fund		62,044
-	Transfer to Depreciation Reservce		6,10,000	-	Appropriated from Depreciation Reserve Fund		1,16,280
20,00,000	Transfer to Infrastructure & Maintenance Reserve		-	-	Appropriated from Research & Development Reserve Fund		5,70,091
1,29,216	Transfer from General Reserve		1,56,147	4,00,000	Appropriated from Staff Benefit Reserve-SITRA (Exgratia and Encashment Salary)		5,00,000
23,29,216	**Total**		**17,66,147**	**23,29,216**	**Total**		**17,66,147**

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For P.N.Raghavendra Rao & Co.,
Chartered Accountant
Firm Registeration No: 003328S
Sd/-Pon Arul Paraneedharan
Partner
Membership Number: 212860

Sd/- Shri.Sanjay Jayavarthanavelu
Chairman

Sd/- Shri.J.Thulasidharan
Member

Sd/- Dr. Prakash Vasudevan
Director

Place : Coimbatore
Date : 04.08.2023

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Ministry of Textiles Sponsored Powerloom Service Centres

BALANCE SHEET AS AT 31st March 2023

Amount in "Rs."

As at 31.03.2022	LIABILITIES	As at 31.03.2023		As at 31.03.2022	ASSETS	As at 31.03.2023	
5,87,89,828	**CONTRIBUTION FROM GOVERNMENT AND GOVERNMENT DEPARTMENTS**		5,87,89,828	6,01,27,709	**FIXED ASSETS (AT COST)**		6,04,44,452
66,81,522	**PLSC/CAD CENTRE - GENERAL RESERVE**		94,57,224	1,33,17,845	**Investments**		74,25,570
	STAFF BENEFIT RESERVE APPROPRIATION FOR TERMINAL BENEFITS				**ADVANCES AND DEPOSITS**		
34,12,216	**Opening Balance**	42,69,855		11,63,782	Sundry Deposits	11,63,782	
10,00,000	Add: Appropriated from PLSC Reserve	20,00,000		1,03,167	Advances for Purchase & Others	85,000	12,48,782
1,42,361	Less: Excess Earned Leave Provision Reversal	22,837					
42,69,855			62,47,018				
					CURRENT ASSETS		
	PSC RESERVE APPROPRIATION FOR CAPITAL EXPENDITURE			35,698	Cash on Hand	46,875	
21,02,799	Opening Balance	23,17,699		12,70,933	Cash at Bank	8,80,111	
2,14,900	Add: Current year Utilisation	3,16,742	26,34,441	3,67,579	Sundry Debtors	25,201	
23,17,699				-	Grant Receivable	1,14,00,000	1,23,52,187
	CURRENT LIABILITIES						
70,000	Creditors for Purchases and Capital Goods	70,000					
20,33,398	Provision for Expenses	11,79,413					
27,778	Advances Received from Customers	33,639					
21,96,634	Branches and Divisions	30,59,428	43,42,480				
7,63,86,713	**Total**		**8,14,70,991**	**7,63,86,713**	**Total**		**8,14,70,991**

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Director

Place: Coimbatore
Date : 04.08.2023

THE SOUTH INDIA TEXTILE RESEARCH ASSOCIATION

Ministry of Textiles Sponsored Powerloom Service Centres

Income & Expenditure Account for the year ended 31st March 2023

Amount in "Rs."

Year Ended 31.03.2022	EXPENDITURE	Year Ended 31.03.2023		Year Ended 31.03.2022	INCOME	Year Ended 31.03.2023	
1,25,31,543	Salaries	1,38,44,710		1,14,00,000	Revenue Grant from Ministry		1,14,00,000
4,56,258	Less: Samarth Scheme	15,93,991	1,22,50,719				
1,20,75,285				1,07,69,219	Income from Services		1,28,99,847
31,96,045	General office expenses	34,13,018		3,72,314	Interest on Bank and other deposits		1,42,736
32,289	Less: Samarth Scheme	50,000	33,63,018				
31,63,756							
38,84,695	Rent, Rate & Taxes	37,85,741					
-	Less: Samarth Scheme	-	37,85,741				
38,84,695							
79,287	Spares, store & Consumables		2,05,847				
9,96,169	AMC/Maintenance of Equipement Expenses	14,02,178					
11,215	Less: Samarth Scheme	-	14,02,178				
9,84,954							
23,53,557	Excess of Income over Expenditure for the year c/o		34,35,080				
2,25,41,533	**Total**		**2,44,42,583**	**2,25,41,533**	**Total**		**2,44,42,583**
23,53,557	Balance Surplus		44,54,451	23,53,557	Excess of Income over Expenditure for the year b/f		34,35,080
10,00,000	Transfer to Staff Benefit Reserve - PLSC		20,00,000	-	Appropriated from Group Gratuity Scheme		10,19,371
13,53,557	Transfer to PLSC/CAD Centre Reserve		24,54,451				
23,53,557			**44,54,451**	**23,53,557**			**44,54,451**

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For P.N.Raghavendra Rao & Co.,
Chartered Accountant
Firm Registeration No: 003328S
Sd/-Pon Arul Paraneedharan
Partner
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Place: Coimbatore
Date : 04.08.2023