CIRCOT

Annual Report 2013 - 2014

A Legacy since 1924...

A Vision for 2050 and beyond

Central Institute for Research on Cotton Technology
(Indian Council of Agricultural Research)
Adenwala Road, Matunga (East), Mumbai 400019

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भाकृअनुप
ICAR

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Front Cover Theme

Background:
Cotton Field at Sunrise

Director CIRCOT and PI ZTM-BPD
Receiving the Best BPD Unit Award
for the year 2013

Back Cover Theme

CIRCOTians
at Institute's
90th Foundation Day
Celebration on
3rd December 2013

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Content

PREFACE

The past year has been truly a triumphant one for CIRCOT. It started with CIRCOT Business Promotion and Development Unit (BPDU) achieving and bagging the title of Best Performing BPD for Technology commercialization in the ICAR system in the month of July 2013 during the Agri-Tech Investors Meet held at New Delhi. Immediately following this on August 2013, CIRCOT was awarded a Total Composite Score of 98% (EXCELLENT rating) for the Annual Achievements on Performance Evaluation of 2012-13 of the Results-Framework Document (RFD), following the Evaluation Methodology provided by the Performance Management Division (PMD) of the Cabinet Secretariat, New Delhi, putting the institute as the topmost achiever in the Engineering Division of the Council. Both these achievements in quick succession definitely boosted our confidence, besides providing us immense happiness of being recognized at the national level. The awards were a fitting culmination of the untiring efforts put in by all CIRCOTians. On a personal note, I would put in my appreciation for the CIRCOT BPDU, which has commercialized ten technologies and signed 15 MoUs worth Rs. 1.3 crore, within a short period after its revival. It was an honour to receive the award at the hands of Dr. K. Kasturirangan, Former Head of ISRO and presently, the Hon'ble Member (S&T) of the Planning Commission. Likewise, the "EXCELLENT" grading of CIRCOT RSC has been gained by each and every staff of the institute, and I congratulate them for their achievement. Now the challenge is to keep up the tempo of hard work and achieve more and more success consistently.

Towards popularisation of developed technologies, the CIRCOT-BPD has in the past year organized a Pre-commercialization workshop on Flexi Check Dam (Rubber Dam) for Watershed Application, conducted successfully a two-day EDP on Absorbent Cotton Technology, organized a One-day Business Development Programme on CIRCOT Calibration Cotton, Absorbent Cotton and Biogas Technologies at Coimbatore and Business Meets on Cotton Processing Technologies related to Ginning, Linter and Calibration Cotton at Guntur and Bhatinda. All the programmes were well attended with the participation of 60-120 numbers of entrepreneurs, industrialists, delegates and other stakeholders on each occasion. It gives me immense pride to put on record that a good number of clients joined in BPD-CIRCOT in the recent years, 26 of them being in 2013-14 alone. Further, the CIRCOT-BPD unit has been allocated a handsome budget of about Rs. 4.5 crores in the penultimate year of NAIP for setting up of a first-of-its-kind in India, a Nanocellulose pilot plant based on CIRCOT developed patented technology.

In the research front, the successful use of banana pseudostem sap, which is obtained as a by-product during fibre extraction as a flame retardant (FR) finishing agent for cotton textiles is an exemplary work on diversified use of natural fibres. The surface modification of coconut fibre using NaOH has altered its surface properties, which is seen to be significant in determining the mechanical properties of composite materials, besides enabling the PP/Coconut fibre composite to achieve a better compatibility with synthetic resin. Good research progresses have been noted in the development of covered DR ginning machine that will help in abating noise and dust pollutions, and in development of PLA-Cotton fibre blended novel and functional textiles and bio-composites, objective model for fabric handle assessment for Indian market, multi-functional cotton textiles, low-cost apparatus for plasma treatment of cotton fabrics and core-sheath nano fibre production and their yarn spinning. More significantly, an accelerated process for the preparation of bioenriched compost from cotton stalk, and a novel process to de-toxify 70% of the total gossypol of the cottonseed with increase in lysine content by about 35%, having potential to substitute soybean in poultry feed have been developed.

I take pride in putting on record that in the reported year, CIRCOT for the first time had conducted Tribal Sub Plan (TSP) programmes to serve the grassroot population spread across the cotton growing belt of the country by making them aware of the cotton related technologies and scope of entrepreneurship. CIRCOT is undergoing the implementation Process of ISO 9001:2008 as per the directive from the Council, the pre-adequacy audit has been completed and will soon become an ISO compliant research institute.

CIRCOT has entered its 90th year. The event was celebrated with much enthusiasm as the 90th Foundation Day on December 3, 2013, which was attended by many past soldiers of the institute and to commemorate the event a fitting memento was released. CIRCOT also reached out to the young India – school and college students - by conducting science project competitions and exhibitions besides having popular science lectures as a part of the National Science Day celebration.

My concluding remark for the achievements of CIRCOT in the year that sailed-by would be the grit and determination, and the hard and collaborative efforts put by all members. It is to be borne in mind that, it is the sincere and passionate actions in work have enabled CIRCOT to be in sync with the aspirations and needs of its stakeholders. We resolve to innovate and work harder to achieve further goals that we set for ourselves.

Dr. S. K. Chattopadhyay

SALIENT ACHIEVEMENTS

Research Achievements

- A functional cotton fabric with dual hydrophobic and hydrophilic character and an antimicrobial finished fabric have been successfully developed using the eletrospraying technique in the lab. For commercial exploitation of the same, a low-cost electrospraying unit with multi-spinneret has been designed for fabrication.
- In the flagship project, cotton/PLA blended fabrics with varying blend proportions have been developed. Cotton/PLA fabric of 65:35 proportion has been found suitable for application as sportswear fabric, as its overall moisture management capacity (OMMC) was found better than the 100% cotton fabric, besides possessing the equivalent hand.
- Shirting fabrics manufactured in India have been characterized into three groups based on the Total Hand Value (THV) as low (0 to 1.5), medium (1.5 to 3.0) and high (3.0 to 4.5). It has been observed that only 22% of such fabrics are with high handle value.
- Cotton fabric treated with Banana Psuedostem sap extracts has shown improved fire retardant properties with Limited Oxygen Index (LOI) value significantly improved to 1.6 times of the untreated control fabric.
- Nanocellulose modified with pentafluoro benzoyl chloride (PFBC) has shown an increase in contact angle of 100 degrees compared to the untreated sample (12 degrees), showing an improved hydrophobicity and strength for the reinforced PE film composite.
- Adoption trial of rotary knife roller ginning has shown a marginal increase in 2.5% span length of cotton fibres compared to that obtained from the double roller gin. However, fibre and seed coat neps, and percent cut-seeds were found to be higher in the ginned lint from the rotary knife gin.
- Three different designs of enclosures for DR gin with an automatic pala doffing mechanism have been developed to arrest fine particles emitting from the gin into the factory environment.
- In the experiments on natural fibre reinforced composite preparation, it has been found that the raw coconut fibre could be directly utilized without resorting to any sort of retting treatment.
- Six large trials of biocompositing with ten tonnes of cotton-stalk have been conducted successfully at Sirsa, Nagpur and Coimbatore. The benefit cost ratio of biocomposting process has been worked out to be 1.08.
- In an effort to produce gossypol-free cottonseed cake with improved lysine content, the cottonseed cake could be produced with 80% reduced free gossypol, 60% reduced total gossypol, 15-25%

increased lysine content, 40-50% improved protein content and 25-30% reduced fibre content compared to the untreated cake. Toxicity studies have shown that the cultures used in the study during the solid state fermentation process are non-toxic to broilers.

- A friction spinning collector (electrode) for the production of yarns from nanofibres using electrospinning setup has been designed and fabricated successfully.
- The plasma treatment of silk material has resulted in higher dye exhaustion, and also in reduced dyeing time from 45 to 5 min. Also, a plasma based waterless process for water repellent finishing of cotton textiles has been developed.
- The study of cleaning treatments for machine picked cotton showed that there is a need for optimization of existing cleaning machines to avoid loss of fibre quality during processing.
- Cotton fabric treated with Harda and Pomegranate rind extracts has shown excellent UV protection (50+ UPF) and 100% antimicrobial activity.
- Scale-up trials on cotton fabric with dye extracted from the tender coconut husk have been successfully carried out.
- Processing conditions have been optimized for scouring of Banana pseudostem fibres to improve the fineness and strength. Utility hand bags and bio-composites have been manufactured from banana fibres.
- For treatment of cotton fabric with Nano ZnO, excellent UPF rating of 50+ and 100% inhibition against *S. aureus* and *K. pneumonia* have been achieved.
- An automated Multi-phase electrospinning set-up has been designed for production of biodegradable mat based sensor (intelligent packaging) for monitoring the ripening of fruits.
- The Spinning machines for making yarn from banana pseudostem fibre have been improvised, and the machines now can be used for spinning one English count of yarn.
- Under the AICCIP project, 13,300 samples have been tested for fibre properties; nine percent of full spinning samples are found to be unspinnable, as they do not have the minimum requirement of fibre quality for spinning. One extra long staple cottons, RAB 8 has been found to meet the tenacity requirement prescribed in the CIRCOT norms.

Technology and Business Promotion Activities

- Around 10,200 commercial cotton samples have been tested at the HQ and its outstations including the Ginning Training Centre in Nagpur.

- Forty-two trainees have been trained in the instrumental evaluation of cotton quality at the HQ.
- One hundred and seventy-one ginners and farmer trainees have undergone training on Double Roller ginning technology and cotton quality evaluation in 11 batches at GTC, Nagpur.
- Sixteen MoUs have been signed by various parties/ organizations, including the one with the reputed and the oldest Engineering college, Veer Jijabai Technological Institute (VJTI) for research, education and technical collaboration.
- Nine technologies have been commercialized during the reported period.
- Conducted one-day pre-commercialization workshop on "Flexi Check Dam, popularly known as rubber dam made of Textile-Rubber composite for Watershed Application on May 30, 2013 at CIRCOT.
- Conducted one-day Business Development Programme on CIRCOT's Calibration Cotton, Absorbent Cotton and Biogas Technologies held on August 20, 2013 at Sardar Vallabhbhai Patel International School of Textiles and Management, Coimbatore.
- Conducted one-day Entrepreneurship Development Programme on Absorbent Cotton Technology in September 2013 at CIRCOT.
- Conducted a Business Meet on Cotton Technologies related to Ginning, Linter and Calibration Cotton in November 2013 at Bathinda, Punjab.
- Organized an Entrepreneurship Development Programme on Disintegration, Defibring of Husk, Segregation and Captive Retting of Coconut Fibre in December 2013 at Vengurla, Sindhudurg, Maharashtra.
- Conducted one-day hands on Training-cum-Workshop on Extraction and Application of Natural Dyes on January 23, 2014 at CIRCOT.

Exhibition and Publicity

CIRCOT Participated in

- Sensitization Meet on Agribusiness Management on July 27, 2013 at CIRCOT.
- Foundation Day of Agri-Innovate India and Conglomerate on Innovative Partnerships & Technology showcasing on October 19, 2013 at New Delhi.
- Two-day industry workshop on Designing Solar Thermal (CST) Application for Reduction Energy

Bills on November 28 and 29, 2013 at Hyderabad.

- Kisan mela on December 11-17, 2013 at Pune.
- International Conference on Management of Agribusiness & Entrepreneurship Development on January 6-7, 2014 at Bhopal.
- Hands-on Training in Business Plan Preparation for BPD Unit on January 20-21, 2014 at New Delhi.
- Asia-Africa Agribusiness Forum from February 4 -6, 2014.
- Krishi Vasant 2014 from February 9-16, 2014 at CICR, Nagpur.

Accolades

- The institute was awarded a Total RFD Score of 98% and a rating of "EXCELLENT" for 2012-13 following the Evaluation Methodology of the Performance Management Division (PMD), Cabinet Secretariat, New Delhi.
- The Performance Indicator (PI) Score of the institute for 2012-13 was 87% as per the prescribed methodology of NCAP (ICAR).
- The institute received an award for Hindi Promotion from Rajbhasha Sansthan April 26, 2013.
- The ZTM-BPD unit was awarded the Best Performing NAIP Business Planning and Development Unit for Technology Commercialization and Maximum License per Technology at the Agri-tech Investors' Meet 2013 held at New Delhi on July 19, 2013 by Dr. K. Kasturirangan, Member, Planning Commission (Science & Technology).
- Dr. V. Mageshwaran was deputed abroad to North Carolina, USA from September 2013 to November 2013 for International Training Programme on Fermentation Technology.
- Shri K.G. Bhat, Proprietor of Precision Tooling Engineers, a long-time licensee of CIRCOT Technologies has been felicitated by Agroinnovate India Ltd on October 19, 2013 at New Delhi. He received the award and the citation from Prof. Abhijit Sen, Member, Planning Commission, Govt. of India.
- The Institute has been accredited by NABL under ISO 17025:2005 in Chemical and Mechanical fields, from March 2, 2014 to March 1, 2016.

- Smt. K. R. Joshi, Technical Officer has won 2nd prize in Chess at the Zonal Sports held in Hyderabad.
- ISO 9001:2008 QMS – Pre-adequacy audit has been completed.
- For the first time, CIRCOT has conducted Tribal Sub-Plan Programmes at GTC Nagpur, Dharwad, Sirsa and Coimbatore Regional Stations. Almost 250 farmers from the tribal areas have benefited from the training programmes so conducted.

Budget Utilization and Revenue Generation

- The Institute utilized 98.69% budget (Rs. 207.24 Lakhs) as against the sanction of Rs. 210.00 Lakhs by the Council under the Plan for year 2013-14.
- The Revenue generation during the year was Rs. 59.86 lakhs, as against the target of Rs. 66.00 lakhs set by the Council.

1. INTRODUCTION

This Ninetieth Annual Report of the Central Institute for Research on Cotton Technology (CIRCOT) covers the period from April 1, 2013 to March 31, 2014.

CIRCOT was established in the year 1924 by the then Indian Central Cotton Committee (ICCC) under the name of **Technological Laboratory of ICCC.** After the abolition of commodity committees including the ICCC, the administrative control was transferred to the Indian Council of Agricultural Research (ICAR) and the name of the Institute was changed to **Cotton Technological Research Laboratory (CTRL).** This name was changed to **Central Institute for Research on Cotton Technology (CIRCOT)** with effect from 1st April 1991.

CIRCOT has served the cotton community over the nine long decades since its inception, by reorienting itself to suit the changing needs of its stakeholders. CIRCOT has spearheaded and sustained the research and development of technologies and machineries for the postharvest processing of cotton. The Institute is widely recognized for its contribution in testing, standardization and development of test methods for different types of textile materials. Presently, CIRCOT has diversified its expertise to research in utilization of other natural fibres like Banana and Coconut for technical applications, and has also started pioneering work in nonwoven technology, and natural fibre based composites. CIRCOT has forayed into the field of nanotechnology, plasma technology and is researching to develop environment-friendly textile processes using these break-through technologies. CIRCOT is fully aware of its strategic role in transferring the developed technologies timely to the stakeholders. It has set up a vibrant and active Business Promotion and Development Unit which is also providing incubation facilities to potential entrepreneurs along with transferring technology through various methods.

CIRCOT VISION AND MISSION

VISION

Global Excellence in Cotton Technology

MISSION

To provide scientific and managerial interventions to postharvest processing and value addition to cotton and other natural fibres and utilization of their by-products to maximize economic, environmental and societal benefits

Mandate

- To develop new technologies and machinery for better utilization of cotton and other fibres by carrying out basic, applied, strategic and anticipatory research in postharvest technology
- To extend effective technological support for improvement of quality of Indian cottons and cotton products
- To act as a nodal centre for diversified utilization of cotton plant by-products & processing waste and other crop residues
- To provide services like training, education, consultancy to textile industries, government and private agencies, and
- To function as a referral laboratory for textile testing

Research carried out in the last two years

- Techno-economic evaluation of fully automatic up and down packing type of bale presses with special emphasis on energy consumption was carried out for the benefit of the cotton ginners for selection of appropriate bale press. Energy consumption was found to be 2.25, 1.75 and 1.5 units/ bale for the down packing presses with capacity of 8,15 and 25 bales/h respectively. Similarly, for the up packing type of bale presses, it was found to be 1.0 and 0.9 units/bale with capacity of 15 and 25 bales/h respectively. It was found that about 40 percent lower energy is required for the up packing press than the down packing type of press. About 15 percent reduction in energy consumption was observed for bale presses with capacity of 25 bales/hr as compared to 15 bales/hr. The up packing type of presses were found to be the cost-effective by about 10 percent as compared to the down packing types.
- Under NAIP project, a novel prototype machine for extraction of fibres from green coconut husk and a segregator machine for segregating different grades of fibres have been developed. The extractor machine works on 3.73kW (3 phase) power. The machine has a capacity to process about 60-70 husks/h. The machine is energy-efficient, and reduces loss of fibres, with improved cleaning efficiency and productivity of fibres. As the husks will undergo dry processing only, the machines will avoid any water pollution. The outturn of the developed fibre segregator has been found to be 50-60 kg per hour, with fine fibre

segregation efficiency being one-third fine fibres produced out of the total bulk processed.

- During the last two years, five rubber check dams have been installed in various locations in Odisha-at Baghamari, Badapokharia, Chandeswod, Chandeswar II and DWM farm under the partnership in a NAIP funded subproject. Sample studies conducted by Directorate of Water Management (DWM) have shown significant increase in crop production because of availability of plentiful water for sufficiently longer period. Encouraging results on Rabi crops have also been noted, and apart from green gram, the farmers cultivated other crops like sunflower and cucumber.

- More than 100 samples of banana fibres obtained from 25 varieties of pseudostem have been evaluated for tensile strength, fineness and elongation properties. On the basis of data, a catalogue has been prepared as a guiding document on properties of banana fibres.

- A study at CIRCOT indicated that Cotton/PLA blended fabric in the ratio of 80:20 have better water management properties compared to the 100% cotton fabrics. The Overall Moisture Management Capacity (OMMC) of 80:20 cotton/PLA fabrics has been found to be 0.6, while that of the 100% cotton fabric, it is 0.5.

- Studies on the development of coir and banana fibre reinforced composite, have showed that the tensile modulus for the banana-PP composite is higher than that obtained with coir-PP composites. This can be attributed to the stiffer nature of the banana fibres compared to coir fibres. It is found that such composite will be suitable for application as wood substitutes for preparing articles requiring high rigidity.

- Normally, the coconut fibre reinforced composites have poor mechanical properties because of their poor compatibility with synthetic resin. To improve the compatibility, the surface of the reinforcement was modified with 5% NaOH. Results showed that 5% NaOH treatment improved the mechanical property of coconut fibre composite with increase in tensile strength by about 30%, and the flexural strength by 20%.

- Textile materials are used for various applications like non-inflatable and inflatable structures along with rubber as composite material. To improve the adhesion between the rubber and textile materials, RFL (Resorcinol Formaldehyde Latex) treatment is normally resorted to in the industry. At CIRCOT, an attempt has been made to increase the peel strength (i.e. adhesion between textile substrate and rubber) using plasma treatment along with RFL, so as to increase the life of the composite materials.

- A new funnel shaped collector has been designed and fabricated for conversion of nano fibre into twisted yarn. This design will pave the way for the production of nano fibre based yarn in an electro-spinning set-up. It is predicted that such yarns from nanofibres will find use in high tech applications.

- An electrospray nano-finishing process has been developed to produce antibacterial effect on cotton textiles. All the spraying parameters have been optmised to enable spraying of chemical with nano-thick coating. This technique has been found to consume only 30% chemicals than that of the conventional padding process, yet produce the similar effect.

- A multi-sheath feeder has been designed as an attachment to banana fibre extractor, i.e., the Raspador machine for aiding the feed of multiple sheaths of banana pseudostem. This feeder will increase the productivity of fibre extraction with the Raspador by 1.5 to 2 times, without any additional energy or manpower requirement. This feeder can also be used for extracting fibres from other plant sources.

- A pedal driven Phoenix Charkha has been designed and developed for spinning coarse long-staple fibres like banana pseudostem fibres at the cottage level. This charkha can produce relatively fine yarn with sufficient uniformity from natural fibres, which are otherwise difficult to spin.

- A capacitive type microcontroller based moisture measuring instrument with both disk and fork type sensors has been developed and calibrated to measure the moisture percentage in cotton sample accurately. While the disk type sensor is used for measuring moisture in seed cotton and cotton lint, the fork type sensor is used for cotton bales.

- To circumvent the problem of loss of readability of bale-markings due to fading away of ink markings done on cotton bales, the institute has developed a bale tagging system, wherein the bales are tagged for the fibre properties. This process will facilitate online tracking of the bales. For this, parameters like Press Mark Number, Year of Manufacture, Lot Number, Bale Number and Weight need to be uploaded in the system. Optional Quality Parameters like Grade, Variety, Fibre Length, Micronaire, % UR, Trash and Moisture can also be updated after the bale is tagged.

- In a novel study, jute yarn has been coated with PLA (poly lactic acid) fibres using a DREF-3000 Friction Spinning to provide an in-situ matrix over the jute yarn. It was found that 45% (by weight) of PLA fibre produced a very good covering over the jute yarn. The same yarns were finally converted into composites by compression moulding process at $200^{o}C$ temperature, acted for 5 m at 40 bar pressure.

- Sixty-four shirting fabrics were studied for low-stress mechanical properties using Kawabata fabric handle evaluation system. These low-stress mechanical properties were used for arriving at the primary handle values namely Koshi (stiffness), Numeri (smoothness), Fukurami (fullness) and Shari (crispness). All the 64 fabrics could be classified into three groups in order of feeling intensity as strong, medium and weak for facilitating development of a prediction model for Hand values of shirting fabrics.

- Modification of fabric surface is very important to impart hydrophobicity to fabrics. This was achieved through a new chemical treatment with 0.6% w/w H_2SO_4 at 60°C for 60 min in a shaking bath followed by fluro-polymer treatment. The Atomic Force Microscope (AFM) analysis showed that the acid treated cotton fabric had 7.5% more surface area than the control sample. Attempts have been made to produce one side hydrophobic and other side hydrophilic cotton fabric by electrosparying with fluorocarbon polymers. Flurocarbon nano particles (80 nm) could be deposited on cotton fabric successfully that gave hydrophobicity to one side of the fabric, leaving the other side of the fabric hydrophilic.

- An attempt was made to improve the ultra-violet (UV) protective functionality of cotton textiles by application of TiO_2 – nanoparticles which was synthesized in-situ. This was applied to the desized, scoured and bleached cotton fabric by pad-dry method, followed by hydrothermal treatment to generate nanoparticles on the fabric. The results indicate that the UPF values significantly increase to 50+ (maximum UPF rating) as compared to the UPF of 11 recorded for the untreated control sample. It may be noted that any textile material having the UPF value of 50 or 50+ is considered to be an excellent UV- protective textile.

- In a project on utilizing tender coconut husk for dyeing of cotton fabric, the husk was extracted with water to obtain the dye. The extract of tender coconut husk is rich in tannin (about 3600 ppm). Hence, the extract was used as the primary mordant to investigate the mordanting as well as dyeing ability of the extract. The study resulted in different shades with satisfactory light and wash fastness properties. The results of the scale-up trials using rope for rotary pressure dyeing machines are quite encouraging.

- Through the use of zinc oxide, silicone and organic acid by simultaneous triple bath pad-dry-cure method, a new hydrophobic treatment for the cotton fabric has been developed. It is equivalent to forty home washes and the treated fabric exhibited higher wetting time of more than 60 seconds with a very good UPF rating of 50+. The sample was also found to exhibit good spray rating up to four wash cycles, equivalent to twenty home washes.

- Cotton textiles hardly provide any protection from UV light. However, through an improved process of application of nano particles with SiO_2 in the core and TiO_2 in the shell, it has been possible to impart excellent UV protective functionality with a UPF rating of 50+. The nanoparticles were also characterized using XRD and UV visible spectroscopy.

- CIRCOT has succeeded in developing an indigenous atmospheric pressure or prototype plasma reactors with and without the cooling system for surface modification of textile substrates.

- In a study on the effect of plasma treatment to cotton fabric in presence of helium (He), (He+O2) and (He+air) gases for 1 to 4 min, it has been observed that the cotton fabric becomes hydrophilic in nature, resulting in reduction of water wicking time from 482 to 420. Studies on dyeing with different dyes, such as (i) Procion red brillian MX-5B (reactive) & dichlorotriazine dye (reactive) (ii) Berberine natural dye (iii) Methylene blue (basic dye) and (iv) Direct yellow dye, improvement in colour has been observed as measured by K/s values. In case of H_2+O_2 plasma treated samples, the K/s value of untreated fabric was 2.49, which increased to 2.73 (by 9.6%) in 2 to 4 min duration of the plasma treatment.

- Pomegranate rind is a non-edible part of the pomegranate fruit, which has been used as a mordant for dying cotton fabric with manjith dye. The results indicate good colourfastness to light, washing, rubbing and perspiration similar to that obtained with conventional mordants. The UPF value is found to be 50+, indicating that such treated fabric can provide excellent protection from ultraviolet light.

- A new process for making nanocellulose compatible with synthetic polymeric matrix like polyethylene and polypropylene has been developed in the laboratory.

- Banana pseudostem sap obtained as a by-product during extraction of fibres from pseudostem could be successfully used as an FR finishing agent for cotton textiles. Bleached and mercerised cotton fabric mordanted with Tannic Acid (5% owf) and Alum (10% owf) was treated at near boil temperature and dried in an oven. Additionally, the fabric showed good property and UV protection.

- To achieve the homogeneous dispersion and to improve the interfacial interaction with polyethylene matrix, the surface of nanocellulose needs to be altered from hydrophilic to hydrophobic. CIRCOT has developed a very simple and highly efficient process for the preparation of hydrophobic nanocellulose for various applications including composite preparation by controlled heterogeneous reaction of nanocellulose with pentafluorobenzoyl chloride. The success of the reaction has also been confirmed through measurement on contact angles between water with the surface.

- A Scale-up trials (5-ton trials in each batch) were undertaken at M/s Star Oil Mills at Tirupur (Tamil Nadu) for extraction of oil from pretreated kernels using commercial enzymes and microbial consortium. Both the enzyme and the microbial consortium treatment of treated kernels gave 3% more oil. However, microbial consortium will definitely be a cheaper pretreatment as compared to pure enzymes, and hence, has been recommended for improved oil recovery.

- Native microbial isolates collected from the soil in which cotton is cultivated, have been explored for detoxification of free gossypol in cottonseed meal. About 131 microorganisms (53 bacteria, 62 fungi and 16 actinomycetes) were isolated from the soil samples. Use of standard cultures *Pleurotus flabellatus* and *Candida tropicalis* showed maximum decrease of gossypol up to 90% in mineral medium. When *C. tropicalis* inoculated in the medium containing cottonseed cake, it showed 69% decrease of free gossypol during solid-state fermentation.

- The institute has developed a process for accelerating the composting of cotton stalks by use of microorganisms. The results on composting trials suggested that by using the microbial consortia, a good quality compost from wet cotton stalks can be obtained in 45 days, while from dry cotton stalks it takes about 60 days. In case of the control (without microbial consortia), the compost could be prepared in 90 days from dry cotton stalks and 60 days from wet cotton stalks. Thus, saving of 15 and 30 days respectively for the preparation of compost from cotton stalks using the CIRCOT developed accelerated process could be achieved.

- Around Twenty five thousand commercial samples have been tested in the last two years.

- Eight-thousand three hundred and ninety-one samples under AICCIP have been evaluated and screened for fibre testing, micro spinning and full spinning.

- The regional centers of CIRCOT has tested around eleven thousand nine hundred samples under various projects.

- One thousand two hundred and forty-six units of Calibration Cottons have been sold to the industry, thus generating a revenue of Rupees seven lakhs forty-two thousand three hundred only.

G. ACCOLADES

The Institute has bagged the Best BPD award in NAIP Agri-Tech Investors Meet from Dr. K. Kasturirangan, Member, Planning Commission (Science & Technology) at New Delhi on July 19, 2013.

Revenue Generation

The Institute has generated Rs. 59.86 lakhs through commercial testing, training and consultancy during the reported year as against the target of Rs. 66.00 lakhs set by the Council.

Organization

The Director heads the organization. The Prioritization, Monitoring and Evaluation (PME) cell of the institute provides,

I Sensitization of policy makers, managers, scientists and others about the need for research priority assessment.

ii. Prioritization of Institute's programmes.

iii. Tracking of current resource allocations.

iv. Interface with ARIS, SREP, ATMA, IVLP, TAR and KVK for Research.

v. Facilitate, Monitoring and evaluation of research projects of the institute.

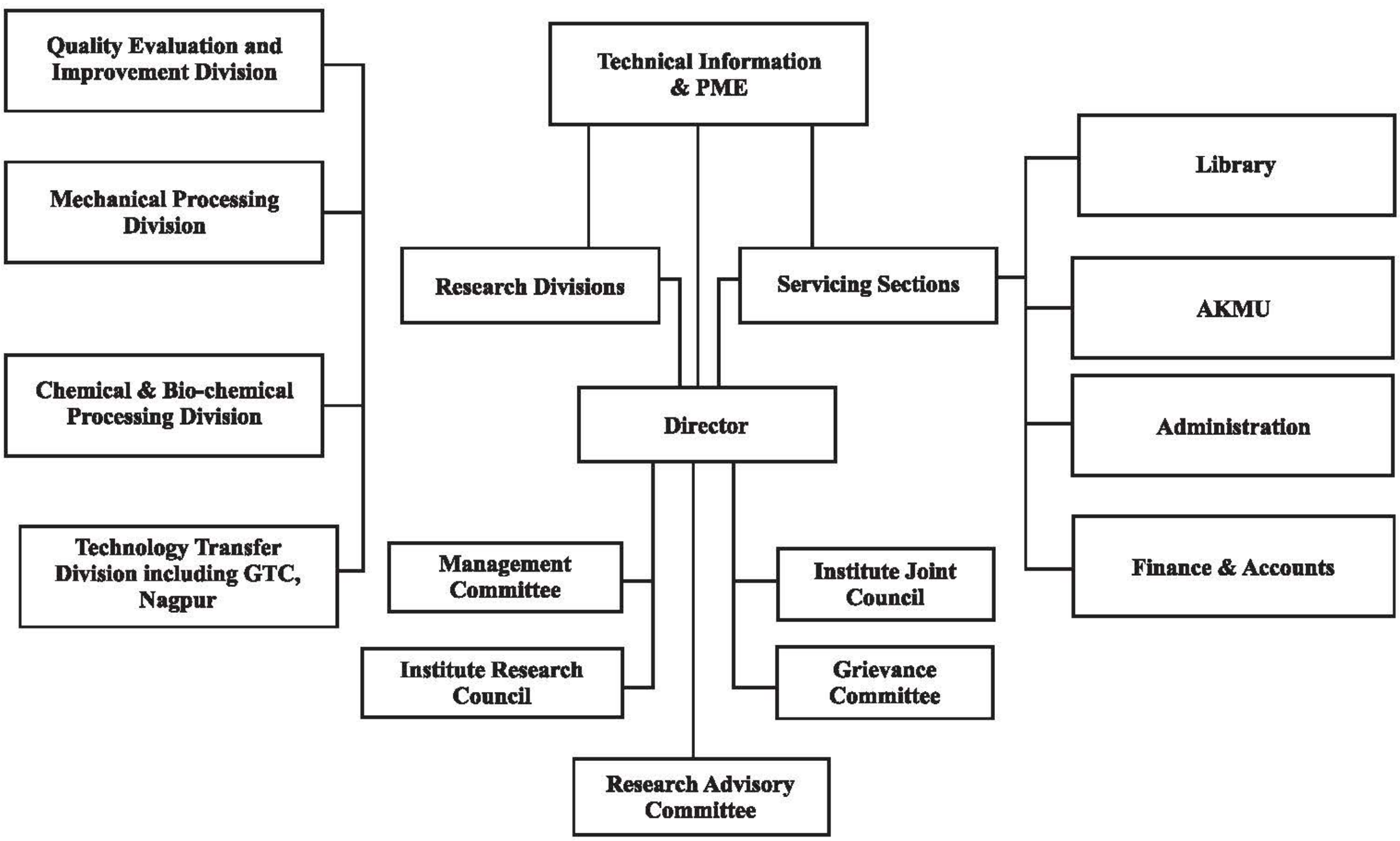
vi. Participation in monitoring and evaluation (site level) activities of NAIP/Institute.

vii. Impact analysis, especially that of research and extension activities of NAIP as well of Non-NAIP activities of institute.

viii. Finalising Monthly and Quarterly Performance Reports.

Research, testing and transfer of technology including human resource and entrepreneurship development activities are facilitated and monitored by the four research divisions. The four servicing sections facilitate the information on services maintaining databank of all research, testing and other activities; the administration of the human resource and the finance disbursement and audit of the institute. The Institute Management Committee (IMC), the Research Advisory Committee (RAC) and the Institute Research Council (IRC) monitor the research and other institute activities in accordance with the mandate of the Institute. The Institute Joint Council (IJC) and the Grievance Committee address the complaints, if any, arising from the staff.

ORGANISATION



BUDGET & EXPENDITURE FOR 2013-14

Sub-Head	NON-PLAN		PLAN	
	R.E. 2013-14	Expenditure up-to 31-03-2014	R.E. 2013-14	Expenditure up-to 31-03-2014
CAPITAL EXPENDITURE				
Equipment	5.31	5.31	22.75	22.68
Information Technology	0.00	0.00	18.71	18.70
Library Books and Journals	0.00	0.00	1.54	1.54
Furniture & fixtures	6.69	6.69	0.00	0.00
REVENUE EXPENDITURE				
Establishment Charges	1196.00	1195.52	0.00	0.00
Overtime Allowance	0.15	0.14	0.00	0.00
Pension & other Retirement Benefits	1130.00	1110.43	0.00	0.00
Travelling Allowances	5.50	5.50	21.20	21.20
Research Expenses	0.00	0.00	9.08	9.08
Infrastructure	68.15	68.10	65.84	65.84
Communication	4.33	4.33	0.00	0.00
Repair & Maintenance				
i. Equipment, Vehicles & Others	27.15	27.14	24.78	24.78
ii. Office building	14.50	14.50	8.76	8.76
iii. Residential building	5.20	5.20	0.00	0.00
iv. Minor Works	1.67	1.66	0.00	0.00
Other (excluding TA)	89.70	89.69	24.84	24.82
HRD Domestic	0.00	0.00	2.50	2.50
Tribal Sub-Plan	0.00	0.00	10.00	7.34
Loan & Advances	6.00	4.34	0.00	0.00
Total	**2560.35**	**2538.55**	**210.00**	**207.24**

REVENUE GENERATION FOR 2013-14

Sub-Head	Amount (Rs. in lakhs)
Training Programmes	4.92
Consultancy Services	6.28
Analytical Testing Fees	24.13
Royalty	1.49
Sale of Publication	0.12
Other Receipts	22.92
Total	**59.86**

2. SIGNIFICANT RESEARCH ACHIEVEMENTS

A brief account of core area-wise significant progress of research for the period 2013-2014 is presented below.

CORE AREA I : PRE-GINNING AND GINNING

Design and Development of Pollution Abatement System for Collection of Flying Dusts from Ginning and Pressing Halls

During the reported period, the design and development of a suitable enclosure and an automatic pala lint doffing system for DR gin have been done (Figure 1), which when used will avoid the spread of fine particulate matter (PM) generated during the ginning operation. As reported earlier that more than 90% fine PMs present in the gin hall is contributed from DR gins. It is an usual practice in ginneries to manually doff/remove the pala lint from DR gins, requiring frequent manual access to the rollers of the DR gin. Hence, any attempt for covering the machine for safety purpose requires automatic doffing of pala lint.

An automatic doffing system consisting of doffing mechanism, take-up unit and driving mechanism have been designed and developed. Teflon bristles, heat resistant rubber, leather and canvas materials have been tried as doffers for removal of pala lint. The diameter of doffer roll was varied from 90-150 mm. It was observed that higher the diameter, better was the doffing performance. In the study, 150 mm diameter was selected for the experiments. It was observed that teflon bristles did not remove the doffed pala lint as it got completely wrapped around the teflon brushes leading to chocking of the system. The performance of heat resistant rubber, leather and canvas as flaps were found satisfactory, the canvas being the best, as it provided more surface contact for the lint.

The placement of the doffing rollers have also been varied in the study. First, the doffing rollers were placed underneath the main ginning rollers. Though the doffing system worked satisfactorily, it caused slight obstruction in the flow of the ginned lint. When the doffers were placed in front of the ginning rollers, the doffing system gave satisfactory performance. Besides three designs of enclosure have also been tried in order to arrest the spread/ disbursement of fine PMs emitting from the gins. The lint collection system from gin to lint cleaner has also been modified to accommodate the developed doffing system and the enclosures. The DR gin along with automatic pala doffing mechanism and enclosures was found to generate less noise and dust pollution.

Fig. 1: DR Gin with Doffing System

Evaluation of Engineering and Economic Performance of High Capacity Rotary Knife Roller Gin for Indian Cottons and Optimization of Machine and Process Parameters for Efficient Ginning

The performance of the rotary knife roller gin for ginning for an Indian cotton was evaluated by conducting experimental trials on a commercial rotary knife ginning machine at M/s. Classic Knits India Pvt. Ltd., Dharwad. The machinery setup comprises of feeder box, inclined pre-cleaner, stick machine and screw conveyor for seed cotton distribution to 10-rotary gin stands, followed by cylinder, air jet lint cleaners and fully automatic down packing baling press. The automatic systems were used for handling seed cotton, lint and seed. Bunny cotton variety was ginned, and the lint and the seed samples were collected at different stages of ginning for assessing the effect of rotary knife ginning on fibre quality, seed quality and spinning performance. The results were compared with quality of lint obtained from the double roller ginning machine.

The rotary knife was fitted with six helical knives, connected to a 30 HP power unit including 25 HP for driving the roller and the rotary knife, and 5 HP for driving the cleaner and the feeder. The gin was operated at a roller speed of 200 rpm, a rotary knife speed of 400 rpm and a feed roller speed of 18 rpm. The pressure between gin roll and the rotary knife was maintained at 80 bar. The capacity of the rotary knife roller gin was found to be 425 kg of lint/h, which is approximately six times that of the Jumbo double roller gin. The capacity of plant was found to be 25 bales/h (Bale Weight: 170 kg), with total connected load of 550 KVA. The energy consumption was found to be 28 units/bale.

The HVI results indicated marginal increase in 2.5% span length of the fibres from the rotary knife ginning over the DR ginning, while the other fibre properties remained unaffected. The AFIS results showed fibre neps to be 250 cnt/gm and 133 cnt/gm and seed coat neps to be 46 cnt/gm and 29 cnt/gm for rotary knife gin and DR gin, respectively. The Full spinning of the ginned cotton was done into 40s and 50s English yarn counts and their properties were evaluated. Lea strength and CSP values were found to be higher for yarns made from the lint of the rotary knife ginning compared to that from the DR ginning. The cut seed percentage was found to be in the range of 2.8-3.8% and 0.40-0.85%, for the rotary and the double roller ginning, respectively.

Development of Cotton Picking Machinery for Small Scale Cotton Production Systems

During the reported period, quality assessment and trash analysis of machine picked cotton samples collected from Abohar were carried out. The results revealed that the machine picked cotton contains around 10-12% trash content, while the hand picked contains around 4-4.5%. However, the machine picked cotton samples (where defoliation was not successful or not done properly) contained trash ranging from 15-16%. It was observed that leaf content is around 70-80% of the total trash content that can be easily removed by using an air jet cleaner.

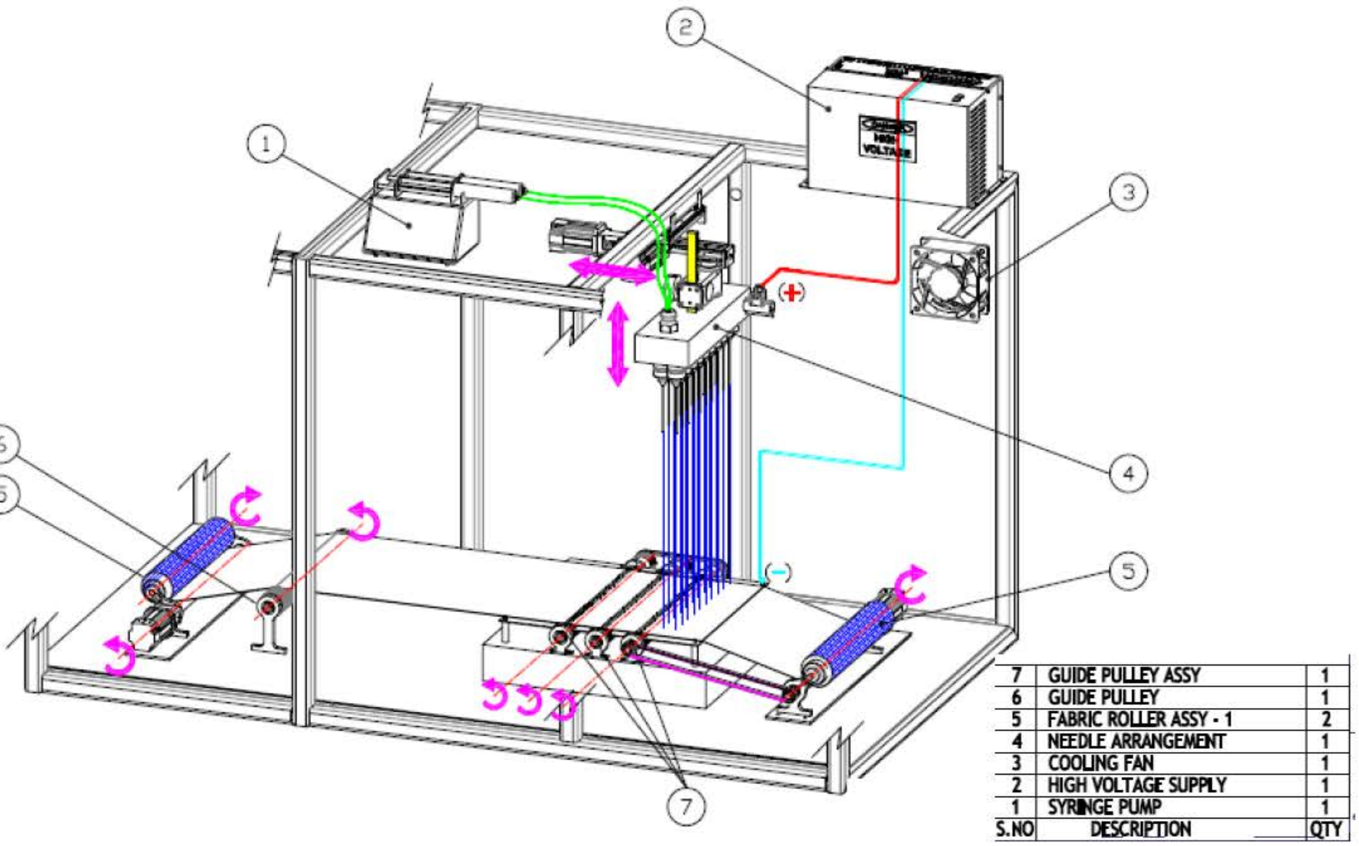
The cleaning trials of machine picked cotton was carried at M/s. B. N. Agro Cotton Ginning Factory, Abohar, Haryana. The entire set of machinery for processing of machine picked cotton namely, Dispensing system, Tower drier, Inclined cylinder cleaner, Stripper cleaner, Stick machine and Impact cleaner were installed for processing of machine picked cotton. The cleaning trial was conducted for three different types of cottons, picked using machine picker supplied by M/s. John Deere India. The results showed (Table 1) that trash content could be reduced to 2-3% from initial level of 12-16%. However, the use of cleaning machinery reduced the fibre length by 0.5-0.8 mm and there was significant increase in the formation of neps. In addition, the processed seed cotton was getting twisted/spun during the cleaning operations. Hence, it is understood that the cleaning machinery parameters need to be optimized for machine picked cotton.

Table 1: AFIS results for machine picked cotton (MPC) and machine picked pre-cleaned cotton (MPPC)

Seed cotton	Length Module Test Result						Nep Module Test Result			
	L(w) mm	UQL (w) (mm)	SFC (w)% (mm)	L(n) mm	SFC (n)% (mm)	5% L(n) (mm)	Fiber Neps		Seed coat Neps	
							Count/g	Mean size (µm)	Count/ g	Mean size (µm)
MPC A #8120	23.9	31.0	14.0	17.6	37.1	35.5	168	661	16	1451
MPPC A 8120	23.1	30.4	16.4	16.5	41.2	35.2	280	666	14	1364
MPC A 3028	20.9	27.1	18.6	15.5	42.1	31.6	206	630	10	1214
MPPC A 3028	19.7	25.7	21.4	14.5	45.5	29.6	242	679	15	1172

Development Of High Performance Cotton Textiles By Electro Spraying / Spinning Technique

The indigenous designing of a Electro-spraying unit with multi-spinneret arrangement for uniform application of finishes in fabric has been completed (Fig. 2). The working and operation mechanism of the unit have been animated for ease in understanding and fabrication.



S.NO	DESCRIPTION	QTY
7	GUIDE PULLEY ASSY	1
6	GUIDE PULLEY	1
5	FABRIC ROLLER ASSY - 1	2
4	NEEDLE ARRANGEMENT	1
3	COOLING FAN	1
2	HIGH VOLTAGE SUPPLY	1
1	SYRINGE PUMP	1

Fig. 2: 3D View of Multi-Syringe Electrospraying Machine

The design has automated adjustments for controlling of X-Y movement of fabric as well as the nozzle sets. Besides, the height and movement of multi nozzles in Z - direction can be controlled for better spraying performance using different polymers and solvents. The machine has three operating modes: auto, manual and independent. The auto and the manual mode can be controlled by different parameters available in the display, while the independent mode can be controlled by individual switchs. In auto mode, the high voltage supply will be turned off, as soon as the doors are opened as a safety precaution. The manual mode has individual control for all the operations, and the independent mode provides warning lamp for the safety control. The setup will ensure uniform feeding of the solution and controlled fabric movement to enhance the even coating throughout the width of the fabric.

A pin type electrode has been fabricated for an even coat application to the fabric. Cotton fabrics above 220 GSM exhibited poor conductivity due to high cover factor that affects the even spraying. To overcome this, the pin collector (Fig. 3) has been so designed as to protrude on to the fabric, thus achieving a better evenness in electrospraying. The same electrode will be incorporated while designing the continuous spraying machine.

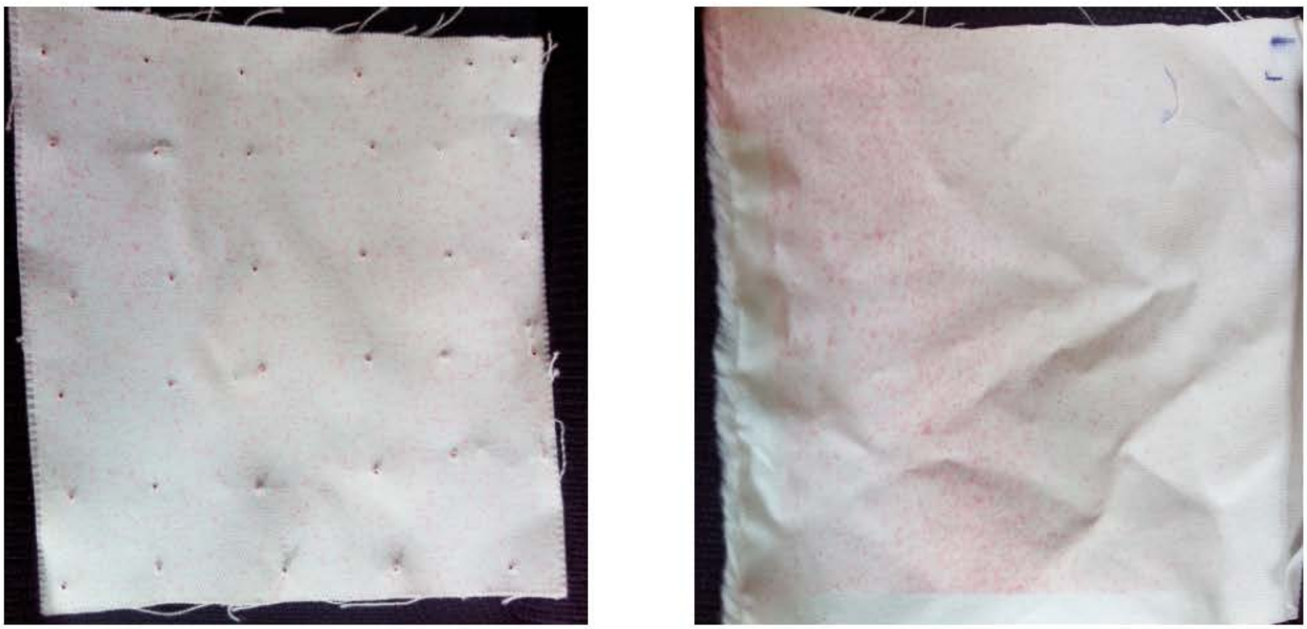


Fig. 3: Pin collector and Plane aluminium collector

Pinned aluminum collector *Plane aluminum collector*

Antimicrobial Finishing

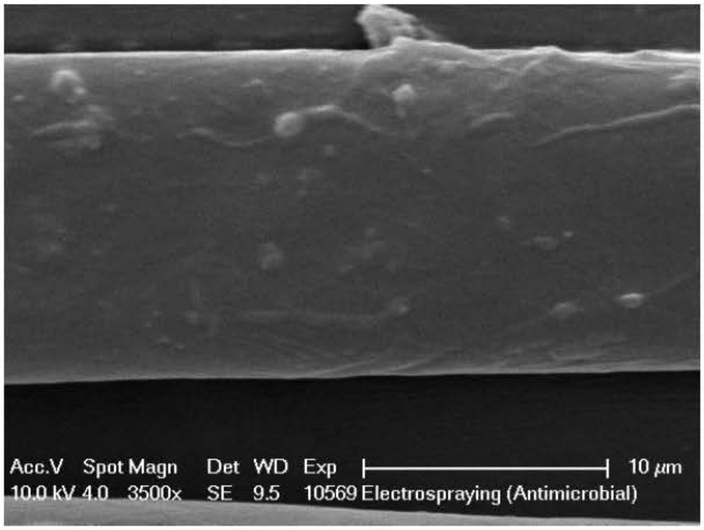
A 10 X 10 cm (130 GSM) plain woven cotton fabric was used for electrospraying with commercial quartnery ammonium based antimicrobial solution (sanitized T9919 Clariant). The flow rate used was 0.03 ml/min, the nozzle distance of 15 cm, and the operating voltage was 30 kV for a 10 min spray duration. The sample was washed using the test method, AATCC 1A and the antibacterial properties were quantitatively evaluated (AATCC 100) against *Staphylococcus aureus*. The bactericidal activity of the electrosprayed fabric was evaluated after 24 hours. The fabric exhibited an excellent antibacterial effect on gram positive bacteria. Table 2 shows the antibacterial effect of single and double sided electrosprayed cotton fabric. Sided it is seen that the double sided sprayed fabric has 100% antibacterial inhibition compared to the control fabric with *Staphylococcus aureus* organism. The washing fastness of the electrosprayed fabric was also found quite satisfactory.

Table 2: Antibacterial effect of electrosprayed cotton fabric

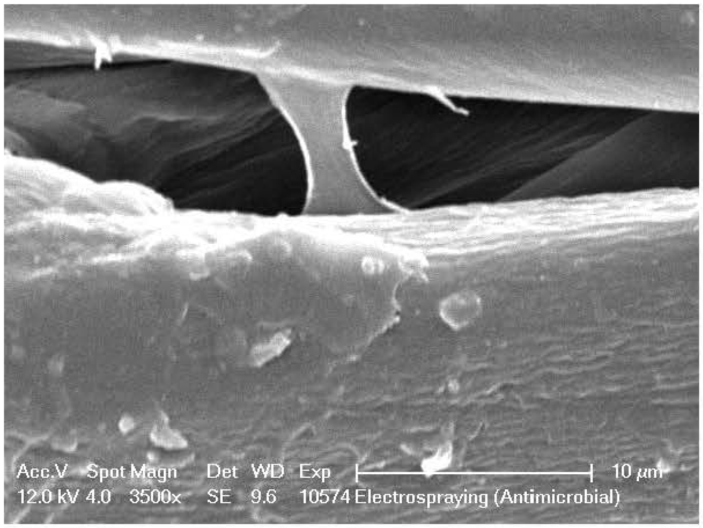
0 h / sample	Neat	Neat	10^{-1}	10^{-1}	10^{-2}	10^{-2}
Control	204	150	16	14	2	1
24 h results						
Control	UC	UC	UC	UC	150	188
S1	2	1	0	0	0	0
Reduction % S1	99	99	100	100	100	100
S2	0	0	0	0	0	0
Reduction % S2	100	100	100	100	100	100

Note: C – Control Samples, S1 – Single side sprayed sample and S2 – Double side sprayed sample

The SEM of the antibacterial treated fabric (Fig. 4) showed clear dotted images, indicating the presence of antimicrobial chemicals on the cotton fibre.



SEM Image of Electrosprayed Cotton Fabric @ 3500 X



Patch Formation due to Wetting in Double Side Sprayed Fabric

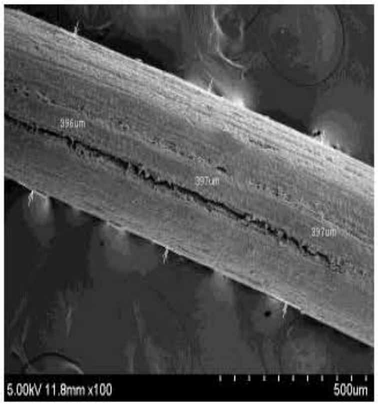
Fig. 4: SEM Image of Electrosprayed Cotton Fabric

Improvement in Coconut Fibre Compatibility for Production of Superior Quality Fibre Reinforced Composites

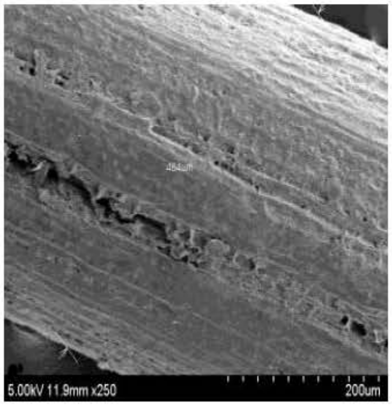
Surface Modification of Coconut fibre with Chemicals

The conditioned samples were treated with sodium hydroxide, sodium chlorite and sodium carbonate at various concentrations (3, 5, 10 and 15%) for 90 minutes. The treated samples were then washed with water and dried at 90°C for 15 minutes.

Coir fibre Surface Analysis with SEM



x100



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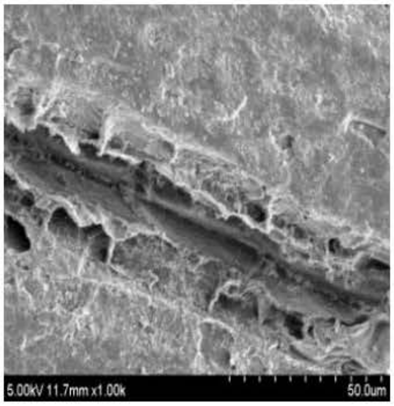

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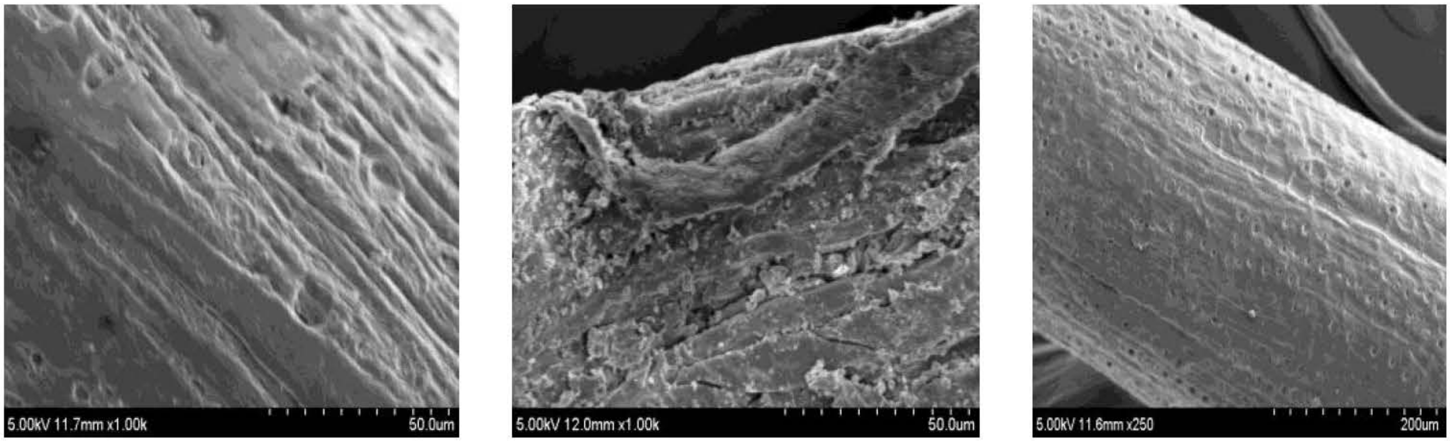
Fig. 5: SEM Micrograph of Raw Coconut Fibre



Sodium Chlorite ***Sodium Hydroxide*** ***Hydrogen Peroxide***

Fig. 6: SEM micrograph of Chemically treated coconut fibre

The SEM images of raw coconut fibre (Fig. 5) show that the fibre is spread with nodes and irregular stripes, but no pits. The fibre surface is heterogeneous with smooth and rough portions and it contains globular protrusions. The SEM image of Sodium chlorite treated fibre (Fig. 6) reveals that the fibre surface is very smooth with all globular protrusions being removed and the pits are formed in a linear manner. The SEM image of Sodium hydroxide treated fibre shows that waxy deposits and protrusions are removed, leading to the formation of a rough surface with pits. The SEM image of Hydrogen peroxide treated fibre shows that the fibre has a smooth surface but with cracks here and there. When the fibre is dewaxed, regularly placed pits are observed on the surface.

Coir Surface Functional Analysis with FTIR

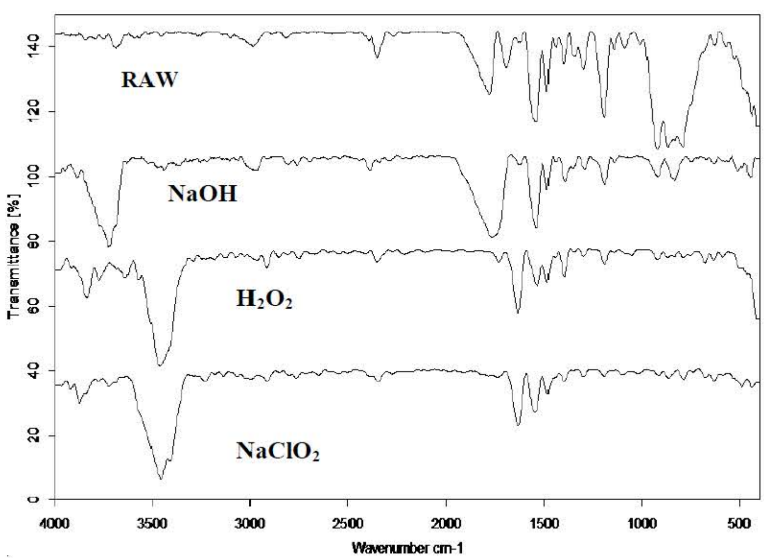


Fig. 7: Spectrogram of raw coconut fibres

In the spectrogram of raw coconut fibres (Fig. 7), the wide band near 770 cm^{-1} to 900 $^{-1}$ is due to the presence of strong vinyl and aromatic C-H bonds. The sharp band near 1230 cm^{-1} is due to the presence of aromatic ether C-O bonds. The sharp band near 1550 cm^{-1} is assigned to strong aliphatic nitro compounds N-O bonds. The small peak near 1700^{-1} is indicates the presence of a little amount of Acyclic C-C bonds. The wide prominent peak at 1760 cm^{-1} is attributed to the presence of C-O bonded groups like aldehyde, ketone, and carboxylic derivatives. The short bands near 3650 cm^{-1} and 2450 cm^{-1} are due to low concentration C-H and O-H bonds. The infra-red spectra of the sodium hydroxide treated sample shows a wide band near 3750 cm^{-1}, which was not seen in the spectra of raw coconut fibre. It indicates the presence of weak OH bonds (alcohols/phenols) and C-H bonds. The wide band near 1800 cm^{-1} indicates the presence of Carboxylic acids with C=O bonds. It can be observed that in the spectrum of raw fibre, this peak is the narrowest. The peak near 1230 cm^{-1} is due to the presence of C-O bonds of aromatic ethers. The peaks near 920 and 790 cm^{-1} are attributed to Vinyl and aromatic C-O bonds.

The FT-IR spectrum of the Hydrogen peroxide showed a few short and less bands near the 3800 cm^{-1} region indicating the presence of alcohols/phenols O-H groups. At 3480, there appears a sharp peak which indicates the presence of strong N-H bonds of primary amines. There are peaks similar to the spectrum of raw fibre in the region of 1700 cm^{-1} to 1400 cm^{-1}. The reduction in the bands in the region 1400 cm^{-1} to 500 cm^{-1} indicates the removal of vinyl and aromatic C-H bonds and C-O bonds. The spectrum of Sodium chlorite is similar to that of the Hydrogen peroxide treated sample, but for the peak at 3480 cm^{-1} it is broader than the peak at the same range. This indicated the presence of more strong Primary amines having N-H bonds.

Commercially retted fibre reinforced composite

Both the raw and the commercially retted coconut fibre were mixed with epoxy resin in the weight ratio of 1:10 (Coconut fibre : epoxy resin). Then the coconut/Epoxy web was kept into steel mould in the compression moulding machine at 100°C temperature and 20 KN pressure for 60 min. The mechanical properties of coconut fibre/epoxy composite sample were analyzed by a Universal Testing Machine. While the tensile strength of raw coconut fibre reinforced epoxy composite was 18.2 MPa, it was 19.6 MPa for the commercially retted sample (fig. 8 & 9). Thus, no significant difference in mechanical property between the two samples were noted.

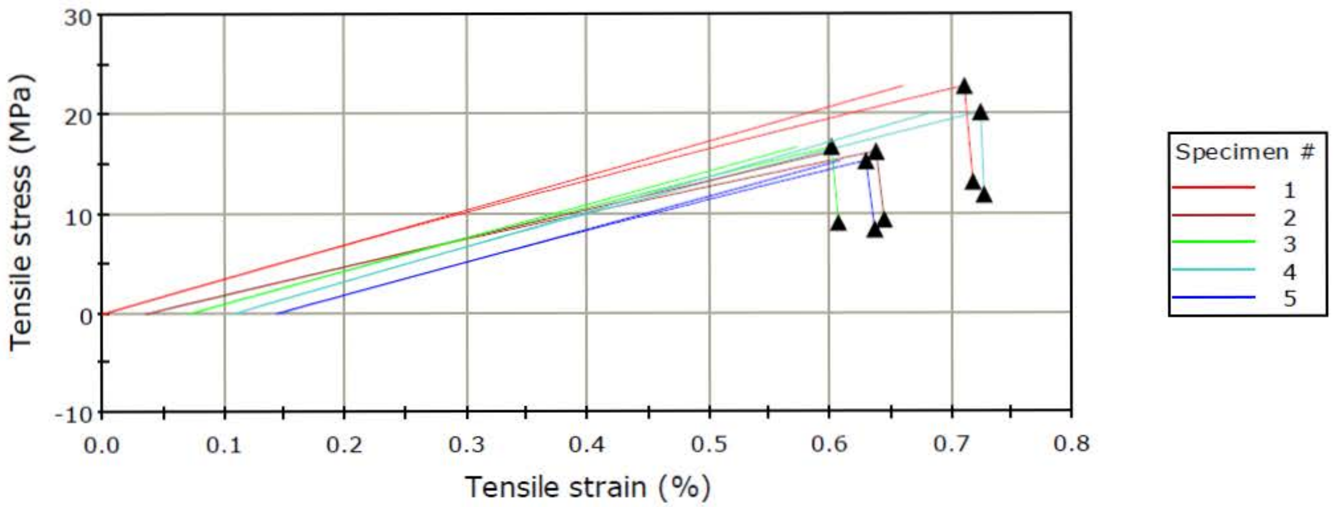


Figure 8: Tensile Strength of Raw Coconut Fibre

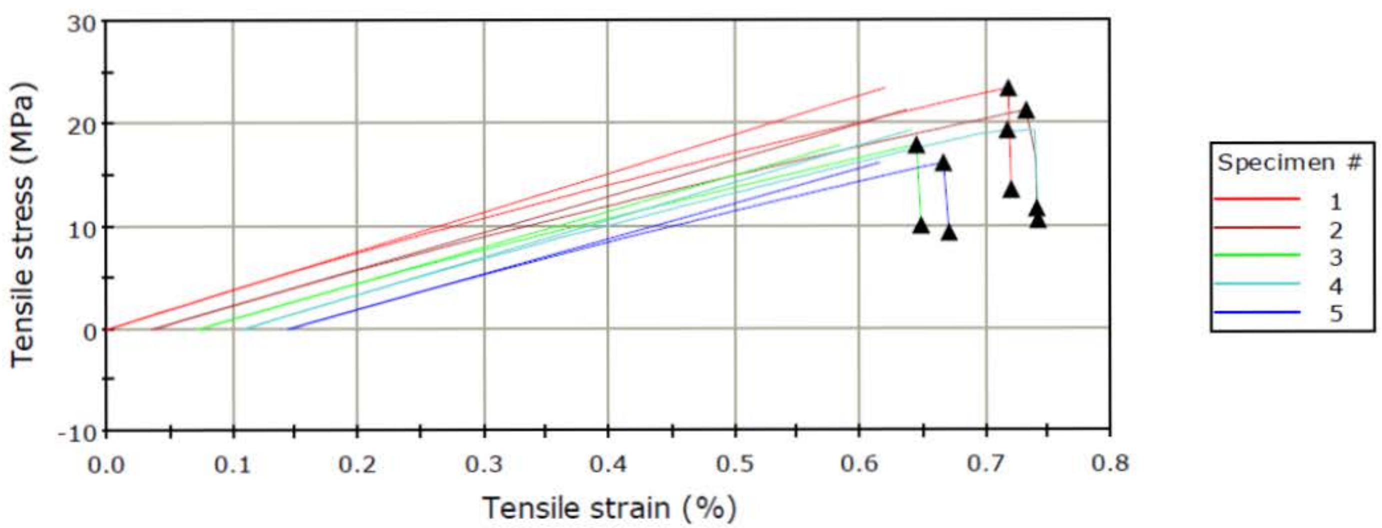


Fig. 9: Tensile Strength of Commercially Retted Fibre Composite

Chemical Treatment of retted coconut fibres using $Na_2S_2O_4$ and $FeSO_4$

The coconut fibre does not react with the dilute acid or alkaline solution. But at a higher concentration of NaOH, the lignin components were found to dissolve. The colour also turned to dark brown, even after the removal of lignin. In case of oxidizing agent like hydrogen peroxide, the colour changed to brown, and while treating with $Na_2S_2O_4$, the lignin components decolorized and changed to pale yellow.

Effect of HYDROS ($Na_2S_2O_4$)

The bleaching effect obtained by HYDROS was found is better than that obtained with hydrogen peroxide. Even at room temperature, the HYDROS bleached the coconut fibre at 4% concentration. When the temperature was increased to 60ºC, a concentration of 2% was sufficient to get the same effect. But at the boil, no prominent change was observed. When treated with an acid, further increase in reflectance was noted (Fig.10 & 11) with sulphuric and hydrochloric acid, rather than acetic acid (Fig. 12 & 13).

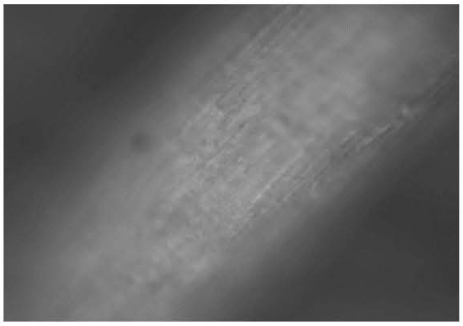


Fig. 10: Microscopic view of raw coconut fibre (200X magnification)

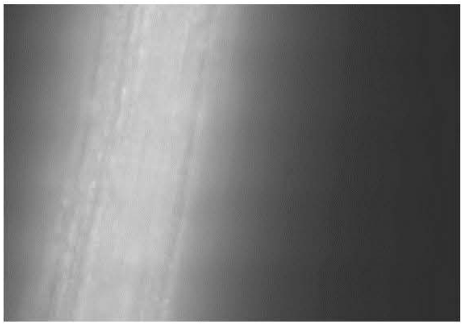


Fig. 11: Microscopic view of coconut treated with 4% HYDROS along with 1% HCl

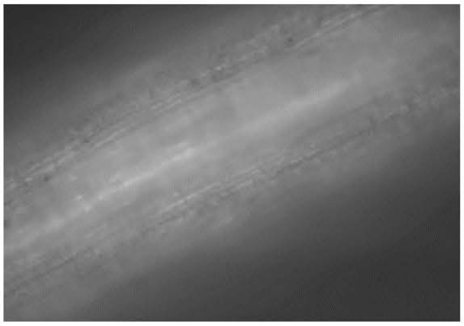


Fig. 12: Microscopic view of coconut treated with 4% HYDROS along with 1% H_2SO_4

Fig. 13: Comparison of Raw Coconut Fibre and 4% $Na_2S_2O_4$ Treated at room temp.

Effect of metallic salt ($FeSO_4$)

As a simple experiment, coconut fibre was treated with 5% $FeSO_4$ solution and it was found that it can absorb more metallic compounds that are present in the solution (Fig. 14). Thus, coconut fibre can be used for the recovery of metallic salt in the effluent.

Fig. 14: Microscopic view of coconut fibre treated with 5% FeSO4 (400X magnification)

For bleaching of coconut fibre, 2 to 4 % of $Na_2S_2O_4$ can be used along with 1% HCl acid. The bleaching can at be carried out at 4-5 pH and room temperature itself. When the temperature is increased to 60°C, slight improvement was observed. But at 90°C, there is no prominent change noted.

Development of Innovative Fibre Blends and Finishes for Improved Functionality of Cotton Textiles

Cotton/PLA blended yarns with blend proportions of 80:20 and 65:35 were knitted into fabrics using a single jersey knitting machine. 100% cotton and 100% PLA yarns were also knitted into fabrics for comparison with the blended yarns. The GSM of the fabric produced was 110 with 49 course and 40 wales per inch. The fabrics were then scoured using enzyme followed by peroxide bleaching. The resultant fabrics were then relaxed by submerging them in water for 12 hours. The relaxed fabrics were conditioned in standard atmosphere prior to testing. All the four fabrics, namely 100% cotton, 100% PLA, 80:20 cotton/PLA and 65:35 cotton/PLA were tested for Hand values using Kawabata Evaluation System (KES) (Table 3).

Table 3: Hand Values of Fabric Samples

Sample	Koshi	Fukurami	Numeri	THV
100% cotton	9.81	5.67	4.92	3.53
Cotton/PLA(80/20)	8.27	6.93	3.58	3.34
Cotton/PLA (65/35)	7.56	7.09	5.22	3.50
100% PLA	8.87	6.34	6.34	3.68

From the results, it can be seen that the Total Hand Values (THV) of blended fabrics are comparable to that obtained with 100% cotton. The higher THV for 100% PLA fabrics is due to its improved surface smoothness. The fabrics were also evaluated for their moisture management properties using the SDL Atlas Moisture management tester (Fig. 3 & 4), and for thermal properties using the KES F-7 tester.

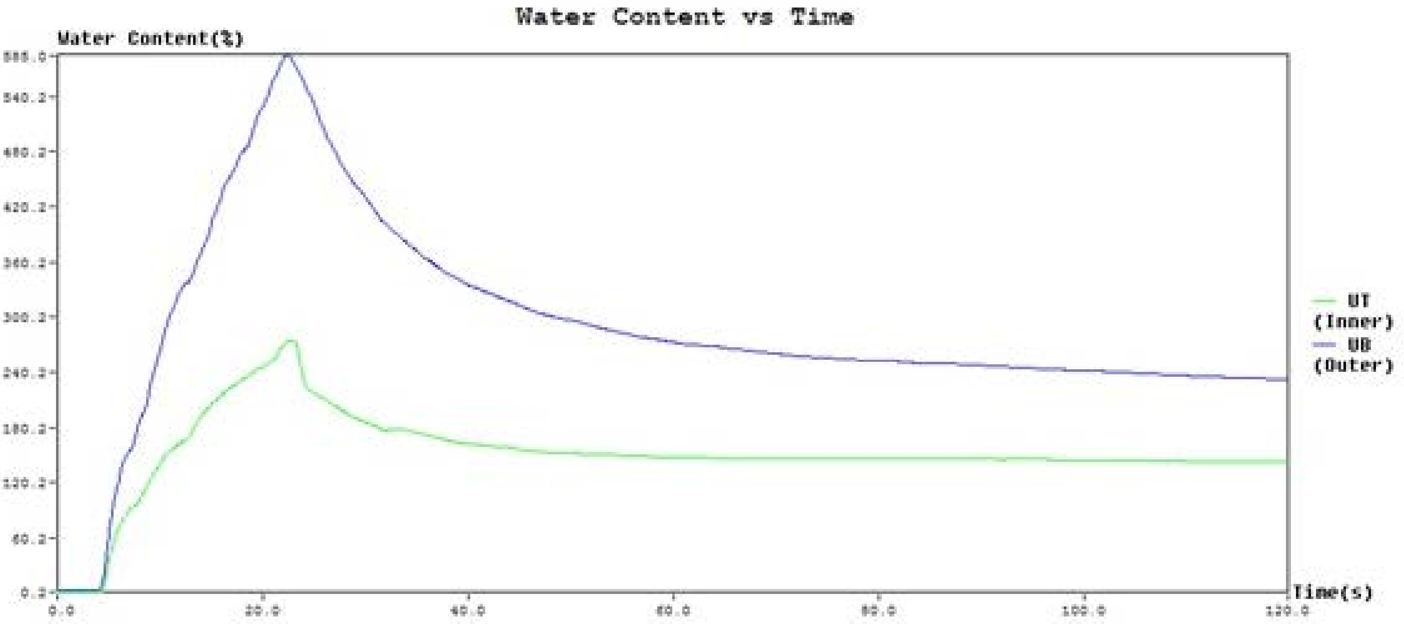


Fig. 15: Representative curve of water content in cotton/PLA (65/35) blended fabric

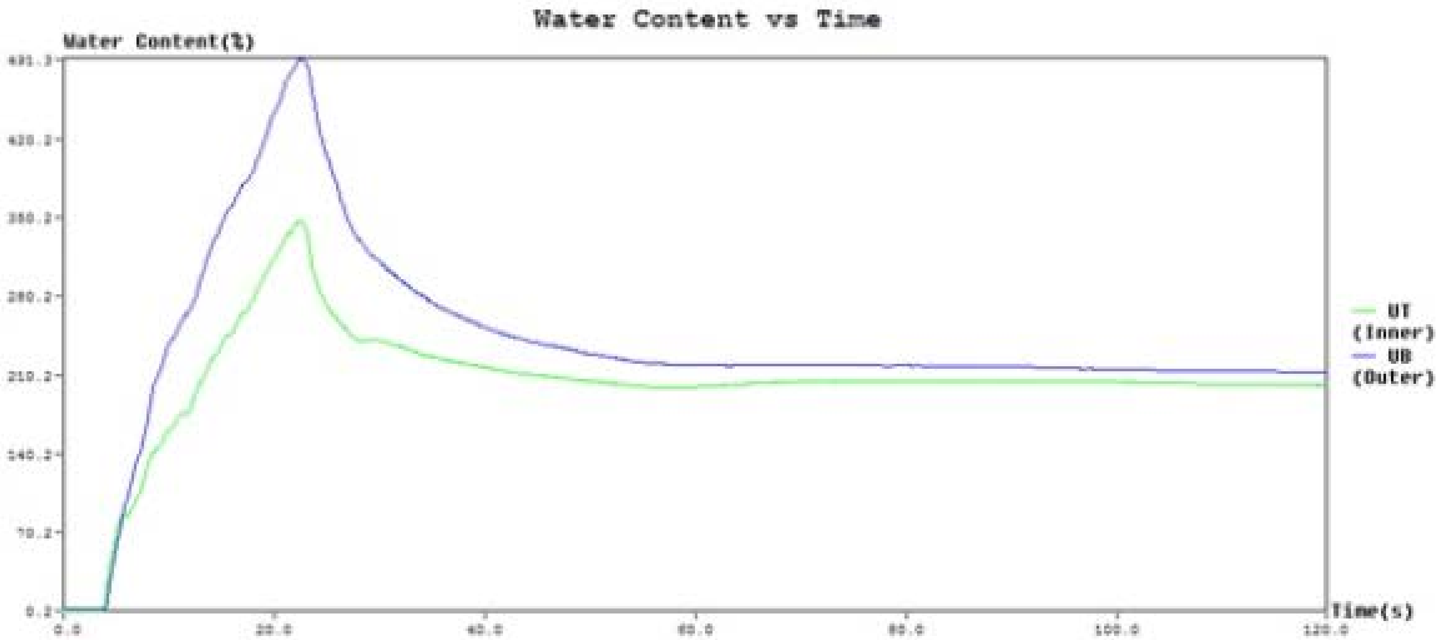


Fig. 16: Representative curve of water content in cotton/PLA (80/20) blended fabric

It can be seen that the moisture management property of cotton/PLA blended fabric with the blend ratio of 65:35 was better than the other fabrics. Wicking was found to be faster and the Overall Moisture Management Capacity (OMMC) is 0.3 in comparison to 0.2 obtained with the other fabrics. The results of Moisture Vapour Transmission Rate (MVTR) are presented in Table 4.

Table 4: MVTR Results

Sample	MVTR ($g/m^2/24$ hr)
100% cotton	1.0056×10^3
Cotton/PLA (80/20)	1.1308×10^3
Cotton/PLA (65/35)	1.1450×10^3
100% PLA	1.8147×10^3

From the table, it can be seen that MVTR of 100% PLA is better than that obtained with 100% cotton followed by the fabric made with 65/35 cotton / PLA blend.

The thermal properties of the fabrics are given in Table 5 and Table 6. It is seen that the heat retention values of 100% PLA fabrics was the best, followed by the 65:35 cotton/PLA blended fabric.

Table 5: Thermal Insulation Values

Sample	Heat retention (%)
100% cotton	32.6
Cotton/PLA (80:20)	33.8
Cotton/PLA (65:35)	38.5
100% PLA	40.6

Table 6: Thermal Conductivity Values

Sample	Thermal conductivity (W/cm.deg C)
100% cotton	6.61×10^{-4}
Cotton/PLA (80:20)	6.26×10^{-4}
Cotton/PLA (65:35)	5.56×10^{-4}
100% PLA	3.53×10^{-4}

Yarn Dyeing: Chemical processing of a cotton-PLA blend is a challenge due to the sensitivity of PLA component to alkaline and high temperature conditions. A single step scouring and bleaching process was attempted for 80:20 cotton-PLA blended yarns. Two alkalis, 1gpl sodium hydroxide and 3 gpl sodium carbonate were used in the process at two different temperature, i.e., 80° and 95°C besides, in the bath, 3 gpl hydrogen peroxide, 1.5 gpl sodium silicate along with 1 gpl sodium lauryl sulphate were used. The treatment time was one hour. To reduce the alkali further, 2 gpl sodium carbonate along with pectinase enzyme was also used under the similar conditions. In another modification, the treatment was initially carried out at 80°C for 30 min and the temperature was then raised to 95°C, and kept at that temperature for 30 minutes. After the treatment, all the samples were thoroughly washed with hot water and then air dried. Tests were carried out for absorbency, whiteness and lea strength. It was found that the 3 gpl sodium carbonate at 95°C was the best in terms of absorbency and whiteness without any loss in strength.

The dyeability and the fastness properties of PLA/Cotton blended materials were also studied. Scoured and bleached blended yarn was dyed with disperse/reactive dye system. The PLA part was first dyed with disperse dyes at 110°C using a pH 4 - 4.5 (maintained using a buffer). The cotton part was then dyed with reactive HE dyes at 80°C using salt and soda method. It was observed that the fabric showed an uniform dyeability and good washing fastness.

Dyeing/Finishing of cotton/PLA fabrics: In an attempt to carry out one bath dyeing of Cotton /PLA (65/35) blended knitted material for selected light shades using disperse /direct dye combination at 110°C, so as to reduce the time and energy consumed during dyeing, optimization of a new dyeing condition is under progress. To improve the moisture management properties of the blended material, it was subjected to finishing process with commercial chemicals using pad-dry-cure method. An UV protective finish was applied on to the Cotton/PLA Fabric and the UV Protection property of the Cotton/PLA (65/35) blend was found to increase from 6 to 43.

Cotton/Bamboo viscose blend: Cotton/Bamboo viscose blends yarns were spun to 30s Ne yarn using a compact-ring spinning machine. The yarns were then tested for CSP, single yarn strength, elongation, U% and twist (Table 7).

Table 7: Yarn Properties

Sl. No.	Yarn	Count (Ne)	CSP	TPI	U%
1	100% cotton	30.1	2788	21.5	13.0
2	Cotton/bamboo viscose (65/35)	29.2	2389	20.9	9.8
3	100% bamboo viscose	29.7	2139	21 .0	9.7

From the results, it can be seen that the moisture management property of cotton/PLA blend ratio of 65:35 is better than the rest of the fabrics. The wicking was found to be faster and the overall moisture management capacity (OMMC) was 3 compared to 2 for the other fabrics. The results on moisture vapour transmission test is given in Table 8.

Table 8: MVTR Results

Sample	MVTR ($g/m^2/24$ hr)
100% cotton	1.0056×10^3
Cotton/PLA (80/20)	1.1308×10^3
Cotton/PLA (65/35)	1.1450×10^3
100% PLA	1.8147×10^3

From the results it can be seen that MVTR of 100% PLA fabric is better than that of other fabrics. The thermal properties of fabrics are given in Table 9 and Table 10. From the results, it can be seen that heat retention of 100% PLA fabric is better than the other fabrics, besides they are also poor conductors of heat.

Table 9: Thermal Insulation Values

Sample	Heat retention (%)
100% cotton	32.6
Cotton/PLA (80:20)	33.8
Cotton/PLA (65:35)	38.5
100% PLA	40.6

Table 10: Thermal Conductivity Values

Sample	Thermal conductivity (W/cm.deg C)
100% cotton	6.61×10^{-4}
Cotton/PLA (80:20)	6.26×10^{-4}
Cotton/PLA (65:35)	5.56×10^{-4}
100% PLA	3.53×10^{-4}

Some of the commercially available sportswear garments were also tested for moisture management properties. Results indicate that the application of moisture management finish is essential to further improve the OMMC rating of cotton/PLA blend fabric.

Yarn Dyeing: Chemical processing of cotton-PLA blends is a challenge due to the sensitivity of PLA component to alkaline and high temperature conditions. Single step scouring and bleaching process was attempted for scouring and bleaching of 80:20 cotton-PLA blended yarns. Two alkalis, 1gpl sodium hydroxide and 3gpl sodium carbonate were used in the process at two different temperature i.e 80° and 95°C. 3 gpl hydrogen peroxide, 1.5 gpl sodium silicate along with 1 gpl sodium lauryl sulphate was used. The treatment time was 1 hour. To reduce the alkali further 2 gpl sodium carbonate along with pectinase enzyme was also used under similar conditions. In another modification, the treatment was initially carried out at 80°C for 30 min and the temperature was then raised to 95°C and treatment was above for further 30 minutes. After the treatment all samples were thoroughly washed with hot water and air dried. Tests were carried out for absorbency, whiteness and lea strength. 3 gpl sodium carbonate at 95° C was best in terms of absorbency and whiteness without loss in strength.

Cotton/Bamboo viscose blend: Cotton/Bamboo viscose yarns were spun to 30s Ne using compact-ring spinning machine using 3.8 TM. Yarns were then tested for CSP, single yarn strength, elongation, U% and twist.

Studies on Preparation of Composite from Fibrous Waste Materials

Paper composites (Fig. 17) were fabricated by using polyester resin as matrix and newspaper as the reinforcement at 40 Bar pressure. Accelerator and catalyst, 2% by weight of each was added to resin at room temperature for curing. A hand lay-up method was adopted to fill up the prepared mould.

Fig. 17: Composite sample from fibrous waste

Mechanical Testing

Both the tensile and the three point bend tests were performed in accordance with ASTM D3039 and ASTM D 790, respectively to determine the tensile properties and also to measure the flexural strength of the composites. The results of the tests are presented in Table 11 and 12.

Table 11: Tensile Strength Test Result

Sample No.	Fibre (%)	Thickness (mm)	Line Pressure (Bar)	Tensile Stress at break (MPa)	Tensile Modulus (GPa)
1	34	2.2	40	77.4	3.3
2	34	2.2	40	68.3	2.5
3	34	2.2	40	76.7	2.2
Mean				**74.1**	**2.6**

Table 12: Flexural Strength Test Result

Sample No.	Fibre (%)	Thickness (mm)	Line Pressure (Bar)	Flexural Stress at break (MPa)	Flexural Modulus (GPa)
1	34	2.4	40	100.8	5.1
2	34	2.4	40	8.2	4.4
3	34	2.4	40	92.4	4.8
Mean				**92.1**	**4.7**

Jute Based Bio-composite for Industry

A good quality composite should essentially have a uniform distribution of the reinforcement and the matrix throughout. For the purpose, a new technique of composite preparation was used in this study. DREF friction spinning system is known to produce good quality core yarns with upto three layers, and if yarns are produced with this system, there will be a very uniform distribution of the reinforcement and the matrix in the structure. Further, when these yarns will be converted into a composite, it will have uniform distribution of reinforcement and matrix in it, which is not achievable with the other commonly used techniques of composite preparation. Trials using this method were carried out at CIRCOT. The jute yarns were directly used in the core during friction spinning in the DREF 3000 system and the polypropylene fibres were converted into slivers before being fed to the DREF machine, as sheath. Three processing routes were used for preparation of polypropylene fibre as sheath materials with jute yarn as core during DREF spinning as shown below:

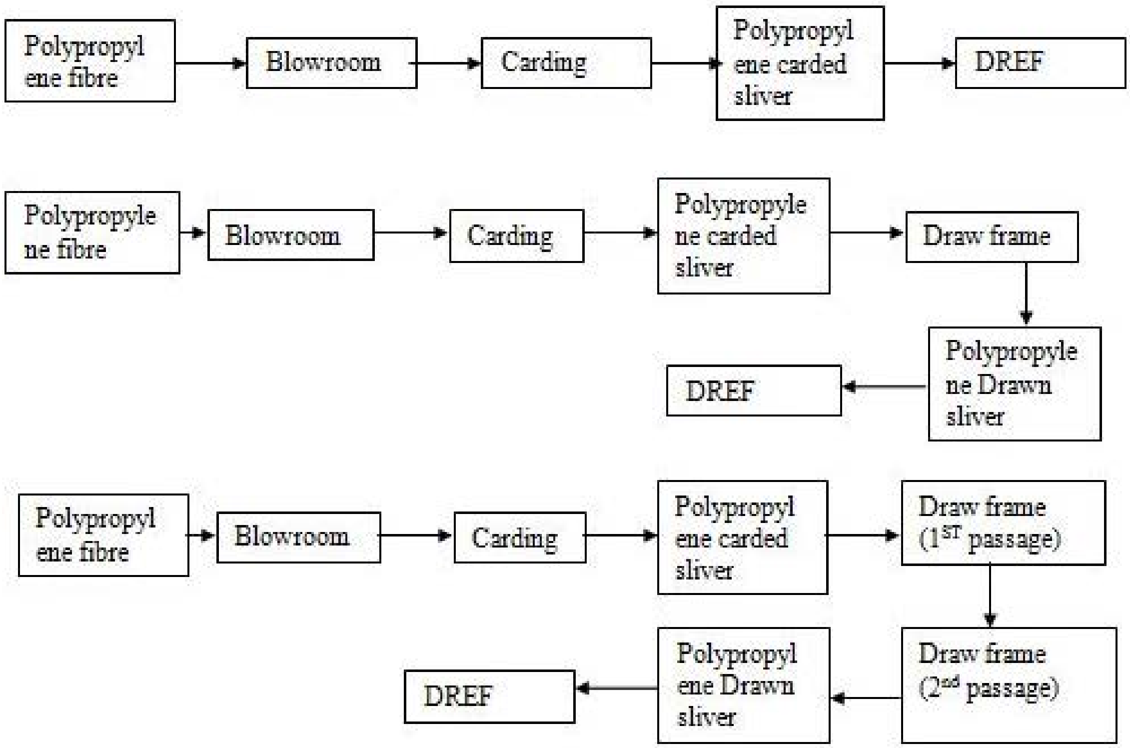


Fig. 18 Flow Chart for DREF your production

Among the three different methods, the processing of polypropylene fibres *via* carding and with minimum two drawing passages were found suitable for better spinning. When only the carded polypropylene sliver was used as the feed in the DREF friction spinning machine, it caused roller lapping on the opening roller due to high level of fibre entanglement in the carded sliver. The fibres being caught by the licker-in tooth of the carding drum in the friction spinning machine, bent and wrapped around the teeth, thus further aggravating the problem. Besides, the fibres melted and formed beads making it impossible to run the machine. In the second method, when only one drawing passage was used, the fibres did not become fully straight and creating the problems to some extent as stated above. But with two drawing passages, the fibres became sufficiently straight and could be used as feed material for DREF friction spinning machine. Thus, it was seen that minimum two drawing passage is required for the polypropylene sliver to be used as sheath material in the DREF spun yarn.

To study the effect of twist per inch (TPI) in the core yarn and the effect of fabric construction on the composite prepared, jute yarns with three different TPI (3, 4 and 5) were prepared. The tensile properties of the yarns produced are given in Table 13.

Table 13: Tensile Properties of Core Yarns

Yarn Twist (tpi)	Yarn Count (Tex)	Yarn Tenacity (N/tex)	CV of Yarn Tenacity (%)	Yarn Breaking Elongation (%)	CV of Yarn Breaking Elongation (%)
3	346	10.7	11.4	1.60	10.9
4	343	10.4	16.6	1.54	11.7
5	322	12.7	14.3	2.76	11.6

With these jute yarns as core and polypropylene as sheath material, three different sets of yarn varying in core:sheath ratio, were produced on the DREF 3000 machine (Table 14).

Table 14: Sampling details of jute (core) : polypropylene (sheath) DREF yarn

Core Jute yarn twist (tpi)	DREF setting for Jute:Polypropylene	Sample Name
3	60 : 40	A1
	50 : 50	A2
	40 : 60	A3
4	60 : 40	B1
	50 : 50	B2
	40 : 60	B3
5	60 : 40	C1
	50 : 50	C2
	40 : 60	C3

The properties of the above nine yarns thus produced are given below in Table 15 and 16.

Table 15: Physical Properties of Various DREF Yarns

Sample Code	Core Jute yarn count (Tex)	DREF yarn count (Tex)	Actual Jute reinforcement percentage (%)	Actual Polypropylene sheath percentage (%)
A1	346	616	56	44
A2	346	699	50	50
A3	346	875	40	60
B1	343	558	61	39
B2	343	687	50	50
B3	343	927	37	63
C1	322	590	55	45
C2	322	650	50	50
C3	322	860	37	63

Table 16: Mechanical Properties of various DREF Yarns

Sample Code	**Yarn Tenacity (N/tex)**	**CV of Yarn Tenacity (%)**	**Yarn Breaking Elongation (%)**	**CV of Yarn Breaking Elongation (%)**
A1	3.22	15.0	2.30	22.0
A2	4.32	15.0	1.75	11.6
A3	4.93	12.3	1.47	7.87
B1	6.61	16.0	1.47	10.4
B2	5.71	16.4	1.50	12.0
B3	4.55	16.2	1.58	12.3
C1	6.58	14.0	2.14	12.0
C2	5.88	15.0	1.78	11.1
C3	4.73	15.5	2.01	11.0

These yarns were converted into fabric samples with two different weave designs, plain and twill (5/1). The physical and mechanical properties of the fabrics produced are given in Table 17 and Table 18 respectively.

Table 17: Physical Properties of Fabric

Sample	GSM of the Fabrics		Ends per Inch		Picks per Inch	
	Plain	Twill	Plain	Twill	Plain	Twill
A1	705	967	15	15	8	12
A2	986	986	14	15	6	9
A3	832	1108	13	12	4	9
B1	822	959	15	15	8	12
B2	567	672	13	13	5	11
B3	822	1105	13	11	5	9
C1	738	823	15	15	7	13
C2	906	916	15	15	6	11
C3	866	1103	13	12	5	9

Table 18: Mechanical Properties of Fabrics

Sample	Plain Weave				Twill Weave			
	Load at break (kgf)		Extension at break (mm)		Load at break (kgf)		Extension at break (mm)	
	Warp direction	Weft direction	Warp direction	Weft direction	Warp direction	Weft direction	Warp direction	Weft direction
A1	103.7	51.2	16.0	6.50	104.6	92.3	14.8	10.7
A2	116.1	43.5	14.6	5.30	92.4	70.5	15.0	10.7
A3	100.6	25.2	19.7	2.90	110.0	50.6	11.9	7.6
B1	115.9	60.8	16.0	8.85	110.4	89.4	11.9	11.7
B2	63.3	41.5	16.9	4.95	81.3	90.0	12.7	13.8
B3	85.1	31.9	17.6	4.15	90.5	51.9	20.2	9.0
C1	104.5	52.1	19.2	7.40	93.6	68.5	13.0	10.8
C2	116.6	38.1	14.4	8.05	72.5	61.2	24.4	21.1
C3	97.5	23.1	17.2	4.60	99.5	45.4	13.9	10.7

Table 19: Comparison of the breaking load of fabrics

Sample	Normalised Load at break (kgf/GSM)			
	Plain weave		Twill weave	
	Warp Direction	Weft Direction	Warp Direction	Weft Direction
A1	0.1471	0.0726	0.1081	0.0954
A2	0.1178	0.0441	0.0937	0.0715
A3	0.1209	0.0302	0.0993	0.0456
B1	0.1410	0.0739	0.1151	0.0932
B2	0.1116	0.0731	0.1195	0.1339
B3	0.1035	0.0388	0.0819	0.0469
C1	0.1417	0.0706	0.1137	0.0831
C2	0.1287	0.0420	0.0791	0.0668
C3	0.1126	0.0267	0.0992	0.0453

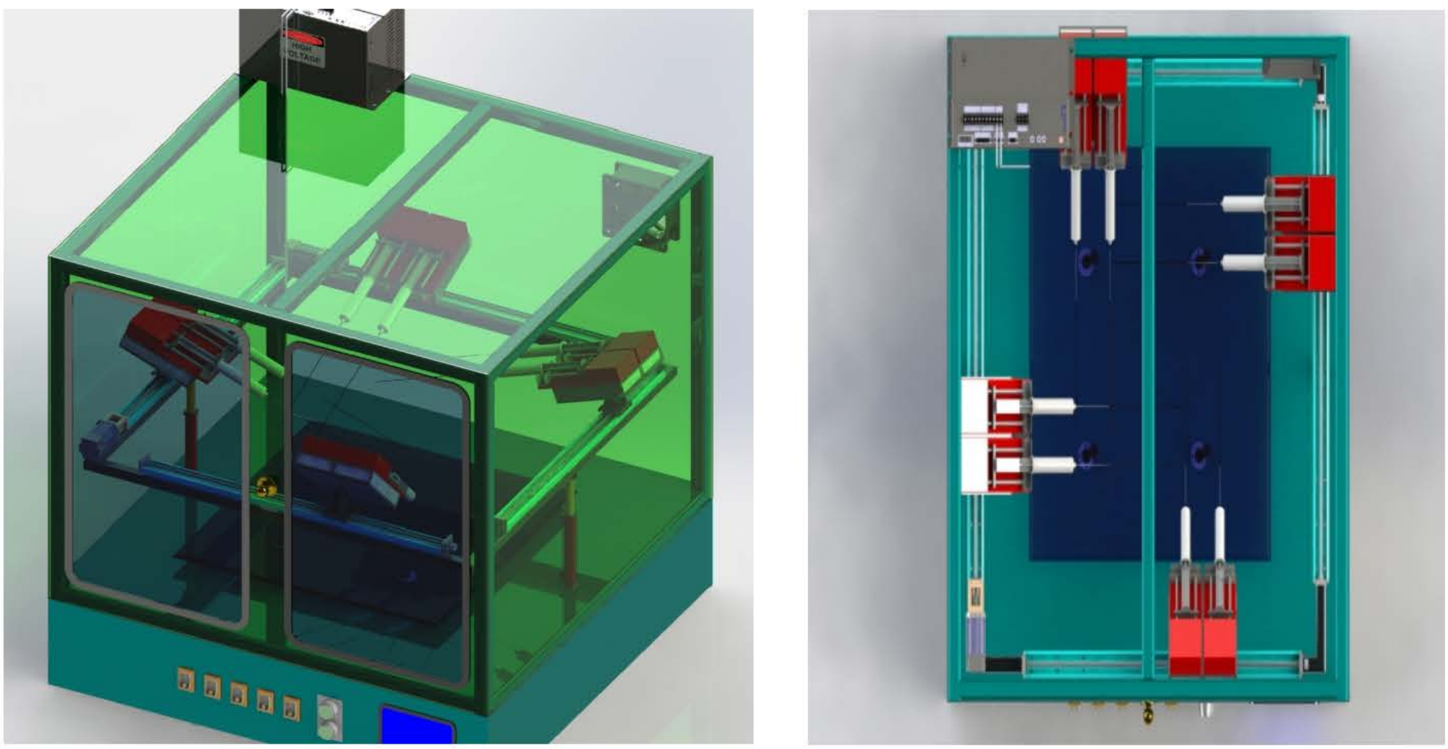
The following observations were made:

- It was found that the normalised tensile strength is higher for the plain woven fabric compared to the twill (5/1) woven construction.
- The core yarn tpi within the chosen range had little effect on the DREF fabric strength characteristics.
- With the increase in sheath proportion in the DREF yarn, the fabric strength was found to reduce in all the tpi range, and for both the weaves.

Biodegradable Electrospun Fibre Mat for Use in Packaging of Fresh Perishable Agricultural Material (NFBSFARA)

Designing and Fabrication of multiphase electro spinning setup

An indigenous and user friendly multi-phase (axial) electro spinning setup has been designed and its fabrication is under progress. The new device will enhance the electrical field distribution and enable parallel solution feeding to all the needles. The customized design has the adjustments and the automations like multi-axial arrangement with different nozzle geometry, angle change, automated linear motion stage and multiple parallel needles to increase the production. The set up can be used for different polymers and solvents. The machine has three operating modes: Auto, manual and independent. Auto and manual mode are controlled from the machine display, and the independent mode is by the individual control switch. Production of a uniform electrospun mat is one of the major bottleneck in the electro spinning process. The developed setup will enhance the uniformity of the mat production with linear and angular movement. The motion and speed can be controlled through a display (Fig. 19).



3D view of the machine

Fig. 19: Laboratory Fabricated Electrospinning setup

Optimization of process parameters to produce biodegradable nonwoven fibre mat of required density and porosity

To optimize the process as well as the machine parameters, a suitable Box and Behnken design was used for conducting the experimental trials and a total of 26 runs were carried out. The parameters considered for the optimization process were flow rate, distance, duration and voltage. The fiber morphology and the mean fibre diameter of the prepared CA was investigated by the Scanning Electron Microscopy, and based on the image analysis software, the porosity and density of the fibre mat were studied (Fig. 20). The porosity was found to be 40.4 as 47.4% at flow rate of 0.03 and 0.02 ml/min, respectively.

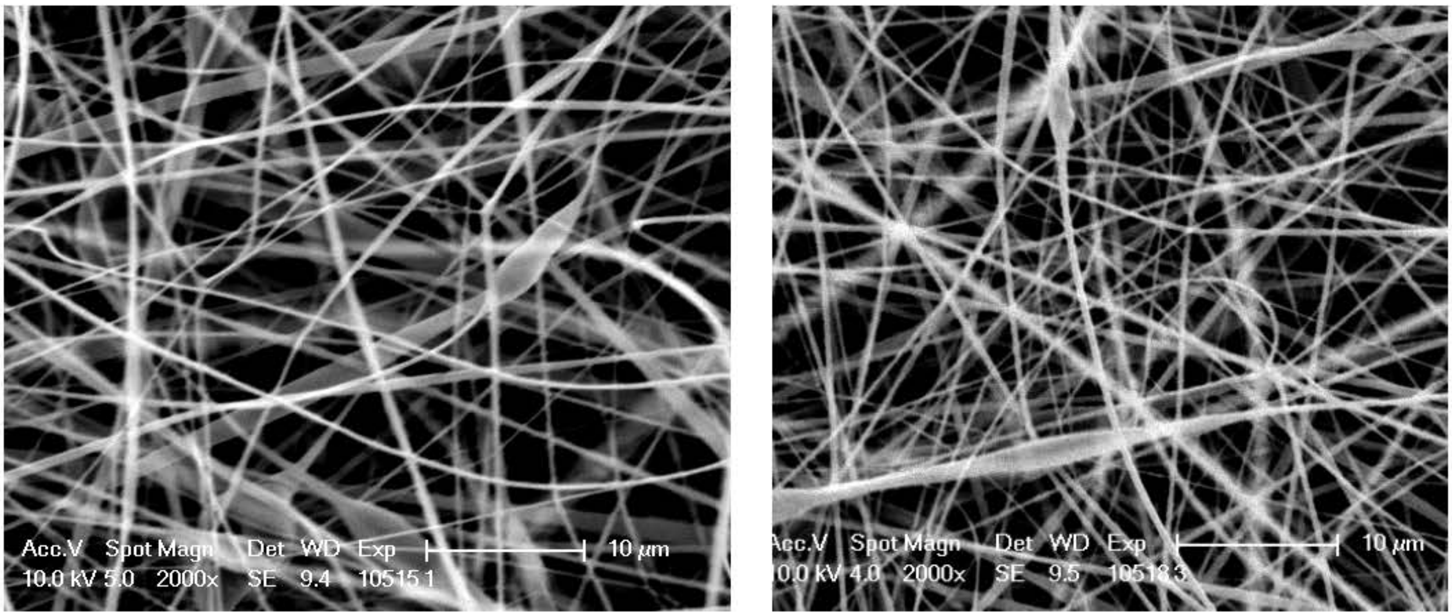
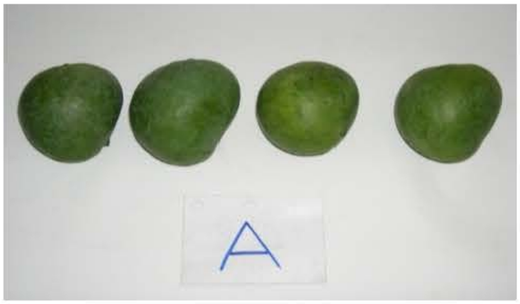


Fig. 20: SEM images of electrospun nanofibers with a) flow rate of 0.03 ml/min, b) flow rate of 0.02 ml/min

Analysis of volatile gas profile of mangoes during ripening

The volatile gas profile during ripening of three different varieties of mangoes (Fig. 21) (Mulgoa, Banganapalli and Imam pasanth) were analysed. Fully matured green mangoes, having uniformity in size and shape, each weighing about 350 to 400 grams and free from any defects qualitatively, were studied. Each fruit variety was kept separately as well as collectively in a closed desiccators for 20 days. The volatile gases were thus collected and analyzed using Gas Chromatography coupled with Mass Spectrophotometer (GC-MS).



A. Malgoa

B. Bangana palli

C. Imam Pasanth

Fig. 21: Different varieties of Mangoes and testing of volatile gas profile

The chromatograms of the volatile gases showed the major peaks at 1.87, 9.75, 10.87 and 11.77 retention times (RT). These peaks were found to match with the retention time peaks of ethyl alcohol, pinene or ocimene, terpinolene and 3-carene molecules.

To confirm the presence of these volatile organic compounds, the mass spectra using single ion recording was carried out and the m/z values and fragmentation patterns were matched with these compounds. The mass spectrum of terpinolene with fragmentation pattern is given below.

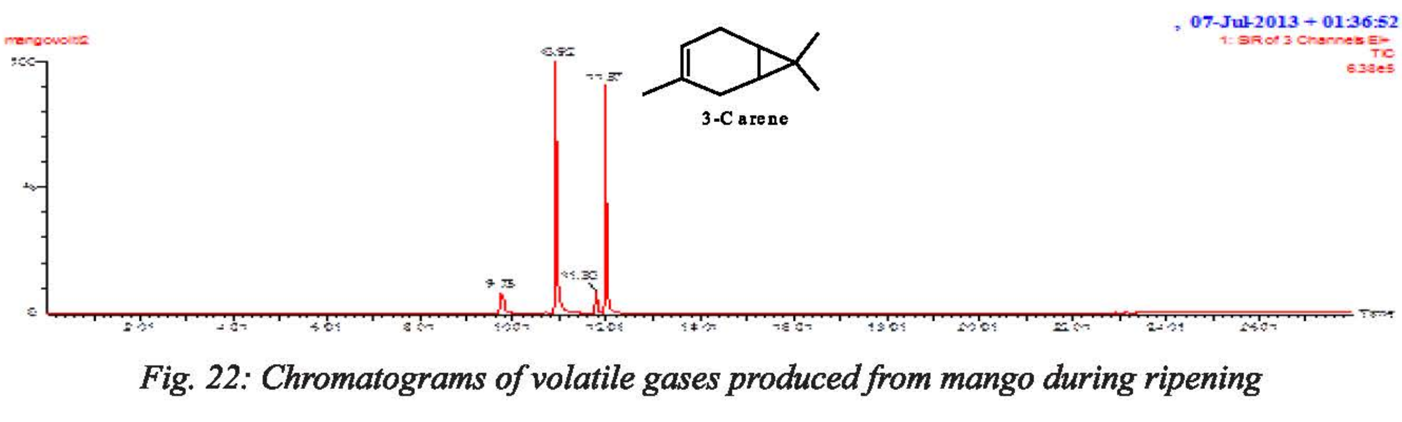


Fig. 22: Chromatograms of volatile gases produced from mango during ripening

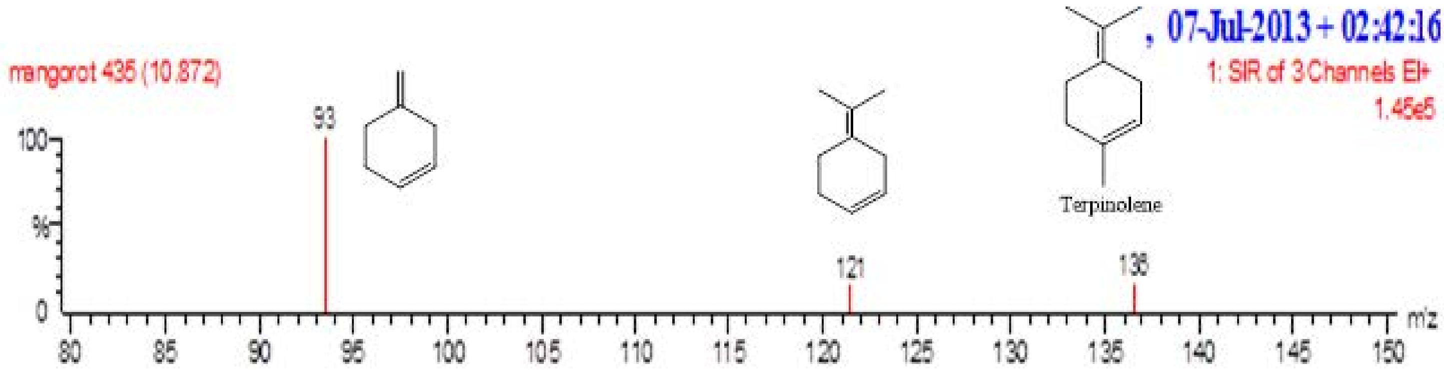


Fig. 23: Mass spectra of volatile compound (terpinolene) showed peak at 10.92 RT

Similarly, the mass spectra of pinene, ocimene and carene were also recorded and studied. The fragmentation patterns were similar to that found in the literature. In summary, ethyl alcohol, pinene or ocimene, terpinolene and 3-carene are the major volatile compounds produced during the ripening of mango fruit.

CORE AREA III: CHARACTERISATION – COTTON AND OTHER NATURAL FIBRES, YARNS AND TEXTILES

All India Coordinated Cotton Improvement Project (AICCIP)

National Trials

- In the initial evaluation trial of *G. hirsutum* under irrigated condition, the entries L-804, BS 1, SCS 1214, Bihani 301, CCH 13-1 and HS 292 in the North, the entries BS 1, TCH 1742, L-804, CPD-1302 and L-1011 in the Central Zone and BS 1, L-1011, L 804, TCH 1742 and TCH 1777 in the South Zone recorded the better result in terms of fibre quality. The entries L-804 and BS 1 have the best fibre quality in all the three zones.
- Under rainfed situations, in the initial evaluation trial of *G. hirsutum*, CSH 1115 is the best in Central Zone as well as in the South Zone.
- RHH 1015 found to give the maximum fibre quality in the Preliminary Hybrid trials of Intra hirsutum hybrids in all the three zones under irrigated conditions.
- DHH 1352 is the best entry in terms of fibre quality among the North zone entries under rainfed conditions and ARBHH 1351, in case of South zone.

- In case of compact genotypes, G Cot 100 and SCS 1206 are the top two entries in North, Central and South Zone under irrigated conditions. Under rainfed conditions, the best entries for North zone are SCS 1206 and DSC 1351 and for South Zone, NH 635 and CNH 123.
- In *G. barbadense* trials, DB 1301 and ARBB 1301 are the best entries in both the Central and the South zone.
- Interspecific hybrid RHB 1005 is the best hybrid in both the Central Zone and the South Zone.
- Among the *G. arboreum* cultures, ARBAS 1302 is the best in the North zone, ANGAS 1301 and ARBAS 1301, in the Central zone and DAS 1302 and ANGAS 1301 are the best in South zone.
- The zonal check is the best performing desi hybrids in the Central zone followed by RHAH 1040. GSGDH 223 and RHAH 1040 entries from North zone.
- GBhv 295 is the best performing entry in *G. herbaceum* trials of the Central zone followed by the zonal check and Gshv 274/09.

Central Zone trials

- GTHH 194 and RHH 0924 were found to have fibre quality better than the zonal check in coordinated hybrid trials under the irrigated conditions.
- In compact genotype preliminary varietal trial, all the four entries namely TCH 1705, LH 2298, ARBC 19, GTHV 04/13 performed better than the zonal check.
- Under rainfed conditions in Preliminary varietal trial, ADB 542 was the best performing entry.
- In coordinated varietal trails of *G. hirsutum* under rainfed condition, SCS 793 performed is the best and even better than the zonal check.
- All entries performed lower than the zonal check, except ARBC 64, which was *at par* with zonal check in case of compact geno type preliminary varietal trial.
- PA 760 was is the best performing entry in the coordinated varietal trial of *G.arboreum* cultures.
- AKDH 956 performed better than the zonal check hybrid in Coordinated hybrid trials under the rain fed condition.

South Zone

a) Irrigated conditions:

- TSH 0499, CCH 12-2, SCS 1001 and RAH 1065 of Preliminary varietal trials performed better than the zonal check.
- In the Coordinated varietal trial, all entries showed fibre quality lower than the zonal check.
- PHCH 270 is the best performer in the coordinated hybrid trials, and from better than the zonal check.
- In the preliminary varietal trial of compact genotype, CCH 12-6, GSHV 167 and LH 2298 performed better than the zonal check.
- All entries performed lower than the zonal check both in the preliminary varietal trial and the coordinated varietal trials of *G.barbadense* cultures.
- In the coordinated hybrid trial, GSHb 999 was the best performing entry.

b) Rainfed conditions:

- Among *G.hirsutum* cultures of the preliminary varietal trial, seven entries performed better than the zonal check.
- In the coordinated hybrid trial, all the entries performed lower than the zonal check.
- Five entries performed better than the zonal check in the preliminary varietal trial of compact genotypes and AKH 2006-2 was having the best fibre quality.
- DAS 385 was the best performing entry in the coordinated varietal trial of arboreum cultures.

In the reported season samples received for Full Spinning tests are given in Table 20.

Table 20: Samples received zone wise for full spinnings

Zone	Centre	No of samples
North zone	Sisra	1
	Faridkot	6
	Bhatinda	4
	Sriganganagar	2
	Hisar	1

Zone	Centre	No of samples
South zone	Dharwad	8
	Raichur	7
	Guntur	6
	Srivilliputtur	6
	Nandyal	8
Central zone	Akola	9
	Nanded	9
	Rahuri	7
	Bhawanipatna	3
	Talod	1
Total		**78**

From Faridkot centre, four samples were received and it was found that two cottons were spinnanble to 41 to 50s, and the remaining two cottons are unspinnable. The test results are given at Table 21, Table 22 & Table 23.

Table 21: Comparison between ICC made and HVI model

HVI Mode Store No. (CIRCOT)	**Entry Name**	**ICC Mode**				**HVI MODE**		
		2.5% SL (mm)	**UR (%)**	**Mic**	**Tenacity (g/tex)**	**UHML**	**Tenacity (g/tex)**	**UI**
140002	FHH 200	27.5	49	4.0	20.4	26.4	30.8	83
140003	LHH 144	26.8	48	3.7	22.3	27.4	32.8	82

Table 22: Yarn Test Results

Store No.	Yarn Count	CSP	U%	Neps/Km	CIRCOT Norm (CSP)
140002	40s	2176	17.2	1455	2208
	50s	1955	18.6	2028	2300
140003	40s	2096	18.6	2840	2208
	50s	1920	20.8	3897	2300

Table 23: Fibre Test Report

HVI Mode Store No. (CIRCOT)	AICCIP Code No.	Entry Name	ICC Mode				HVI MODE		
			2.5% SL (mm)	UR (%)	Mic	Tenacity (g/tex)	UHML	Tenacity (g/tex)	UI
140007	--	LD 949	19.9	54	5.9	16.2	19.7	24.4	73
140008	--	FDK 124	20.4	52	6.4	17.0	20.1	27.2	75

- It can be inferred that FHH 200 cotton is spinnable to count 41s to 50s. However, this cotton has 5.2 g/tex of lower tenacity and 1.5 mm lower length than that required. Hence, the cotton has to be under spun to less than 41s Ne to get a good quality yarn.
- LHH 144 cotton is spinnable to count 41s to 50s. However, this cotton has 3.7 g/tex of lower tenacity than the required and the length is lower by 2.2 mm. Hence, this cotton has to be under-spun to less than 41s Ne to get a good quality yarn.
- LD 949 and FDK 124 cotton have micronaire values more than the maximum of 5.0 specified in CIRCOT norms, and the tenacity is lower than the minimum (20 g/tex). Hence, these cotton were unspinnable. These cottons may be promoted as absorbent cotton.

Evaluation of Quality of Standard Varieties of Indian Cotton

Twenty – nine cotton samples were received and fibre quality evaluation of all the samples have been completed. The results are presented in Table 24.

Table 24: Standard Cotton Fibre Test Results

Store No	Variety	2.5% SL	UR	MIC	Strength (g/tex)
131007	JK-4J	24.7	49	3.1	20.4
131009	JK-5	24.4	51	4.1	21.2
131195	H-1117	24.6	51	3.9	22.9
131196	H-1226	24.6	52	4.8	21.2
131197	H-1098	24.6	50	4.2	20.8
131198	H-1236	27.7	48	4.7	21.3
131199	H-1300	27	49	3.9	23.1
131200	HD-123	26.2	57	4.1	21.9
131201	HD-324	17.6	54	6.4	15.1
131202	HD-432	20.9	52	6.7	18.3
131203	AKA-5	22.9	51	6	19.1
131204	AKA-7	25.8	50	4.6	22.3
131206	AKH-8401	25.1	51	4.1	22.9
131207	PKV-Rajat	28.6	49	4.4	24.3
131208	AKH-8828	24.1	51	3.9	19.9
131209	AKH-081	26.5	49	3.3	21
131210	BHY-286	26.1	51	3.1	22.4
131378	G.Cot-15	26.4	50	2.9	25.5

Store No	Variety	2.5% SL	UR	MIC	Strength (g/tex)
131379	G.Cot-19	25.5	51	5.2	21.3
132347	V797	25	51	5.6	19.9
132348	G.Cot 13	25.3	52	4.8	20.4
132349	G.Cot 21	25.3	48	5.6	19.7
132350	ADC-1	26	50	5.9	20.2
132351	G.Cot.23	24.4	51	4.6	18.8
132352	GN.Cot-25	24	50	5.7	18.3
132353	G.Cot-16	24.8	49	5.4	21.4
132354	G.Cot M DH-11	26.3	51	3.8	23.5
132355	G.Cot-10	25.7	50	6.2	19.5
132356	G.Cot-20	26.9	51	4.9	18.4

A comparison was made between the fibre length and the micronaire values at the time of release of the variety and values noted in 2013, and the results are depicted in bar chart (Fig. 24 – 26).

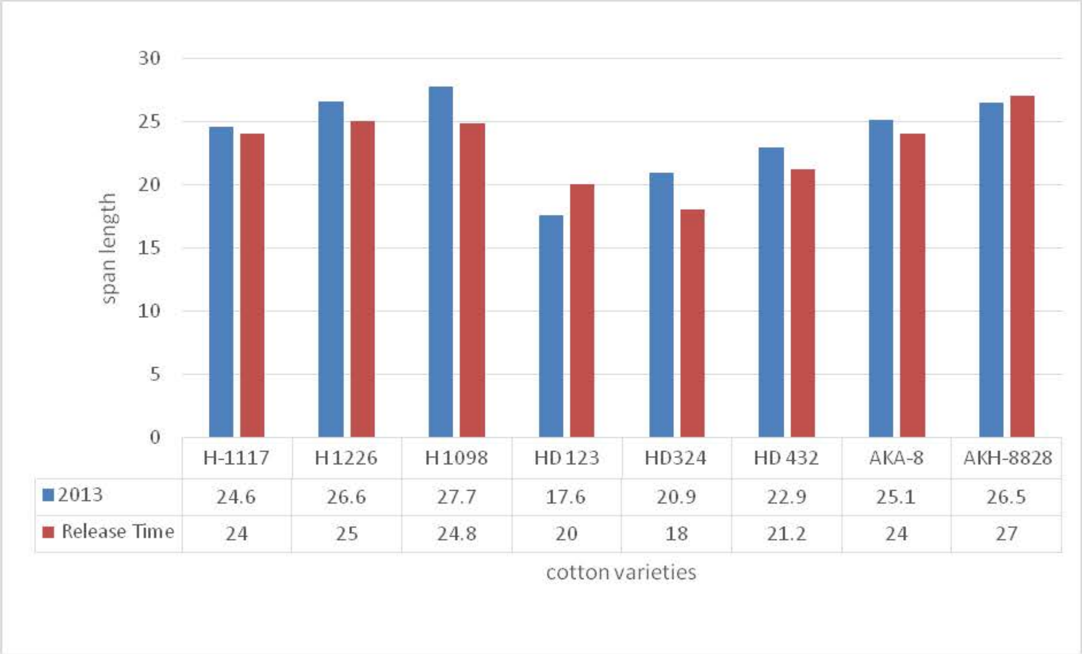
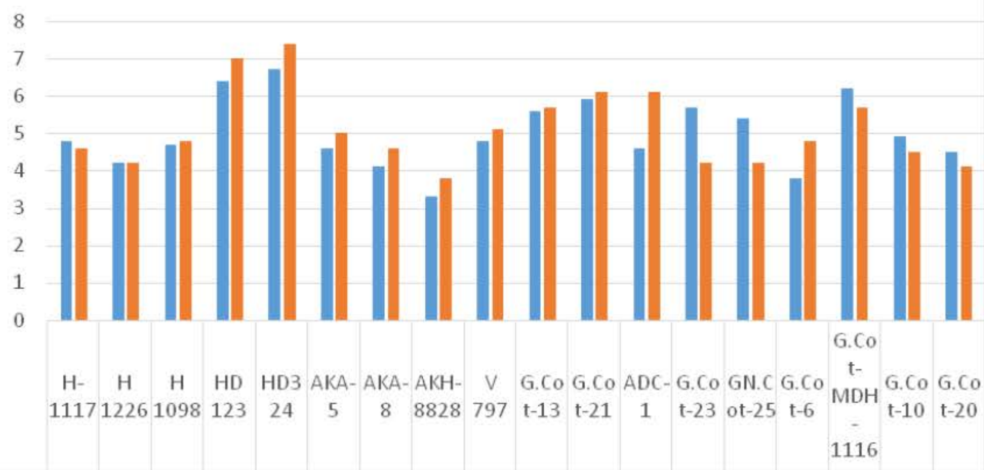


Fig. 24: 2.5% Span length of fibre

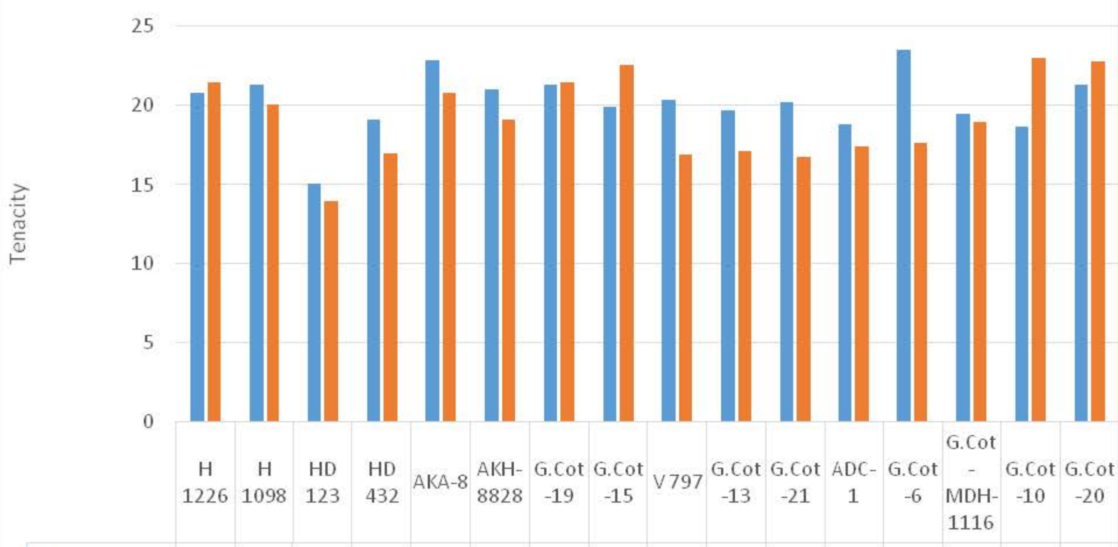
It may be noted that except for variety HD123, all the other varieties are maintaining its release time value.



	H-1117	H 1226	H 1098	HD 123	HD3 24	AKA-5	AKA-8	AKH-8828	V 797	G.Cot-13	G.Cot-21	ADC-1	G.Cot-23	GN.Cot-25	G.Cot-6	G.Cot-MDH-1116	G.Cot-10	G.Cot-20
2013	4.8	4.2	4.7	6.4	6.7	4.6	4.1	3.3	4.8	5.6	5.9	4.6	5.7	5.4	3.8	6.2	4.9	4.5
Release Time	4.6	4.2	4.8	7	7.4	5	4.6	3.8	5.1	5.7	6.1	6.1	4.2	4.2	4.8	5.7	4.5	4.1

Fig. 25: Micronaire value of fibre

In majority of the cases, the micronaire value has marginally increased compared to release time values.



	H 1226	H 1098	HD 123	HD 432	AKA-8	AKH-8828	G.Cot-19	G.Cot-15	V 797	G.Cot-13	G.Cot-21	ADC-1	G.Cot-6	G.Cot-MDH-1116	G.Cot-10	G.Cot-20
2013	20.8	21.3	15.1	19.1	22.9	21	21.3	19.9	20.4	19.7	20.2	18.8	23.5	19.5	18.7	21.3
Release Time	21.5	20.1	14	17	20.8	19.1	21.5	22.6	16.9	17.1	16.8	17.4	17.65	19	23	22.8

Fig 26: Fibre Tenacity

In general, the tenacity of fibres were found to improve in the reported year compared to that reported during their release time.

Development of Objective Fabric Handle Model for Indian Market

Shirting fabrics numbering 67 were studied for low stress mechanical properties, and primary and total handle values. The total handle value of shirting was found in the range of 0.90 to 4.07 (Table 25).

The fabrics were categorized into four groups (Table 26) based on the total handle values as Low (0 to 1.5), Medium (1.5 to 3.0), High (3.0 to 4.5) and Very high (≥4.5). Among the fabrics studied, 72% of the fabrics were found to be in the Medium handle category, and only 22% of the fabrics was found to be in the High handle category. There was no fabric found with very high handle value.

Table 25: Primary and Total Handle Values

Fabric Handle Parameters	N	Minimum	Maximum
Koshi	67	2.22	13.8
Shari	67	0.41	12.1
Fukurami	67	-1.0	8.0
Hari	67	1.47	13.5
THV_S	67	0.90	4.07
THV_W	67	0.68	4.63
Valid N (listwise)	67		

Table 26: Fabrics Classified According to THV Values

THV CATEGORY		Koshi	Shari	Fukurami	Hari	THV_S
Low	N	4	4	4	4	4
	Minimum	6.71	0.41	5.70	6.33	0.90
	Maximum	8.95	2.43	7.90	8.97	1.44
	Mean	7.70	1.43	6.69	7.28	1.21
	% of Total N	6.0%	6.0%	6.0%	6.0%	6.0%
	Range	2.24	2.02	2.20	2.64	0.54

THV CATEGORY		Koshi	Shari	Fukurami	Hari	THV_S
Medium	N	48	48	48	48	48
	Minimum	2.22	0.69	-1.0	1.47	1.52
	Maximum	13.8	12.1	8.0	13.5	2.96
	Mean	7.28	4.76	5.26	6.76	2.32
	% of Total N	71.6%	71.6%	71.6%	71.6%	71.6%
	Range	11.6	11.4	9.0	12.0	1.44
High	N	15	15	15	15	15
	Minimum	3.44	2.52	1.80	2.93	3.05
	Maximum	9.97	9.04	5.40	10.0	4.07
	Mean	6.87	7.49	3.42	6.53	3.52
	% of Total N	22.4%	22.4%	22.4%	22.4%	22.4%
	Range	6.53	6.52	3.50	7.10	1.02
Total	N	67	67	67	67	67
	Minimum	2.22	0.41	-1.0	1.47	.90
	Maximum	13.81	12.09	8.0	13.45	4.07
	Mean	7.24	5.17	4.94	6.74	2.52
	% of Total N	100.0%	100.0%	100.0%	100.0%	100.0%
	Range	11.59	11.68	9.0	11.98	3.17

The bivariate correlation coefficient was calculated between PHV and THV values (Table 27). It can be seen from the table that Koshi (stiffness) is highly correlated with Hari (anti-drape stiffness ($r=0.941$) and hence, any one of the parameter may be sufficient to calculate the value of THV. The total handle value of shirting meant for summer wear and winter wear are negatively correlated at r value of -0.86 and is statistically significant.

Table 27: Bivariate Correlation between PHV and THV

Statistical Parameters		Koshi	Shari	Fukurami	Hari	THV_S	THV_W
Koshi	Pearson Correlation	1	.621**	-.736**	.941**	-.111	-.315**
	Sig. (2-tailed)		.000	.000	.000	.369	.009
	N	67	67	67	67	67	67
Shari	Pearson Correlation	.621**	1	-.856**	.583**	.653**	-.863**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	67	67	67	67	67	67
Fukurami	Pearson Correlation	-.736**	-.856**	1	-.777**	-.527**	.831**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	67	67	67	67	67	67
Hari	Pearson Correlation	.941**	.583**	-.777**	1	-.064	-.321**
	Sig. (2-tailed)	.000	.000	.000		.609	.008
	N	67	67	67	67	67	67
THV_S	Pearson Correlation	-.111	.653**	-.527**	-.064	1	-.864**
	Sig. (2-tailed)	.369	.000	.000	.609		.000
	N	67	67	67	67	67	67
THV_W	Pearson Correlation	-.315**	-.863**	.831**	-.321**	-.864**	1
	Sig. (2-tailed)	.009	.000	.000	.008	.000	
	N	67	67	67	67	67	67

** Correlation is significant at the 0.01 level (2-tailed).

Table 28 gives the THV values according to the blend composition and it can be seen that there is no direct relationship between fibre composition of the fabric and its tactile handle values. It confirms that fabric handle is mostly influenced by fabric construction and its finishing processes.

Table 28: Blend Composition and Fabric Handle Values

Blend	THV (Min)	THV (Max)	No of Samples	% of N
Cotton	0.90	4.07	22	32.8
Cotton/Linen	3.82	3.82	1	1.5
Cotton/Viscose	2.75	2.75	1	1.5
Linen	2.45	3.98	4	6.0
Linen/Cotton	3.76	3.76	1	1.5
Poly/Cotton	2.02	3.79	18	26.9
Polyester	2.28	3.28	6	9.0
Poly/Viscose	1.52	3.15	13	19.4
Ramie/Linen	3.16	3.16	1	1.5

All the 66 fabrics were divided into three groups in order of feeling intensity as strong, medium and weak. Three swatches per primary handle value was selected as illustrative fabric as given in table 29.

Table 29: Proposed Hand Values of Illustrative Fabrics

Primary Handle	Strong	Medium	Low
Koshi (stiffness)	13.8	7.2	2.2
Numeri (smoothness)	8.2	5.7	2.4
Fukurami (fullness)	8.0	4.9	-1.0
Shari (crispness)	12.0	5.1	0.4

A Value Chain on Utilization of Banana Pseudostem for Fibre and other Value added Products

Modifications have been carried out on Ring Spinning, Gill Drawing and cutting machines. In the lab model banana pesudostem ring frame, the drafting system has been modified to 4/4 from 3/3 with a draft zone of 31 cm to make it suitable for banana fibre spinning. Trials were undertaken to spin 590 tex (1.0 Ne) count and the machine was running without any end break.

I) **Preparation of Utility Hand Bags from Banana Yarn:** Banana fibre/jute mixed union fabric was prepared at Gloster Jute Mills, Kolkata. This Fabric has been used for making utility hand bags (800 Nos). The fabric was prepared with following specifications:

a.) Warp: Jute yarn of 20 pounds b.) Weft: Banana yarn of 17 pounds c.) Ends/dm: 42 d.) Picks/dm: 44 e.) Loom speed : 142 rpm (0.3 metre/minute) f.) Fabric width 0.55 metre g.) Weave plain h.) 60% banana and 40% jute (weft 100% banana and warp 100% jute) i.) Bag size – 17 x 14 inch

ii) **Preparation of Composite from Non-woven Felt:** An attempt was made to prepare a composite from banana non-woven felts at CIRCOT without using any binder. A non-woven fabric of 450 gsm was compressed with different combination of mechanical parameters and 8 types of sheets were prepared. These sheets were tested for its strength properties. On the basis of these findings, an experiment was conducted for preparation of banana fibre composite using Acrodur DS 3515 as a binder at BASF Chemical Ltd., Mumbai. For the purpose, a non-woven felt of 500 gsm, prepared at Gloster Jute Mills, Kolkata, was used. The proportion of raw material to binder was 75:25 and binder density, 450 g/L. The pressing parameters were 200^{0}C temperature and 150 bar pressure. The two semi-finished products were compressed in the longitudinal direction of a planar plate. Sample 1 and Sample 2 are made from banana pseudostem and hemp/kenaf reinforcements, respectively. The prepared semi-finished composite sheets were tested for various parameters and results are presented in Table 30.

Table 30: Properties of Composite Sheets

Parameters		Sample 1	Sample 2
Plate Thickness	(mm)	1.43	1.39
Density	(g/cm^3)	0.72	0.85
Water Absorption after 2 hr	(%)	43	26
Water Absorption after 24 hr	(%)	66	47
Swelling after 2 hr	(%)	19	14
Swelling after 24 hr	(%)	22	18
Impact ISO 179-1/1fU	(kJ/m^2)	3	4
Bending E-module W2 14125	(N/mm^2)	3481	3360
Flexural Strength	(N/mm^2)	37	33

It was found that the composites made from banana pseudostem fibre has properties similar to hemp and kenaf composites.

iii) **Softening Trials of Banana Fibres:** The experiments were conducted on mechanically extracted banana fibres received from Navsari and Vivekananda Institute of Biotechnology (VIB), Nimpith, Kolkata. These fibres were scoured and bleached as follows:

A. Scouring (1% alkali)

B. Scouring (1% alkali) + Bleaching with H_2O_2 (3%)

Both the raw banana fibres (Control) and fibres with above specified treatments were studied for the tensile characteristics by Instron (Table 31).

Table 31: Tensile Characteristics of Treated Banana Fibres

Sample Code	Sample Details	Tex	Tenacity (g/tex)	Elongation (%)
A	Control	11.2	51.8	1.5
B	Scoured	9.2	43.0	1.5
N1	VIB Control	12.5	54.6	1.1
N2	VIB Scoured	6.8	32.2	1.0

The bending properties were studied using a Bending Tester (KES-FB2) and reported in Table 32.

Table 32: Bending Characteristics of Treated Banana Fibres

Sample Code	Sample Details	B (gf.cm^2/m)	2HB
A	Control	0.0685	0.141
B	Scoured	0.0242	0.046
N1	VIB Control	0.1529	0.256
N2	VIB Scoured	0.0242	0.051

The fibre becomes fine and flexible (e.g., reduction in bending rigidity) after scouring. However, there is a loss of strength after scouring. The bending characteristics were studied by using a Kawabata Evaluation system by a method developed at CIRCOT. It can be seen from Table 32, that the scoured samples show less Bending rigidity (B) and Hysteresis of bending moment (2HB). This indicates that banana fibre becomes fine due to the treatment and hence, there is a reduction in bending rigidity. However, there is a loss of strength after scouring. Optimization of scouring process is needed to improve the fibre fineness with minimal loss of strength.

CORE AREA IV: CHEMICAL AND BIOCHEMICAL PROCESSING AND BIOMASS AND BY-PRODUCT UTILISATION

Chemical and Biochemical Processing

Use of Plant Extracts for Dyeing and Imparting Ultraviolet Protective and Antibacterial Finishing of Cotton Textiles

Aqueous extracts of Helu (Meyna laxiflora), Shewara *(Wendlandia thyrsiodea), Ranmodi (Eupatorium repandum)* and Jambhul *(Syzygium cumini)* leaves were applied to cotton fabrics mordanted with tannic acid and alum using two methods. The treated fabrics were evaluated for colour parameters and UV protective performance. The fabrics mordanted with modified procedure showed significantly higher colour strength values. All dyed fabrics showed excellent UV protection (UPF 50+), but fabrics mordanted using the modified procedure had the higher numerical UPF values.

Harda and pomegranate rind (cv.Ganesh) extracts had shown good antibacterial activity against both the gram negative and the gram positive bacteria. These were applied to cotton fabric without using any mordant for fixation. Fabics thus treated showed excellent UV protection (50+ UPF) and antibacterial activity (100%) against *S. aureus*. Harda treated fabric showed about 95% antibacterial activity against *K. pneumoniae* also, but this activity was considerably reduced upon washing the fabrics with ISO-1 test procedure. The UV protective property of washed fabrics also got reduced as UPF decreased to 50 for Harda, and 40 for Pomegranate rind. Pomegranate rind (cv. Bhagwa and Ganesh) treated samples which were subsequently treated with alum showed very good retention of colour and UV protective properties upon washing with the ISO-2 test procedure indicating a good wash durability, but did not show much antibacterial activity.

Improving interfacial interaction of Nanocellulose with Commodity Polymers to Enhance their Performance

Nanocellulose (NC) is known for its unique potential as a reinforcing material in composite preparation due to its high stiffness/strength, biodegradability, chemical stability, and ability to form superstructures. A homogeneous dispersion of nanocellulose in commodity polymer matrix like polyethylene is required for obtaining a well-defined mechanical properties and consistent performance of the final composite, because the aggregation of nanocellulose has a detrimental impact on its tensile strength as it acts as a stress concentrator. Nanocellulose, as such is incompatible with hydrophobic polyethylene due to its hydrophilic nature, and leads to aggregation. In order to achieve the homogeneous dispersion of nanocellulose as well as to improve the interfacial interaction with polyethylene matrix, the hydrophilic surface of nanocellulose was changed into hydrophobic through a chemical reaction. Nanocellulose was heterogeneously reacted with pentafluorobenzoyl chloride (PFBC) at different reaction times (1, 3, 5, 8, 10, 15 and 20 h) and temperatures (30, 50, 65 and 85°C) to study the effect on the surface properties of the modified nanocellulose (Fig. 27).

The success of the reactions, as well as their progress was clearly confirmed by FTIR analysis, mainly on the basis of the appearance of a new carbonyl band at 1740 cm^{-1} (Fig. 28).

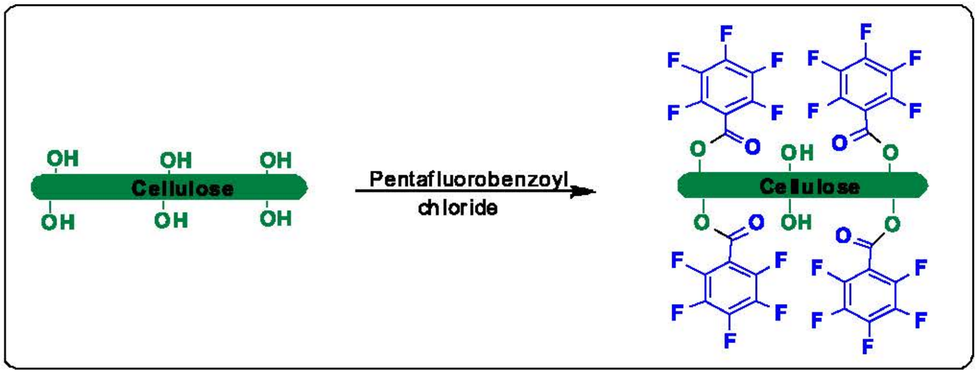


Fig. 27: Pentafluorobenzoylation of Nanocellulose

Additionally, the occurrence of new absorption in the range of 1000-1500 cm^{-1}, typically of C-F stretching modes and of the aromatic ring stretching vibrations, gave further confirmation of the presence of the fluorine containing aromatic moieties on cellulose. Trifluorobenzoyl chloride was also reacted with cellulose to achieve the hydrophobic surface of nanocellulose. The contact angle of the modified nanocellulose was measured with water droplet and considerable increase in hydrophobicity was demonstrated by increase in contact angle. The increase in contact angle is due to the presence of fluoro moiety on cellulose surface. In case of PFBC modified nanocellulose, the contact angle increased to 100° from 12°, as found with the control nanocellulose (Table 33).

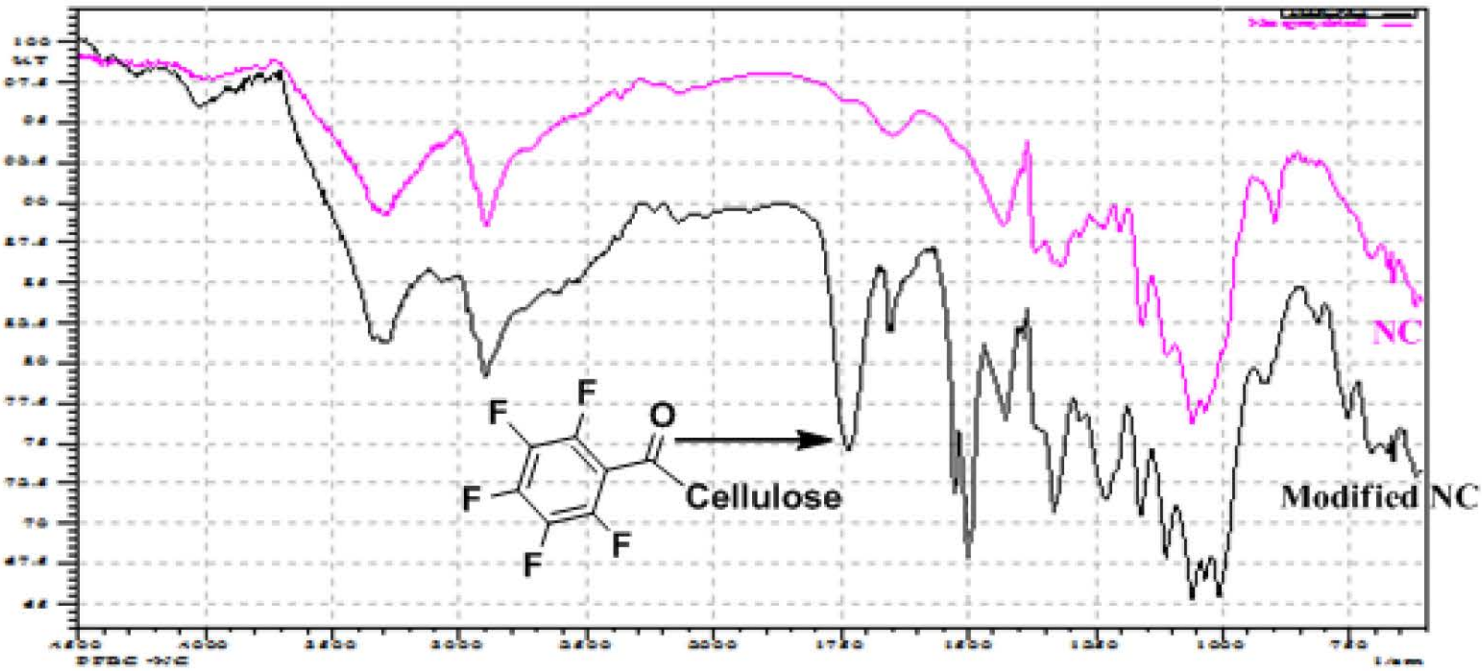


Fig. 28: IR Spectra of Control and PFBC Modified Nanocellulose

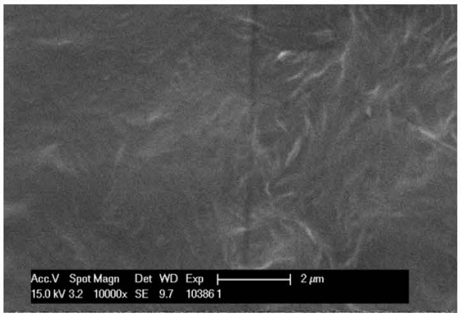
The hydrolytic stability of nanocellulose modified with pentafluorobenzoyl chloride and trifluorobenzoyl chloride was studied at room temperature in neutral, acidic (pH 4) and alkaline (pH 9) medium. The PFBC modified nanocellulose was found to be very stable at neutral and acidic pH, whereas at alkaline (pH 9) medium, a slight decrease in IR band strength of carbonyl group of ester that indicated the partial hydrolysis was noted. Nanocellulose modified with trifluorobenzoyl chloride was found to be sensitive to water and hydrolyzed in few minutes.

Table 33: Contact Angle of Nanocellulose

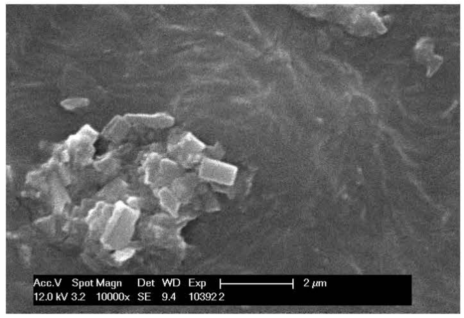
S. No.	Sample	Contact Angle (degree)
1	Control NC	12
2	PFBC modified NC	100
3	TFBC modified NC	90
4	PE	66

Besides, commercially available fluorocarbon (FC) and silicone were also used to modify nanocellulose. The various concentrations of these chemicals were used to find out the optimum quantity required to convert hydrophilic surface of nanocellulose into hydrophobic for better dispersion in nonpolar organic solvent (toluene) and 6% and 8% (w/w) concentrations of fluorocarbon and silicone were found to be the optimum to modify the surface of nanocellulose respectively. The modified cellulose nanocrystals suspended in water were phase transferred to organic solvent for preparation of nanocellulose-polyethylene composite films by solvent casting method. The thermal stability of the modified nanocellulose was carried out and found to be better than the control nanocellulose.

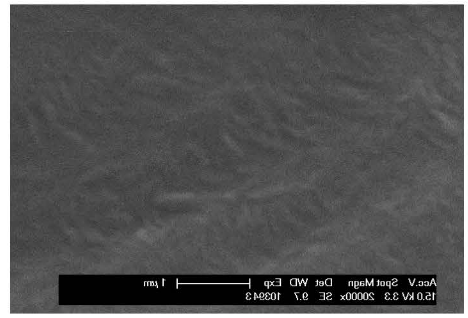
Composite films were prepared by solvent-casting method using high density and linear low density polyethylene as the matrix polymer and nanocellulose as the reinforcing material. Different concentrations (5, 7 and 9%) of modified and unmodified nanocellulose were dispersed in toluene under ultrasonication for few minutes, and added in the fixed quantity under constant stirring until complete homogenization. Finally, the solution was casted into a hydrophilic dish. After the solvent was evaporated at ambient conditions the film was coated uniformly. The dispersion of nanocellulose into polymer matrix was studied by a Scanning Electron Microscope (SEM). The modified nanocellulose, particularly the PFBC modified NC showed complete homogeneous dispersion in the polymer matrix, whereas unmodified NC was found incompatible with the matrix forming aggregates (Fig. 29). When loaded with higher amount of unmodified nanocellulose (7 and 9%) in hydrophobic matrix, it was found extremely difficult to process for composite formation.



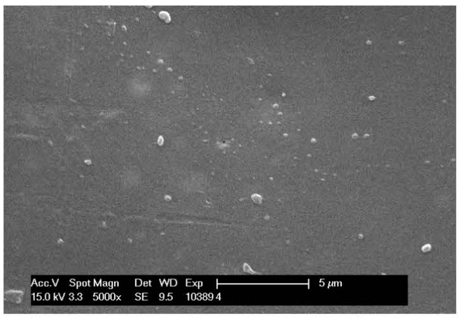
PE film



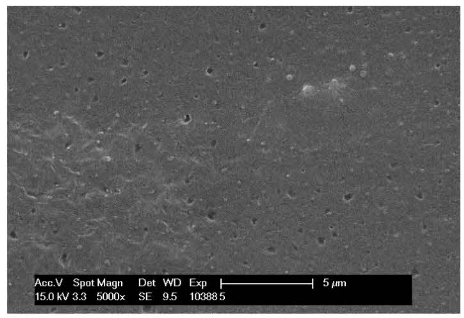
NC-PE film



PFBC modified NC-PE Film



FC Modified NC-PE Film



Silicone Modified NC-PE Film

Fig. 29: Scanning Electron Micrographs of Composite Films

To establish the improvement in tensile strength of nanocomposite films, the mechanical properties were evaluated and results are given in table 34. It can be seen that all the modified nanocellulose reinforced PE films showed significant improvement in the tensile strength. However, pentafluorobenzoyl chloride modified nanocellulose reinforced PE film was found to be the strongest one.

Table 34: Mechanical Properties of NC-PE Composite Films

S.No.	Composite Film	Load at Break (Standard) (gf)	Maximum Load (gf)	Extension at Break Standard (mm)	Extension at Maximum Load (mm)
1	PE	670	918	26.6	11.6
2	5% NC-PE	972	99	4.50	4.30
3	5% PFBC modified NC-PE	1393	1399	7.10	6.90
4	5% FC modified NC-PE	1247	1270	10.3	9.30
5	5% Silicone modified NC-PE	1066	1137.8	14.0	11.3

The water vapour transmission rate (WVTR) of the composite films was also evaluated and about 20% reduction was found in case of the modified NC-PE composite films in comparison to the pure and unmodified NC-PE films.

Conversion of Hydrophilic Nanocellulose into Hydrophobic through Silanization Reaction

A simple and highly efficient water based process has been developed for preparation of hydrophobic nanocelluose. Under the process, nanocellulose was reacted with silane at an ambient temperature in aqueous medium under acidic condition for 2 hours (Fig. 30). Then the product was washed and dried at 60°C for 6 hrs.

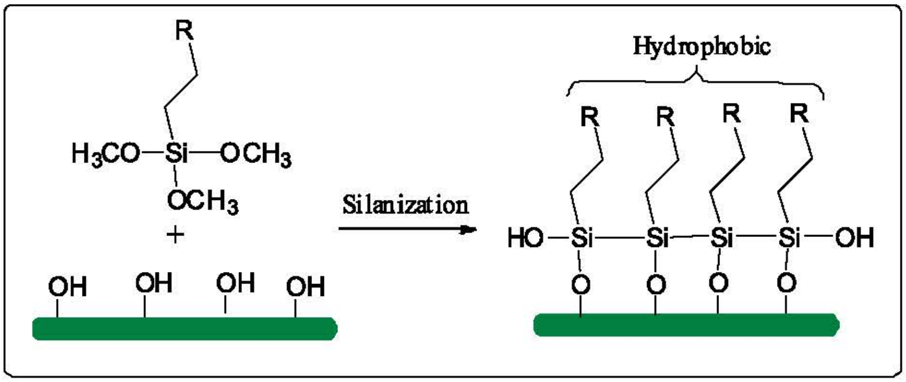


Fig. 30: Silanization of Nanocellulose

Fire Retardant Cotton Fabric using Plant Extract

Most of the chemicals used for fire retardant finishing of cotton textiles are synthetic compounds that are hazardous, non-ecofriendly, and non-biodegradable. In order to maintain the environment balance and human safety, use of herbal plant material has been investigated for development of fire retardant cellulosic fabric. In this regard an ecofriendly natural flame retardant finish has been prepared from the banana pseudostem sap for textile application. The extracted sap has been made alkaline and was applied to the premordanted, bleached and mercerized cotton fabrics. Tannic acid (5%) and Alum (10%) were used as mordant. The retardant properties of the control and the treated fabrics were analyzed in terms of Limiting oxygen index (LOI), horizontal and vertical flammability. The treated fabric showed good FR property, as its LOI significantly improved to 1.6 times of the untreated control fabric. In case of the Horizontal flammability, the treated sample showed no flame however sample burn with a propagation rate of 7.5 mm/min, which was almost 10 times lower than the control fabric. This prevented the sample from catching fire probably due to the fixation of nitrogenous and phosphatic substances and minerals present in pseudostem sap onto the fabric. The same can be verified the from the ATR and the EDAX analysis. The

SEM images of the treated fabric showed uniform coating throughout the network structure. The TG and the DSC analysis of treated and control samples showed that pyrolysis of the treated fabric started at a much lower temperature of ~240° (~ 320° for the control sample) and at a slower rate (Fig. 31). Hence, it can be deduced that the applied banana pseudostem sap reduced the combustion temperature of the cellulosic substrate and diluted the flammable volatiles by the generation of non oxidizable CO_2, H_2O at a comparatively low temperature (Fig. 32).

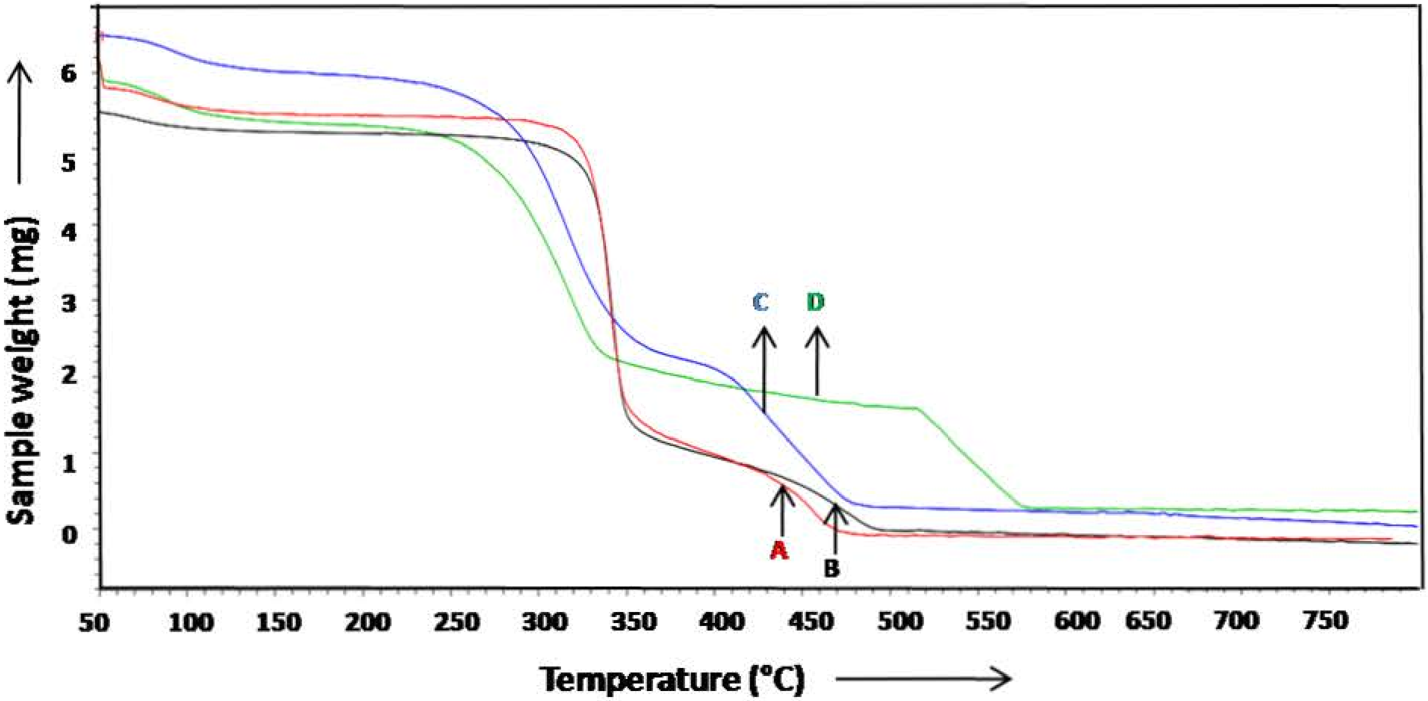


Fig 31: TG Curves of the Control (A), Mordanted (B), 1:1 BPS Treated (C) and 1: 0 BPS Treated (D) Cotton Fabrics

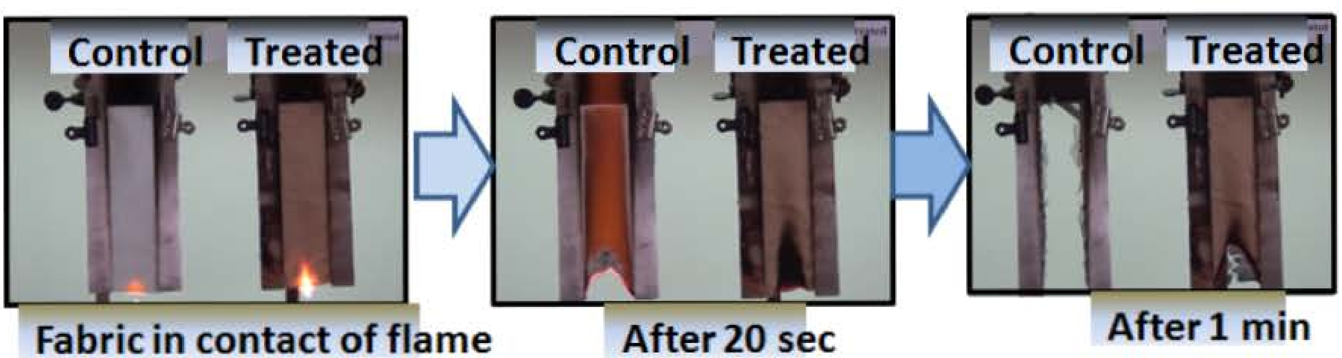


Fig 32: Burning Behaviour of Control and Treated Fabric Samples

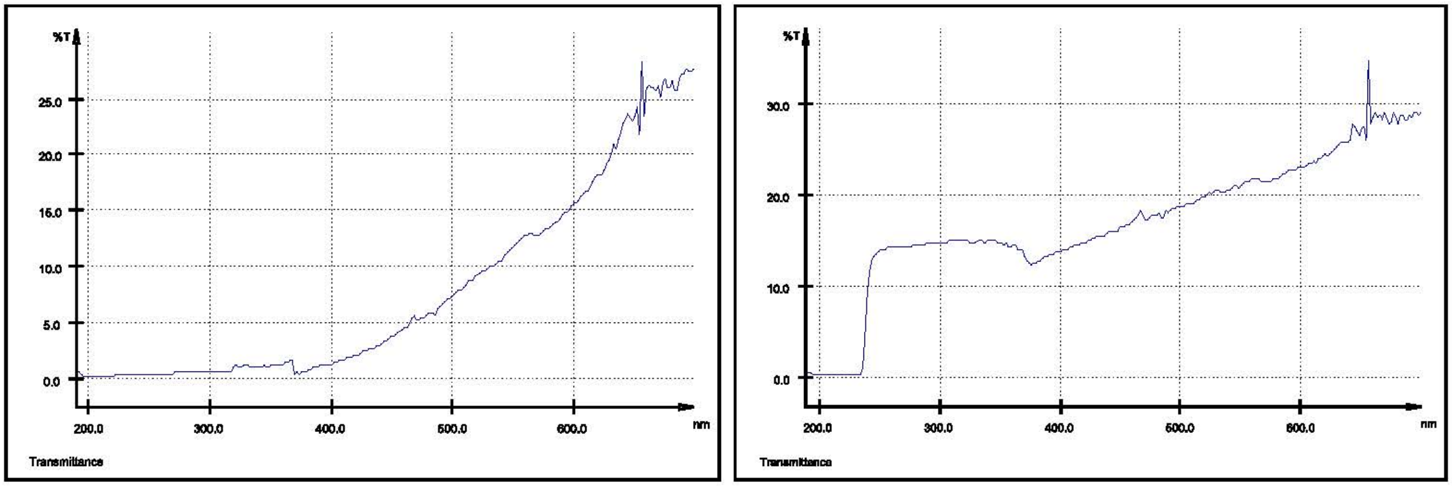
The durability of the flame retardancy to light and weather has been studied. It revealed that the treated fabric showed no change in oxygen index after 10 days of day light (10 am to 3 pm) exposure. However, the flame retardant property was not satisfactory after washing. The performance properties of the fabrics have been evaluated by the tensile strength. It can be observed that the process does not have much undue adverse effect on the strength properties of the treated cellulosic fabric, rather it improves the colour of the treated fabric. These results are very important as banana pseudostem sap is an inexpensive source of raw material.

Multifunctional Durable Finishing of Apparel Grade Cotton Fabrics with Nano ZnO

Nano zinc oxide is water insoluble, having no affinity towards cellulosic materials. It poses lot of problem for practical application to cotton textiles for achieving better functional properties. It was hypothesized that by increasing the swelling or pore size of the cotton fibre, more amount of zinc oxide can be entrapped into the cotton fibre. Recent research reports indicated that ionic liquids can be considered as greener solvents for the modification of cellulosic based materials. In the present study, it was attempted to modify the woven cotton fabric (100%, Plain, GSM 130) with 1-Butyl 3-methyl imidazolium chloride (BMIC), which is an ionic liquid. Application of nano zinc oxide on cotton textile was carried out using an exhaustion method at 1:15 MLR in an IR beaker dyeing machine. It was found out that the addition of 8-10 gpl ionic liquid increases the exhaustion of zinc oxide on cotton fabric, with optimum temperature and time being 80°C and 60 min. The UPF (Ultra Violet Protection Factor) of the treated textiles was found out using AATCC 183 method in a Labsphere equipment. Table 35 gives the improvement in UPF of the cotton textiles due to the addition of ionic liquid in the exhaustion bath of zinc oxide.

Table 35: Effect of Ionic Liquid with ZnO in the UPF of Cotton Textiles

S.No	ZnO Concentration (% OWM)	Ionic Liquid	UPF
1	0.5	-	11
2	0.5	10 gpl	20
3	2.0	-	22
4	2.0	10 gpl	32



0.5% ZnO *0.5% ZnO + 10 gpl ionic liquid*

Fig. 33: UV –Visible Transmission Spectrum of Residual Exhaustion Bath

To find out the concentration of zinc oxide in the exhausted bath, the transmission of the residual solution was determined in the UV visible spectrophotometer from 190 nm to 800 nm. It was interesting to note that transmission of ionic liquid based bath was higher than that obtained with zinc oxide alone. Higher UV transmission of ionic liquid based bath indicated that more amount of zinc oxide was taken up by the material. The same trend was observed in case of 2% zinc oxide application. Atomic Absorption Spectrophotometry (AAS) studies have also confirmed that more amount of zinc oxide was present in the fabric of ionic liquid based process. These results confirmed that the presence of ionic liquid in the exhaustion bath impacts positively to entrap more zinc oxide on cotton fabric.

In-situ Preparation of Nano Zinc Oxide on Cotton

Nano zinc oxide was synthesised on cotton fabric using a wet chemical method. Cotton fabric was used as the substrate for the in-situ synthesis. Methanolic solution of zinc nitatre and sodium hydroxide were used as precusers for the synthesis. Pad-dry–wash-cure-wash process was used for producing the nano particles in the cotton fibre structure. The SEM analysis revealed that fine zinc oxide particles were formed during the in-situ process. The diameter of the particles were found to be between 80-130 nm in the fabric. Also it was noticed that the particles adhered well on the surface without any aggregation (Fig. 34).

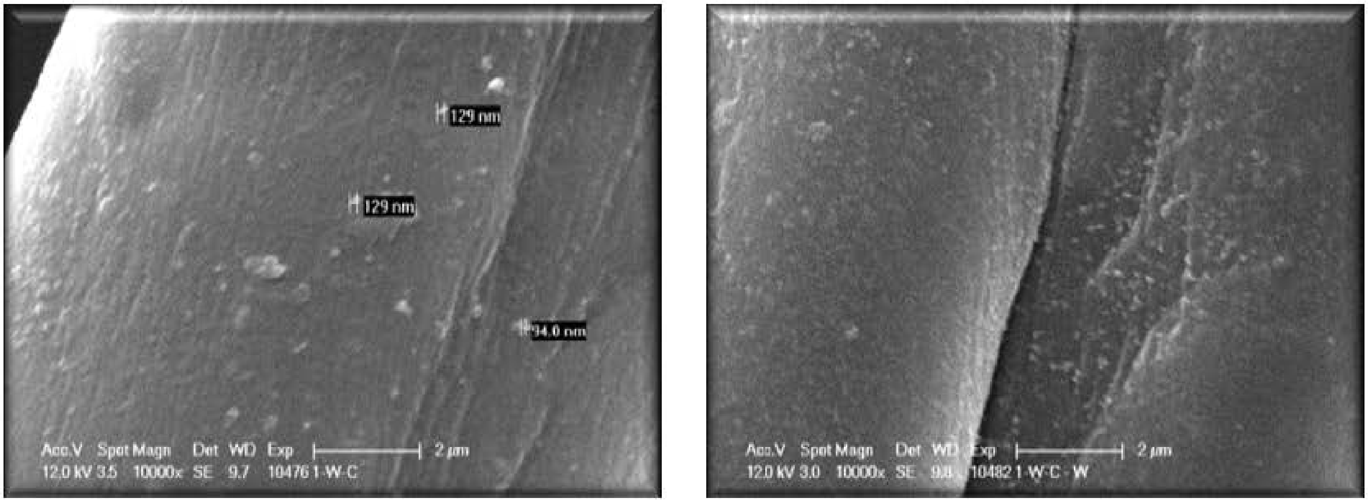


Fig. 34: Scanning Electron Micrographs of treated Cotton Fabrics

The treated textile were evaluted for antimicrobial property by AATCC 100 method, and UV protection property using AATCC 183 method. It was found that it produced excellent UPF rating of 50+ and 100% inhibition against *S.aureas* and *K.pneumoniae*. The air permeability of the treated fabric was lower by 10% than the untreated control sample.

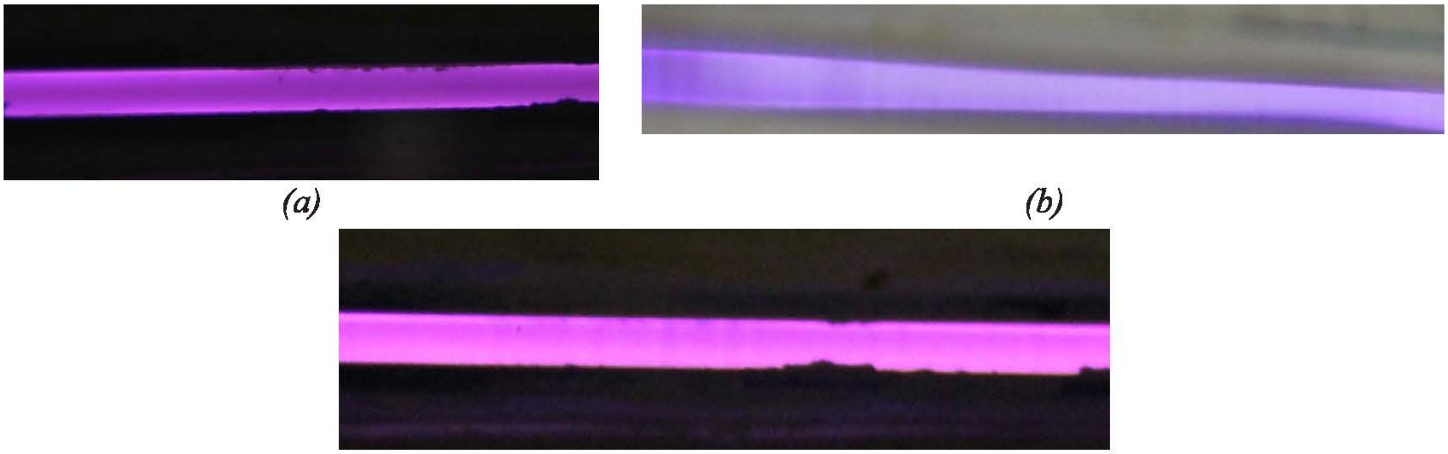
The AATCC 61-2010 (2A) method was used to find out the wash durability of the treated textiles. The Zinc content in the treated fabric and the washed liquor were monitored by using AAS. After four cycle of washes, it was found that zinc content in the fabric was reduced from 3.2% to 2.4%. It was also observed that the amount of zinc which was leaching out from the fabric during washing had been reduced drastically when the number of washing cycles were increased. Even after four cycle of washes, the fabric was found to give excellent UV protective property (50+).

Externally Aided Project

Improvement in Cotton Fabric Quality by Plasma Nano-technology: An Eco-Friendly Approach (NFBSFARA/GB-2017/2011-12)

(a) Generation of Plasma in Different Gases

Atmospheric pressure cold plasma was generated in the presence helium (He), Argon (Ar), He+air, He+Nitrogen, He+Oxygen and He+Fluorocarbon gases. Different plasmas gave different colours depending upon the ionization pattern of a gaseous molecule inside the plasma zone as shown below in Figure 35. It can be seen that the helium gas upon ionization produces purple colour, however when nitrogen gas is introduced along with He, the colour changed to bluish purple. Helium in the presence of air produced a strong violet colour.



(a) (b)

(c)

Fig. 35: Colour of the Different Plasmas (a) Helium (He), (b) He+fluorocarbon, and (c) He+Air Plasma

(b) Optical Emission Spectroscopy (OES) Analysis of Plasma

Plasma is an ionized gas composed of ions, electrons, neutrals, exited particles, UV light and photon. Therefore, the light emitted by the excited atoms and molecules over the wavelength of 200 to 1100 nm was analyzed using OES. Figure 36 shows the optical emission spectrum (OES) of helium (He) plasma. It can be seen that upon ionization, He shows the strong atomic lines at 704 nm & 655 nm, followed by at 586 nm, 666 nm & 725 nm. Similarly, in He/air plasma the atomic line of oxygen was observed at 776 nm in addition to He lines as indicated above. It was interesting to note that when fluorocarbon gas was introduced along with He, several atomic and molecular lines appeared in the lower wavelength range (<400 nm). Some of those atomic lines are F line at 311 nm, F & CF2 line at 318 nm, F line at 325 nm, F line at 341 nm, and F line at 429 nm.

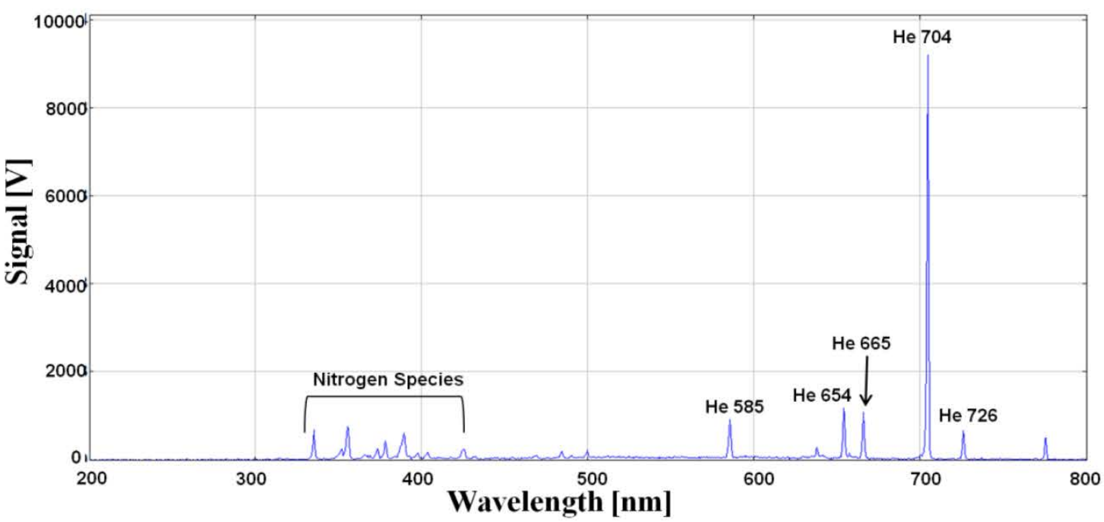


Fig. 36: OES Spectrum of He Plasma

For further analysis, the atomic line of helium (He) at 704 nm was taken as a characteristic peak. It was observed that the intensity of the He 704 nm atomic line remained nearly constant over the plasma discharge time (Figure 37). Since the emission intensity of a species is directly related to its density (concentration), this observation indicates that stable plasma could be established in pure He.

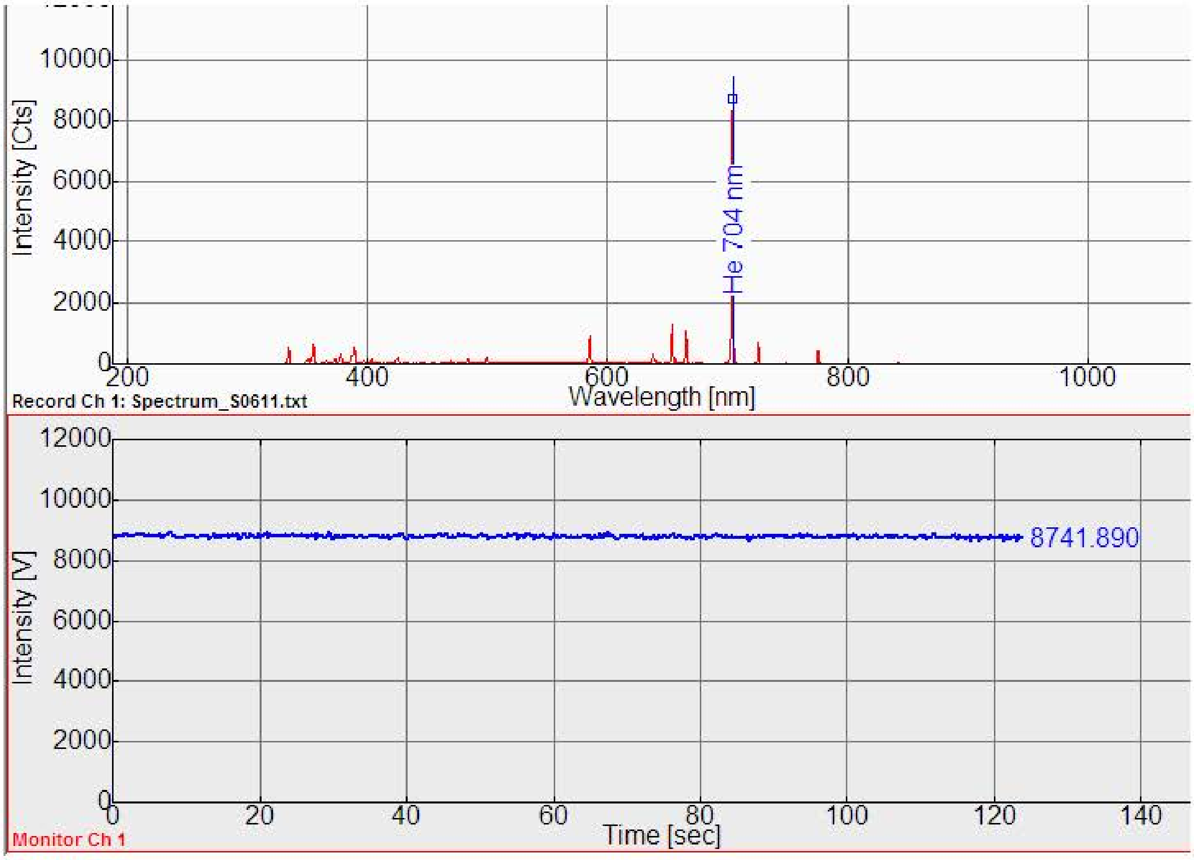


Fig. 37: Intensity of He 704 atomic line with plasma discharge time

(c) Effect of Plasma Treatment in Colouration of Textiles

The untreated and the plasma treated cotton fabrics were dyed using different type of dye classes, such as (i) Reactive (ii) Berberine natural dye (iii) Basic dye (Methylene blue), and (iv) Direct yellow dye. To study the effect of plasma treatment in improvement of colour value of cotton textile, samples were initially plasma treated in the presence of helium (He), He+Oxygen, He+Air, He+Nitrogen, and He+Ammonia gaseous mixtures. It was observed that only in the case of He+Oxygen plasma treated samples, there was a small improvement in the K/S value compared to the control sample (Fig. 38).

However, instead of cellulosic textile such as cotton, when a protein fibre like silk was used, the improvement in colour value was found much promising. The silk fabric was dyed with acid dye at 60°C. It was observed that the K/S value increased from 2.29 in the untreated sample to 5.22 (i.e.127% increase) in the He+Nitrogen plasma treated sample. It can be seen from Figure 38 that with increasing dyeing time, the dye exhaustion percentage increased. The dye exhaustion percentage remained always higher in the plasma treated sample compared to the untreated sample. It is interesting to observe that conventionally silk is dyed at 90°C for a period of 45 min. This developed technology would help to reduce the dyeing temperature from 90°C to 60°C and the dyeing time from 45 min to 5 min.

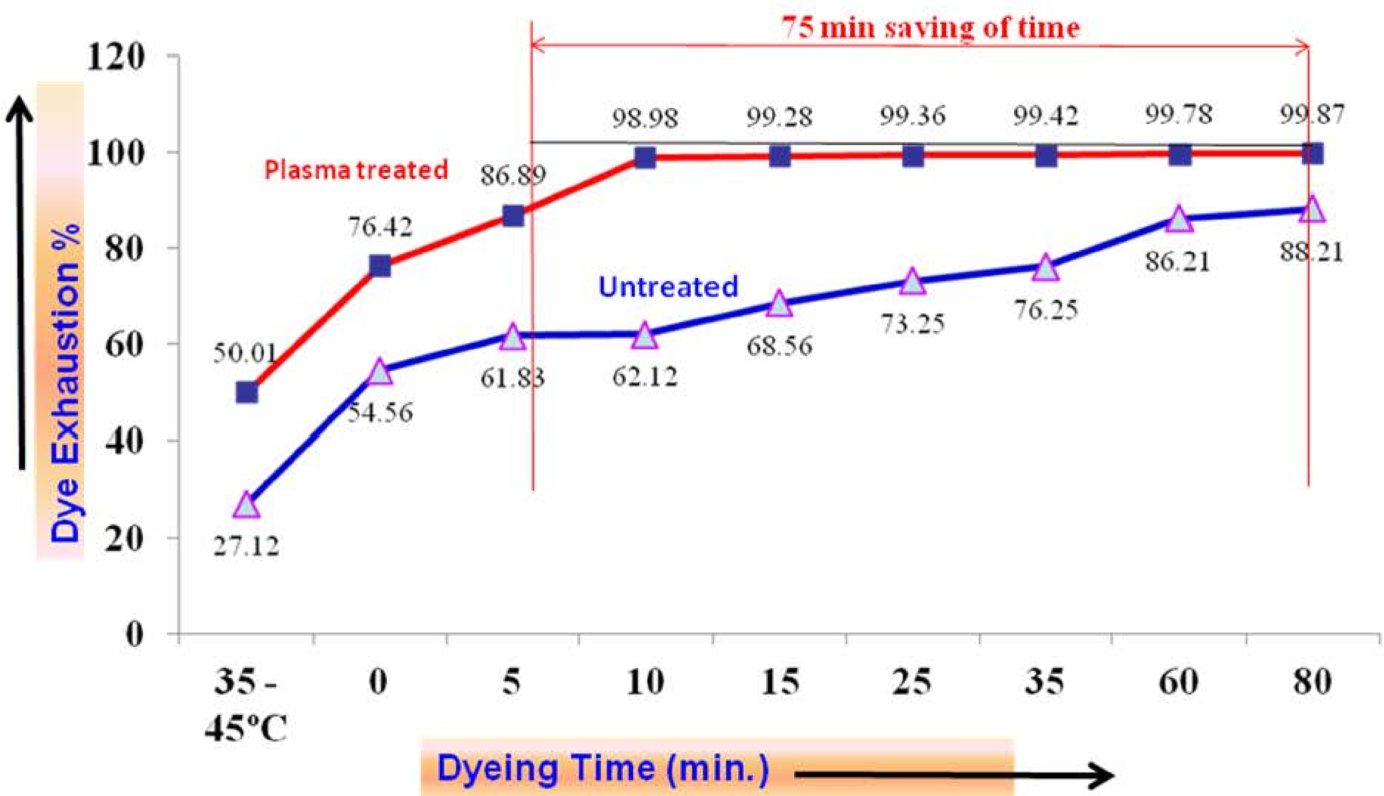


Fig. 38: Effect of Plasma Treatment in Colouration of Protein Fibre (Silk)

(d) Hydrophobic Finishing of Cotton Textile

An atmospheric pressure cold plasma was generated in the presence of helium and fluorocarbon (FC) gas. This plasma was utilized for hydrophobic surface modification of cotton textile to impart a good quality hydrophobic functionality. It was observed that after the plasma reaction, the hydrophilic cotton turned into hydrophobic cotton as shown in Figure 39.

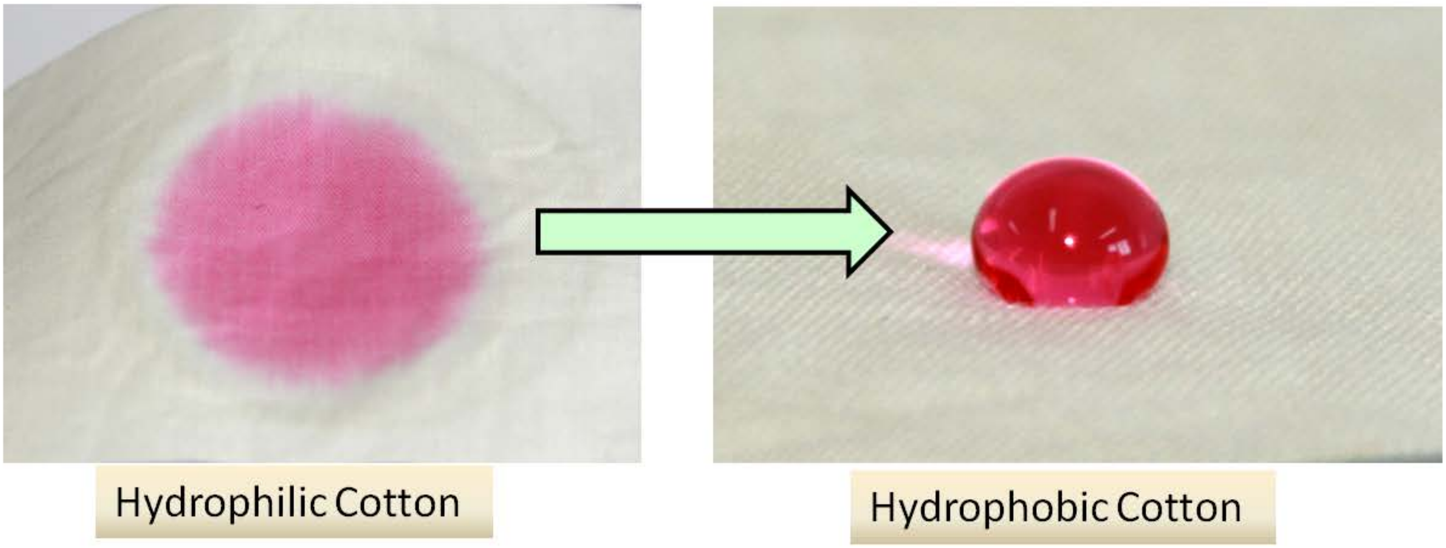


Figure 39: Conversion of Hydrophilic Cotton to Hydrophobic Cotton by Plasma Reaction

As a result, a water droplet did not get absorbed by the fabric even after 3600s, whereas for the untreated sample, it got fully absorbed by the fabric within 5s. It was observed that in the untreated sample water contact angle was ~0°, whereas in the FC plasma treated sample, the water contact angle increased to 142°. In this process as no water has been used, the developed process can be regarded as environment friendly and cost-effective in operation.

Analysis of Plasma Chemistry of Textile

The surface chemistry of the untreated and plasma treated cotton textiles was analyzed using EDX. About 4.2% atomic fluorine is present on the surface of the plasma treated sample as shown in Table 36 and as expected, no fluorine was detected in the untreated sample.

Table 36: Elemental Atomic Percentage in Different Cotton Samples

Different Elements	Atomic Percentage	
	Untreated	Plasma Treated
C	55.5	52.1
O	44.5	43.7
F	0	4.2

The surface chemistry of the plasma treated sample was also analyzed using secondary ion mass spectrometer (SIMS) to study the surface molecules at 2 nm level. The mass spectrum of the untreated sample showed the presence of major species at mass values of 12 amu for C^-, 13 amu for CH^-, 16 amu for O^-, and 17 amu for OH^-. Interestingly, in the fluorocarbon plasma treated cotton sample there was a strong mass peak of F^- at 19 amu. The presence of fluorine molecular peak in the plasma treated sample is an indication of plasma reaction of fluorocarbon gas with cellulosic textile.

Electrospinning Geometry Optimization for Preparation of Core-Sheath Nanofibres and Conversion of Nanofibres into Yarns

The funnel shaped collector is fabricated as given in Figure 40. A Conical funnel (9 inch dia) made of SS having the stem diameter of 5 mm is attached onto a bearing for rotation up to 5000 rpm. The yarn collection mechanism was arranged with a motor having a maximum rpm of 2000 with a regulator control. A Centrifugal pump with adjustable flow rate is provided for circulation of 2 litre solution. The solution flow from the pump created a vortex (Figure 41) with a speed of 360 rpm and the same was increased to 960 rpm by rotating the funnel at 50 rpm. The water flow rate at that optimal level of operation was 1.35 litre/min. The vortex formed in the water helped in imparting twist to nanofibres during the yarn formation.

Figu. 40: Funnel Collector Assembly   *Fig. 41: Vortex Formation in Funnel Collector*

The picture (Fig. 42) shows the vertical configuration of the design having solid copper rollers for better electrical conductivity. These two copper rollers rotate in the same direction and kept very close to each other. The gap between these copper rollers can accommodate a nylon filament, on which the nanofibres are formed on the rollers and get transferred due to friction. The core filament feeder is kept at the top and the yarn collection mechanism is kept at the bottom. The controller consists of speed controls for both the copper rollers and the yarn collection mechanism. A nylon filament is being used as the core, while cellulose acetate is used as the sheath (nanofibres). The gap between the copper rollers is maintained at 10 thou, and the speed varied between 500 to 1500 rpm.

Fig. 42: Friction Spinning Collector and Controller

By-Product Utilisation

Regeneration of Waste Polymerized Frying Cottonseed Oil and its Utilization

The polymerized cottonseed oil was purchased from Fast Food Center, Thane, Mumbai and were evaluated as per the standard methods. The results showed that all the parameters such as peroxide value, *p*-anisidine value, FFA value, viscosity and colour were beyond the permissible limit of edible oil. To purify the polymerized cottonseed oil, a total of 13 combinations of different adsorbents such as silica gel, activated charcoal and aluminium oxide were tested and the results are shown in Table 37. Silica gel with 4% activated charcoal showed the best result for peroxide value, *para*-anisidine value, FFA and viscosity, whereas colour parameter was slightly lower than the oil purified by the combination of 1% activated charcoal with silica gel and aluminium oxide. The combination of silica gel + aluminium oxide with 1, 1.5 and 2% activated charcoal showed that three parameters, such as free fatty acid, colour and peroxide values were close to the value that obtained from 4% activated charcoal with silica gel. The maximum improvement up to 85% was achieved with free fatty acid with combination of 1% activated charcoal with silica gel.

Table 37: Evaluation of cottonseed oil quality parameters

S.No.	Adsorbents	Peroxide Value (%)	*p*-Anisidine Value (%)	FFA Value (%)	Viscosity Centistoke	Color OD
1	Fresh Oil	5.70	4.10	0.14	51.75	1.03
2	Polymerized CSO	14.43	152.74	0.92	78.00	2.51
3	Silica gel (SG) (60 - 120)	13.44	81.35	0.51	72.25	1.79
4	Aluminum Oxide (ALO)	13.69	47.35	0.45	75.00	1.73
5	SG (230 -400) + 1% Activated Charcoal (ACH)	8.53	32.10	0.35	52.50	1.39
6	ALO + ACH (1%)	13.42	56.90	0.41	74.25	1.73
7	SG (60-120) + ALO	14.29	72.41	0.70	74.50	1.74
8	SG (230 -400) + ALO + ACH (1%)	8.53	45.72	0.20	69.75	1.19
9	SG + ACH (1.5%)	9.85	36.90	0.29	64.25	1.30
10	ALO + ACH (1.5%)	10.05	36.57	0.23	68.25	1.32
11	SG + (230-400) + ALO + ACH (1.5%)	7.70	26.25	0.22	51.75	1.24
12	SG + ACH (2%)	8.26	29.00	0.23	59.50	1.26
13	ALO + ACH (2%)	12.50	51.81	0.12	68.75	1.36
14	SG + (230-400) + ALO + ACH (2%)	7.80	22.98	0.12	51.50	1.22
15	SG + ACH (4%)	6.23	19.35	0.13	48.13	1.22

To evaluate the performance of adsorbents for multiple purifications, a total of three different combinations were run for purification, successively three times and the results are given in table 38.

Table 38: Multiple Purification of Polymerised Cotton Seed Oil with Same Adsorbent bed

Sr. No.	Adsorbents	FFA (%)	Viscosity Centistoke	Colour OD
1	SG + ALO + ACH (1%) 1st run	0.202	77.40	0.7432
2	SG + ALO + ACH (1%) 2nd run	0.434	83.05	1.0726
3	SG + ALO + ACH (1%) 3rd run	1.030	91.50	1.1340
4	SG + ALO + ACH (1.5%) 1st run	0.208	90.95	0.6230
5	SG + ALO + ACH (1.5%) 2nd run	0.902	93.10	1.0532
6	SG + ALO + ACH (1.5%) 3rd run	1.020	94.60	1.1753
7	SG + ALO + ACH (2%) 1st run	0.227	77.90	0.5810
8	SG + ALO + ACH (2%) 2nd run	0.818	79.10	0.9988
9	SG + ALO + ACH (2%) 3rd run	1.052	80.30	1.2447

The column chromatography was also used to purify the polymerized oil and the colour parameters are given in Table 39.

Table 39: Color parameters of Cotton Seed Oil Purified using Column Chromatography

Sr. No.	Adsorbent	Colour OD
1	Fresh oil	1.03
2	SG + ALO + ACH (1%)	0.3667
3	SG + ALO + ACH (1.5%)	0.3468
4	SG + ALO + ACH (2%)	0.3303
5	SG + ALO + ACH (4%)	0.3119

Low Temperature Technology for Preparation of Absorbent Cotton for Decentralized Sector

Most of the absorbent cotton industries in our country being set-up are under unorganized sector, while some of the industries are of SME type. The research with respect to scouring and bleaching for the preparation of absorbent cotton preparation is limited when applied to such sectors. At present, the industry is facing stiff competition from other developing countries in terms of cost and technology. Stringent pollution norms set-up by the State and the Central governments needs to be followed. Hence, it is very important to develop energy-efficient, sustainable scouring and bleaching technologies for manufacturing absorbent cotton. The development of low-temperature scouring and bleaching process for the preparation of absorbent cotton will reduce the cost of production.

In this direction, the current project attempts to develop a low temperature scouring process using enzymes. Pectinase, cellulase and the combination of pectinase and cellulase enzymes were used for scouring *Bengal desi* variety of cotton, which is generally used for making absorbent cotton. The following experiments were carried out:

1. Commercial enzyme A with alkaline pectinase formulation, 2. Commercial enzyme B with alkaline pectinase and bleach additive formulation, 3. Alkaline pectinase enzyme, 4. Commercial enzyme C with neutral pectinase formulation, 5. Neutral cellulase enzyme, 6. A combination of cellulase and commercial enzyme C, and, 7. Conventional scouring process by boiling the fibre using sodium hydroxide at 115°C for 4hrs.

The enzymatic scouring was done in corresponding pH range at 85°C for 60-90 minutes. The scoured fibre was then tested for absorbency in terms of sinking time and water holding capacity as per the Indian Pharmacopoeia standards. From the results, the following processes has been identified for low temperature scouring of cotton.

1. Commercial enzyme B with alkaline pectinase and bleach additive with 12 seconds of absorption time, and
2. The combination of cellulase and commercial enzyme C (neutral pectinase) with 24 seconds of absorption time.

The commercial enzyme B produced fibres with good whiteness in addition to the required absorbency.

An Accelerated Process for the Preparation of Bioenriched Compost from Cotton Plant Stalks

Using CIRCOT developed microbial consortia, 15 days of time could be saved for wet cotton stalks and 30 days for dry cotton stalks for the preparation of compost. This means a saving of 60 – 75 days for the preparation of compost in comparison with FYM method.The compost from cotton stalks was enriched with nutrients and plant growth promoting microorganisms. The NPK content was found higher in cotton compost compared to FYM though the cost of production of cotton compost is similar to FYM (Table 40). The field evaluations showed that the compost from cotton stalks is at par with FYM as far as the growth and yield of cotton is concerned, even though half the quantity of that required with FYM was applied during the field trials.The compost thus prepared could be stored for the period of up to one year without any deterioration in its quality. Considering less availability of FYM, the preparation of compost from cotton stalks is a viable proposition for improving soil fertility. The technology developed will be an effective way of on-farm management of cotton crop wastes, bringing additional income to farmers. Besides, it will reduce environmental pollution that may arise due to the burning of cotton stalks in the field.

Table 40: Comparison Between Compost from Cotton Stalks and FYM

Parameters	**Compost from cotton stalks**	**FYM**
Cost (Rs.) per tonne	3200	3000 to 3500
NPK content (%)	1.1, 0.9, 0.5 (wet cotton stalks) 1.43, 0.78, 1.82 (dry cotton stalks)	0.5, 0.2, 0.5
Duration of preparation	45 days (wet cotton stalks) 60 days (dry cotton stalks)	120 days

Fig. 43: Live Technology Demonstration at Krish Vasant 2014 held at CICR, Nagpur

EXTERNALLY FUNDED PROJECT

Development of Gossypol-free Lysine-rich Cottonseed Cake by Solid State Fermentation

Solid state fermentation processes have been developed using the heat and chemical sterilization with two culture combinations viz., 1. *Candida tropicalis* and *Saccharomyces cerevisiae* and 2. *Pleurotus sajor-caju* and *S. cerevisiae* 6933. The native microorganisms capable of detoxifying gossypol and improving lysine content in the cottonseed cake have been isolated and preserved as repository. The native fungal isolates such as LF1-2F1, LF1-5F1 and SV-2F2 have showed better detoxification of gossypol with simultaneous improvement of lysine content in cottonseed cake.

The fermented cottonseed cake showed improved nutritional qualities such as 80% reduced free gossypol, 60% reduced total gossypol, 15 – 25% increased lysine content, 40 – 50 % improved protein content and 25 – 30% reduced fibre content compared to the untreated cottonseed cake (control) (Table 41 & 42). The fermented UDCSK stored up to three months showed no change in its quality. The characterization of biodegraded gossypol samples revealed the attack by microorganisms on functional aldehyde groups and aromatic structure of gossypol, with reduction in concentration of gossypol and its toxicity.

Table 41: Effect of solid state fermentation process (chemical sterilization) on nutritive parameters of UDCSK

Process	FG (%)	FGR (%)	TG (%)	TGR (%)	Lysine Content (%)	Crude Protein (%)	Crude fibre content (%)
Ist process (*C. tropicalis* + *S. cereviseae*)	0.045	79.5	0.89	61.8	1.25	33.5	25.6
IInd process (*P. sajor caju* + *S. cereviseae* 6933	0.048	78.2	0.88	62.1	1.15	32.6	26.1
Control	0.22	-	2.32	-	1.00	20.1	37.1

Table 42: Effect of solid state fermentation process (heat sterilization) on nutritive parameters of UDCSK

Process	FG (%)	FGR (%)	TG (%)	TGR (%)	Lysine content (%)	Crude protein (%)	Crude fibre content (%)
I[st] process (*C. tropicalis* + *S. cereviseae*)	0.037	83.2	0.87	62.5	1.25	28.2	29.6
II[nd] process (*P. sajor caju* + *S. cereviseae* 6933	0.040	81.8	0.86	63.1	1.15	28.3	28.2
Control	0.22	-	2.32	-	1.00	20.3	37.2

Agro Techniques for High Density Planting System and Surgical Cotton Varieties (TMC MMI 1.4)

Under the project, 151 samples were received from Nagpur, Sirsa, Ludhiana, Akola and Mudhol. All the samples were evaluated for fibre length and micronaire. Based on the fibre properties, 23 samples were selected for the preparation of absorbent cotton. All these samples were first evaluated for wax content, which was found less than 1%.

CIRCOT has developed a patented time and energy saving process for the preparation of absorbent cotton from short staple cotton that is economically viable. It was found that 1.5% Sodium Hydroxide, 1.5% Hydrogen Peroxide, 0.75% Wetting Agent and 0.75% Sodium Silicate were suitable for the preparation of absorbent cotton. Using the single stage process and the standardized conditions, trials were conducted to prepare absorbent cotton from 23 selected cotton samples.

All the prepared samples were evaluated for different parameters as per the standard methods. It was found that the samples received from Sirsa station showed better absorbency and are suitable for preparation of absorbent/surgical cotton (Table 43 & 44).

Table 43: Properties of Absorbent Cotton Prepared by CIRCOT process (Cotton samples received from Sirsa station)

Samples	Ash (%)	Moisture (%)	Absorbency (sec)	Sinking Time (sec)	Water Holding Capacity (g/g of cotton)	2.5% S. L.	MIC
130989	0.45	7.2	1.1	1.2	23.8	17.8	7.9
130994	0.32	6.9	1.1	1.5	24.2	18.2	7.0
130973	0.39	6.8	1.1	1.5	23.0	17.3	7.6
130975	0.43	7.0	1.1	1.5	23.0	18.6	7.0
130967	0.22	6.9	1.1	1.7	23.5	18.0	7.7
130957	0.28	6.3	1.1	1.7	25.8	17.2	---
130956	0.26	6.2	1.0	1.5	24.5	18.2	6.9
130968	0.27	6.5	1.1	1.4	24.4	18.1	7.2
130969	0.24	6.3	1.6	1.9	25.1	17.6	7.6
130993	0.25	6.4	1.3	1.5	23.8	17.3	7.9
Standard	<0.5	<8.0	<10.0	<10.0	<23.0		

Table 44: Properties of absorbent cotton prepared by CIRCOT process (Cotton samples received from Ludhiana station)

Sample	Ash (%)	Moisture (%)	Absorbency (sec)	Sinking Time (sec)	Water Holding Capacity (g/g of cotton)	2.5% S.L.	MIC
121307	0.40	6.8	1.8	3.5	23.4	25.5	4.3
121308	0.44	6.7	1.8	3.4	23.6	23.4	4.5

Sample	Ash (%)	Moisture (%)	Absorbency (sec)	Sinking Time (sec)	Water Holding Capacity (g/g of cotton)	2.5% S.L.	MIC
121309	0.45	6.5	1.6	3.2	23.4	24.5	4.6
121310	0.40	6.9	1.6	3.1	23.5	24.3	4.8
121311	0.45	6.7	1.6	3.1	23.5	24.7	3.3
121312	0.49	6.8	2.0	3.8	24.0	24.1	2.8
Standard	=0.5	=8.0	=10.0	=10.0	=23.0		

CORE AREA V: ENTREPRENEURSHIP AND HUMAN RESOURCE DEVELOPMENT

Impact Assessment of CIRCOT-Bajaj Cotton Pre cleaner

CIRCOT had developed an inclined type pre-cleaner for cleaning of seed cotton before ginning to improve the ginning performance and the technology was commercialized in association with Bajaj Steel Industries. To undertake an *ex-post* impact assessment of the technology a detailed questionnaire was prepared to capture the ginning performance, trash content, maintenance cost and the quality of the fibre in the ginning factories. The questionnaire also included collection of response from the Ginning and Pressing factories, regarding the different attributes of the pre-cleaners that influenced the adoption of the technology.

A Preliminary survey was conducted initially in five ginning factories in and around Nagpur viz., M/s. Sultania, M/s. Bhagirath, M/s. Sudarshan, M/s. Gimatex and M/s.Vinayak to pre-test the questionnaire. Based on the tested questionnaire, the Primary data was collected from 20 ginning and pressing factories at Adilabad and samples before and after pre cleaner as well the lint samples were collected from different ginning factories that were working with and without pre-cleaners. The collected samples were analyzed using trash separator to measure the efficiency of the pre-cleaner in removing the trash. The results presented in Table 47 reveals that overall cleaning efficiency of the pre-cleaners is around 15 percent and is significant at 1 per cent level of significance.

Table 45: The trash analysis of the samples with and without the use of pre-Cleaners

Trash (Per Cent)		t-Stat	P-value
Before Pre-Cleaner	After Pre-Cleaner		
4.11	3.5	5.798	0.001

The determinants of adoption of the cotton pre-cleaner was assessed based on the grading of different attributes by the ginners in the scale of 1-10, higher score representing higher satisfactory response. The major factors that influenced the adoption of the pre-cleaners in the ginning factories as revealed by the ginners are presented in Table 46.

Table 46: Determinants of adoption of CIRCOT Bajaj Pre-Cleaner

Traits	Rank (0-10 scale)
Improvement in the grade of the Lint	8.4
Bale value improvement	7.8
Improvement in the TMC rating	7.0
Cleaning efficiency of the Pre Cleaner	6.4
Reduction in the dust level/ pollution in the ginning factory	6.2

Improvement in the quality of the lint and the bale value are the prominent factors that influenced the adoption of the pre-cleaners followed by the rating of the TMC.

Externally Funded Activity

Technical Assistance Programme (TAP) to Strengthen Cotton Value Chain in Cotton 4 Countries (Benin, Burkina Faso, Chad & Mali) and Malawi, Nigeria and Uganda in Africa

The B1 activity, "Training Cum Exposure Programme on Post-harvest management of cotton and value addition to crop residues was completed on January 12-25, 2013. During the reporting period feedback from the delegates about the lectures, Industrial/study visits, lodging, boarding and overall day-wise impression were analyzed. The overall rating of the programme was 9.04. The completed report on the "Training-cum-Exposure Programme on Post-harvest Management of Cotton and Value addition to Crop Residues" was made into a publication.

Zonal Technology Management and BPD Unit at CIRCOT, Mumbai (National Agricultural Innovation Project, Component 1)

Media Products Developed/Disseminated

Sr. No.	Type of Publication	Title
1	Leaflet	Flexi Check Dam (Rubber Dam) made of Textile -Rubber Composite for Watershed Application
2	Leaflet	Microbiological Testing Services for Textiles
3	Leaflet	Biogas from Textile Mill Waste
4	Brochure	A brochure on Business meet on Cotton Technologies Related to Ginning, Linter & Calibration Cotton technology
5	Brochure	A brochure on ' CIRCOT's Calibration Cotton, Absorbent Cotton and Biogas Technologies
6	Booklet	An Overview of CIRCOT HVI Calibration Cotton Standards and Guidelines for Testing
7	Leaflet	Entrepreneurship Development Programme on Absorbent Cotton Technology
8	Leaflet	Cotton Linter
9	Booklet	IPR News letter, TECHNO IMPRINTS
10	Booklet	Cotton Processing Technologies Developed by CIRCOT
11	Book	COMPENDIUM on Entrepreneurship Development Programme On Absorbent Cotton Technology
12	Leaflet	CIRCOT Calibration Cotton
13	Booklet	Appropriate Technology For Indian Ginning Industry
14	Calendar (2014)	CIRCOT & West Zone Technologies
15	Brochure	Entrepreneurship Development Programme on Distegration, Defibring of Husk, Segregation & Captive Retting of Coconut Fibre
16	Leaflet	Banana Pseuostem Central Core, A noval nutritive product developed by Navsari Agricultural University, Gujarat
18	Leaflet	Technology for production of bypass fat indigenously developed by ICAR Research complex for Goa
	Leaflet	ZTM-BPD CIRCOT at a glance
	Leaflet	NANOCELLULOSE PRODUCTION: Eco- friendly & energy-efficient CIRCOT Technology
	Leaflet	Utility Card about ZTM & BPD of CIRCOT
	Leaflet	कचरा रहित स्वच्छ एव उत्तम गुणवत्तायुक्त कपास का उत्पादन
	Leaflet	उत्तर भारत में कपास की सघन खेती में उप्पादन व गुणवत्ता बढ़ाने के तरीके
	Catalogue	AGRI-TECHNOLOGIES AVAILABLE FOR COMMERCIALISATION (WEST ZONE)

Meetings/Seminars/Trainings/Kisan Mela, etc. organized

Sr. No.	Details of event	Location	Year
1	Pre-commercialization workshop on Flexi Check Dam, popularly known as rubber dam made of Textile -Rubber Composite for Watershed Application	Central Institute for Research on Cotton Technology, Mumbai	May 2013
2	Business Development Programme on CIRCOT's Calibration Cotton, Absorbent Cotton and Biogas Technologies	Sardar Vallabhbhai Patel International School of Textiles and Management, Coimbatore	August 2013
3	Business meet on Cotton Technologies related to Ginning, Linter and Calibration cotton	Nannapaneni Venkataratnam AC conference hall, Andhra Pradesh Cotton Association, Lakshmipuram, Main road, Guntur	September 2013
4	Entrepreneurship Development Programme on Absorbent Cotton Technology	Central Institute for Research on Cotton Technology, Mumbai	September 2013
5	Ginning Business Meet	Khandesh Gin/Pressers Association, Jalgaon	November 2013
6	Business Meet on Cotton Technologies related to Ginning, Linter and Calibration Cotton	Bathinda, Punjab	November 2013
7	Entrepreneurship Development Programme on "Disintegration, Defibring of Husk, Segregation and Captive Retting of Coconut Fibre"	Vengurla, Sindhudurga, Maharashtra	December 2013
8	One day Training-cum-Workshop on Extraction and Application of Natural Dyes	Central Institute for Research on Cotton Technology, Mumbai	January 2014

Participation in Conference/ Meetings/Trainings/ Radio talks, etc.

Sr. No.	Details of event	Duration (From-To)
1	Sensitization Meet on Agri-Business Management at CIRCOT	July 27th, 2013
2	Agri-Tech Investors Meet at NASC Complex, New Delhi	July 18-19, 2013
3	Foundation Day of Agri-Innovate India and Conglomerate on Innovative Partnerships & technology showcasing at NASC, New Delhi	October 19th, 2013
5	Kisan Exhibition, Pune	December 13-17, 2013
6	International Conference on "Management of Agribusiness & Entrepreneurship Development at Bhopal	January 6-7, 2014
7	Hands-on Training on Business Plan Preparation for BPD Unit in the NARS, Hyderabad	January 20-21, 2014
8	Asia-Africa Agri-Business Forum	February 4-6, 2014
9	Krishi Vasant	February 9-16, 2014

Technology Commercialization

Sr. No.	Technology commercialised	Mention whether patent filed/granted or NA	Status of commercialisation (Licenses/MoU/JV's/tie-ups)	Name of Entrepreneur/ Firm
1	Bleached Cotton Linter	Patent filed	MoU signed	Synergy Exports Pvt Ltd, Pune
2	Evaluation of Denim fabric samples	NA	MoU signed	Sandip Soni, JDIET, Yawatmal, Maharashtra

Sr. No.	Technology commercialised	Mention whether patent filed/granted or NA	Status of commercialisation (Licenses/MoU/JV 's/tie-ups)	Name of Entrepreneur/ Firm
3	Saw ginning technology	NA	MoU signed	Rathi Chemical, Nagpur, MS
4	Nanocellulose from sugarcane bagasse	Patent Filed	MoU signed	Godavari Refineries, Mumbai, MS
5	Kawabata Testing of Worsted fabric sample	NA	MoU signed	Mr. Ganesh Kakad, JDIET, Yawatmal, Maharashtra
6	Cotton Technological Assistance to strengthen cotton value chain in C-4 countries and Malawi, Nigeria and Uganda in Africa	NA	MoU signed	IL & FS
7	Developing various machines in ginning	Patent Filed	MoU signed	Bajaj Steel Industries
8	Production of Nanocellulose from 5 different samples of cellulose	Patent Filed	MoU signed	Thapar Centre for Industrial Research and Development, Yamunanagar, Haryana
9	Technology for Absorbent cotton	Patent filed	MoU signed	M/s Atharva Health care, Mumbai

Sr. No.	Technology commercialised	Mention whether patent filed/granted or NA	Status of commercialisation (Licenses/MoU/JV 's/tie-ups)	Name of Entrepreneur/ Firm
10	Nanocellulose Production Technology	Patent Filed	Licensed-MoU Signed	M/s Kankadhara agricultural Innovations Pvt. Ltd
11	Nanocellulose Production Technology	Patent Applied	Licensed-MoU Signed	M/s Clean cotton Impex Tirupur (Tamil Nadu)
12	Technology on Eco-friendly dyes	NA	Licensed	M/s Acharya N. G.Ranga Agricultural University Hyderabad (Andhra Pradesh)
13	Miniature Particle board machinery manufacturing technology	NA	Licensed-MoU Signed	M/s Trytex Machine Company, Coimbatore, (Tamil Nadu)
14	Nanocellulose Production Technology	Patent filed	Licensed-MoU Signed	M/s Madhya Pradesh Association of Cotton Processors and Traders,
15	Phoenix Charkha	Patent filed	Licensed-MoU Signed	M/s Phoenix products
16	Miniature Ginning system	NA	Licensed-MoU Signed	M/s Precision Tooling Engineers
17	Kawabata testing and Analysis	NA	Licensed- MoU Signed	Hindustan Unilever Limited

Apart from this, a historic MoU with Veermata Jijabai Technological Institute (VJTI), Mumbai for Research, Education and Technical Collaboration has been signed.

Entrepreneurial Support

- No. of entrepreneurs enrolled and supported: 48 in 2013-14
- Number of Entrepreneurs incubated : 7 in 2013-14

Media products developed: 'Entrepreneur' magazine of Viacom18 media has landed CIRCOT- ZTM & BPDU performance in its 4th Anniversary issue (August 2013).

Awards and Recognitions

- For its exemplary performance, BPD-CIRCOT was bestowed with Best Performing BPD for Technology commercialization award for 2012-13 at the NAIP Agri – Tech Investors Meet, July 2013.
- Maximum license per technology award given by Dr. K. Kasturirangan, Former Head ISRO and Planning Commission Member (S&T) in July, 2013.
- Mr. K.G. Bhat, Proprietor of Precision Tooling Engineers, Nagpur, an incubatee of ZTM & BPD Unit-CIRCOT has been felicitated by Prof. Abhijit Sen, Member, Planning Commission, Govt. of India for manufacturing machines based on CIRCOT developed ergonomic designs, October2013.

3. ON-GOING PROJECTS: 2013 – 14

CORE AREA I: PRE-GINNING AND GINNING

Sl. No.	Proj. Code	Name of the Project (Year: From-To)	Principal Investigator	Co-PIs / Associates
1.	MP.73	Design and Development of Pollution Abatement System for Collection of Flying Dusts from Ginning and Pressing Halls (October 2011 – March 2014)	Dr. S. K. Shukla	Dr. (Smt.). J. M. Nath Dr. P. G. Patil
2.	MP.74	Evaluation of Engineering and Economic Performance of High Capacity Rotary Knife Roller Gin for Indian Cottons and Optimization of Machine and Process Parameters for Efficient Ginning (October 2012 - September 2015)	Er. V. G. Arude	Dr. S. K. Shukla Shri R. K. Jadhav Shri U. D. Devikar

Externally aided Project

Sl. No.	Proj. Code	Name of the Project (Year: From-To)	Funding by	Principal Investigator	Co-PI's/Associates
1.	MM 1.7	Development of Cotton Picking Machinery for Small Scale Cotton Production Systems (April 2013 - March 2017)	TMC - MM1	Dr. S. K. Shukla	Er. V. G. Arude

CORE AREA II: MECHANICAL PROCESSING, TECHNICAL TEXTILES AND COMPOSITES

Sl. No.	Proj. Code	Name of the Project (Year: From-To)	Principal Investigator	Co-PI's/Associates
1.	MP.75	Development of High Performance Cotton Textiles by Electro Spraying / Spinning Technique (October 2012 - September 2015)	Er. G.T.V. Prabu	Dr. N. Vigneshwaran Shri A. Arputharaj Er. G. Krishna Prasad
2.	MP.76	Improvement in Coconut Fibre Compatibility for Production of Superior Quality Fibre Reinforced Composites (November 2012- September 2015)	Er. T. Senthilkumar	Dr. R. Guruprasad Er. G. Krishna Prasad Dr. N. Vigneshwaran Dr. Kartick K. Samanta
3.	MP. 77 Flagship Project	Development of Innovative Fibre Blends and Finishes for Improved Functionality of Cotton Textiles (April 2012 - March 2017)	Dr. R. Guruprasad	Dr. S. K. Chattopadhyay Er. G.T.V. Prabu Er. G. Krishna Prasad Er. T. Senthilkumar Shri R. K. Jadhav Shri D. U. Kamble Dr. P. K. Mandhyan Dr. Sheela Raj Dr. M.V. Vivekanandan Shri C. M. More Shri R. S. Prabhudesai Shri B. R. Pawar Dr. (Smt.) Sujata Saxena Shri A. Arputharaj Dr. Virendra Prasad Dr. Kartick Kumar

Sl. No.	Proj. Code	Name of the Project (Year: From -To)	Principal Investigator	Co-PI's/Associates
				Samanta Shri Santanu Basak Dr. R. R. Mahangade Shri R. R. Chhagani Dr. N. M. Ashtaputre
4.	MP.78	Studies on Preparation of Composite from Fibrous Waste Material (November 1, 2013 – October 31, 2015	Er. Sekhar Das	Er. Manik Bhowmick Shri Santanu Basak Shri R. K. Jadhav Shri M. G. Ambare Shri S. Banerjee

Externally aided Project

Sl. No.	Name of the Project (Year: From -To)	Funding by	Principal Investigator	Associates
1.	Jute Based Bio Composite for Industry (April 2012 - March 2015)	National Fund for Basic Strategic & Frontier Application Research in Agricultural (NFBSFARA)	Er. Manik Bhowmick (CCPI)	Dr. R. Guruprasad Er. T. Senthilkumar
2.	Design and Development of Rubber Dams for Watersheds (January 2008 - March 31, 2014)	National Agricultural Innovation Project (Component 4)	Er. A. K. Bharimalla	Er. Krishna Prasad Er. Sekhar Das Smt. Bindu Venugopal

Sl. No.	Name of the Project (Year: From -To)	Funding from	Principal Investigator	Associates
3.	A Value Chain for Coconut Fibre and its By-products: Manufacture of Diversified Products of Higher Value and Better Marketability to Enhance the Economic Returns of Farmers (December 2008 - March 31, 2013)	National Agricultural Innovation Project (Component 2)	Er. Ashok Kumar Bharimalla	Dr. S. K. Dey Er. T. Senthilkumar Smt. Bindu Venugopal
4.	Biodegradable Electrospun Fibre Mat for Use in Packaging of Fresh Perishable Agricultural Material (April 2013 – March 2015)	NFBSFARA	Er. G.T.V. Prabu	Dr. N.Vigneshwaran Dr. R. Guruprasad Dr. Virendra Prasad Dr. C. Sundaramoorthy

CORE AREA III: CHARACTERISATION – COTTON AND OTHER NATURAL FIBRES, YARNS AND TEXTILES

Sl. No.	Proj. Code	Name of the Project (Year: From-To)	Principal Investigator	Associates
1.	A.1	Evaluation of the Quality of Cotton Samples under the All India Co-ordinated Cotton Improvement Project (1924 - Continuing)	Er. Sekhar Das	Er. G.T.V. Prabu Er. T. Senthilkumar Dr. Hamid Hasan Dr. S. Venkatakrishnan

Sl. No.	Proj. Code	Name of the Project (Year: From-To)	Principal Investigator	Associates
				Shri S. Mukundan Shri R. S. Prabudesai Shri D. N. Moon Shri B. R. Pawar Shri R. K. Jadhav
2.	A.3	Evaluation of Quality of Standard Varieties of Indian Cotton (1926 - Continuing	Er. Sekhar Das	Er. G. Krishna Prasad Shri H. S. Koli Shri S. M. Gogate Shri S. Banerjee Shri D. N. Moon Smt. BinduVenugopal
3.	MP.72	Design and Development of Field Level Banana (Musa spp.) Pseudostem Fiber Extraction Machines (April 2011 - March 2014)	Er. P. S. Deshmukh	Dr. V. Mageshwaran Shri R. K. Jadhav
4.	QE.105	Design and Development of RFID Bale Tagging and Software System for Centralised Bale Trading and Tracking Application (October 2011 - September 2013)	Dr. (Smt.) Jyoti M. Nath	Dr. S. K. Shukla

Externally aided Projects

Sl. No.	Name of the Project (Year: From - To)	Funding from	Principal Investigator	Associates
1.	A Value Chain on Banana Pseudostem for Fibres and other Value Added Products (June 2008 - March 31, 2014)	National Agricultural Innovation Project (Component 2)	Dr. N. Shanmugam	Dr. S. K. Dey Dr. P. K. Mandhyan Dr. M. V. Vivekanandan Shri B. R. Pawar

CORE AREA IV : CHEMICAL AND BIOCHEMICAL PROCESSING BIOMASS AND BY-PRODUCT UTILISATION

Sl. No.	Code	Name of the Project (Year: From-To)	Principal Investigator	Co-PI's/Associates
1.	CH.85	Use of Plant Extracts for Dyeing and Imparting Ultraviolet Protective and Antibacterial Properties to Cotton Textiles (April 2012 - March 2014)	Dr. (Smt.) Sujata Saxena	Shri S. Basak Dr. R. R. Mahangade Dr. N. M. Ashtaputre Dr. M.V. Vivekanandan Shri R.S. Narkar
2.	CH.86	Improving Interfacial Interaction of Nanocellulose with Commodity Polymers to Enhance their Performance (April 2012 - March 2014)	Dr. Virendra Prasad	Dr. N. Vigneshwaran Er. Ashok Kumar Bharimalla Dr. R. D. Nagarkar Shri Rajesh Kadam

Sl. No.	Proj. Code	Name of the Project (Year : From-To)	Principal Investigator	Co-PI's/Associates
3.	CH. 87	Fire Retardant Finishing of Cotton Fabric using Herbal Extract (October 2012 - September 2014)	Shri Santanu Basak	Dr. (Smt.) Sujata Saxena Dr. R. R. Mahangade Shri R. S. Narkar
4.	CH. 88	Regeneration of Discarded Polymerized Frying Oil and its Utilization (October 2012 - September 2015)	Shri R. M. Gurjar	Dr. Virendra Prasad Dr. (Smt.) Sudha Tiwari Shri Manoj Ambare
5.	CH. 89	Low Temperature Technology for Preparation of Absorbent Cotton for Decentralized Sector (November 1, 2013 – October 31, 2015)	Dr. A. S. M. Raja	Shri A. Arputharaj Dr. R. D. Nagarkar Dr. N. M. Ashtaputre
6.	CH. 90	Multifunctional Durable Finishing of Apparel Grade Cotton Fabrics with Nano ZnO (Nov. 2013 - Oct. 2015)	Shri A. Arputharaj	Dr. Sujata Saxena Dr. Virendra Prasad
7.	MB. 55 (Interinstitutional Project)	An Accelerated Process for Preparation of Bioenriched Compost from Cotton Plant Residues (April 2011 - March 2014)	Dr. V. Mageshwaran	Dr. P. G. Patil Dr. (Smt.). A. A. Kathe Dr. R. D. Nagarkar Dr. Hamid Hasan Dr. N. M. Ashtaputre Dr. S. Venkatakrishnan Shri U. D. Devikar

Externally aided Projects

Sl. No.	Name of the Project (Year: From-To)	Funding from	Principal Investigator	Associates
1.	Improvement in Cotton Quality by Plasma Nanotechnology: An Eco-friendly Approach (June 2011 - May 31, 2014)	National Fund for Basic, Strategic & Frontier Application Research in Agriculture, ICAR (NFBSFARA)	Dr. Kartick Kumar Samanta	Dr. (Smt.) Sujata Saxena Shri A. Arputharaj Er. Manik Bhowmick
2.	Electrospinning Geometry Optimization for Preparation of Core-sheath Nanofibres and Conversion of Nanofibers into Yarns (March 2012 - March 31, 2014)	Department of Science and Technology (DST)	Dr. N. Vigneshwaran	Shri A. Arputharaj Dr. Kartick Kumar Samanta Er. Manik Bhowmick
3.	Development of Gossypol-free Lysine-rich Cottonseed cake by Solid State Fermentation (June 2012 - May 2014)	National Fund for Basic, Strategic & Frontier Application Research in Agriculture, (NFBSFARA)	Dr. V. Mageshwaran	Dr. (Smt.) A. A. Kathe Shri Nishant D. Kambli
4.	Agro Techniques for High Density Planting System and Surgical Cotton Varieties (April 2013 - March 2017	TMC - MM1	Shri R. M. Gurjar	Er. Shekhar Das Dr. R. D. Nagarkar Shri R. S. Prabhudesai Dr. N. Ashtaputre

CORE AREA V: ENTREPRENEURSHIP AND HUMAN RESOURCE DEVELOPMENT

Sl. No.	Name of the Project (Year: From-To)	Principal Investigator	Co-PI's/Associates
1	Technical Assistance Programme (TAP) to Strengthen Cotton Value Chain in Cotton 4 Countries (Benin, Burkina Faso, Chad & Mali) and Malawi, Nigeria and Uganda (April 2012 to Sept. 2014)	Dr. P. G. Patil	Shri R. M. Gurjar Dr. S. K. Shukla, Dr. (Mrs.) Jyoti Nath Er. V. G. Arude Er. Ashok Kumar Bharimalla Er. P. S. Deshmukh Dr. C. Sundaramoorthy
2	TT.2 Impact Assessment of CIRCOT Bajaj Cotton Pre-cleaner (October 2012 _ September 2014)	Dr. C. Sundaramoorthy	Er. V. G. Arude Dr. S. K. Shukla
3	Marketing and Widening the Customer Base of CIRCOT Calibration Cotton (October 2013 – March 2017)	Dr. N. Shanmugam	Dr. P. K. Mandhyan Dr. S. Venkatakrishnan Shri B. R. Pawar Shri H. S. Koli Shri R. S. Prabhudesai

Externally Aided Project

Name of the project (Year From-To)	Funding Agency	Principal Investigator	Associates
Zonal Technology Management and Business Planning & Development Unit at (ZTM-BPDU) (November 2008 - March 31, 2014)	National Agricultural Innovation Project (Component 1)	Er. Ashok Kumar Bharimalla	Dr. A. S. M. Raja Dr. N. Vigneshwaran Shri R. M. Gurjar Shri B. R. Pawar Dr. S. Venkatakrishnan Shri K. Narayanan Shri S. Mukundan Dr. Hamid Hasan Shri G. G. Mistry

4. TECHNOLOGY ASSESSED AND TRANSFERRED

The institute is engaged in developing newer technologies in the area of post harvest processing of cotton, eco-friendly finishing of textiles, better utilization of by-product of cotton stalk and refinement of already developed technologies. Continuous monitoring of the transferred technologies and processes enables the institute to provide enhanced benefit to the users. For the success of any technology, there needs to be a constant monitoring of the already commercialised technologies and the impact it has on the user group. Hence, studies on the impact assessment of the technologies are taken up in a project mode recently.

The Institute maintains a liaison with private organizations and entrepreneurs to meet their needs and also to generate revenue. This chapter summarizes the technologies developed and consultancies offered by the Institute during the current year. Attempts were made for popularization and commercial adoption of viable technologies through periodically conducted Awareness Meets and through participation in various exhibitions and seminars.

Consultancies Undertaken

The following consultancies were undertaken during the reporting period

Sl. No.	Title of Consultancy / Area	Name of the Coordinating Scientist	Name of the Organisation to which Consultancy was given	Amount (Rs.)
1	To characterize a Pharmaceutical Sample with 5% Ingredient to Achieve the Required Particle Size	Dr. N. Vigneshwaran	M/s. Fusion Scientific Technologies Pvt. Ltd. Mumbai	16, 854
2	Size Recovery Using Ultrafilteration	Dr. P. K. Mandhyan	VJTI, Mumbai	11, 236

Sl. No.	Title of Consultancy / Area	Name of the Coordinating Scientist	Name of the Organisation to which Consultancy was given	Amount (Rs.)
3	Design of Machinery for Automatic Cotton Ginning Pressing Plant	Dr. P. G. Patil	M/s. Bajaj Steel Industries Ltd. Nagpur	6, 14, 631
4	Analysis of Protruding Hairs on the Fabric Surface using Image Analyzer	Dr. M. V. Vivekanandan	M/s. Hindustan Unilever Ltd., Mumbai	12, 000
5	Establishment of Absorbent Cotton Plant at MIDC, Kudal	Er. Ashok Kumar Bharimalla	M/s. Atharva Healthcare, Mumbai	56, 180
6	Bending and Surface Evaluation of Knitted and Woven Cotton Fabrics on KES -FB System	Dr. Sheela Raj	M/s. Hindustan Unilever Ltd., Mumbai	3, 79, 215
7	Kawabata Testing of Worsted Fabric Samples	Dr. Sheela Raj	M/s. Jawaharlal Darda Institute of Engineering & Technology, Yavatmal, Maharashtra	26, 966

Sl. No.	Title of Consultancy / Area	Name of the Coordinating Scientist	Name of the Organisation to which Consultancy was given	Amount (Rs.)
8	Evaluation of Microbial Fermentation Sample and Analysis of Sugar Content and Colour Intensity	Dr. N. Vighneswaran	M/s Roha Dyechem (P) Ltd., Mumbai	5, 618
9	Preparation of Folders, Paper Bags, Writing Pads and C cover using cotton linter pulp	Shri R. M. Gurjar	DKMA, ICAR, New Delhi	4, 55, 000

Commercial Testing

More than 11,000 samples were tested during the year under report at the Headquarters and other quality evaluation stations at Coimbatore, Guntur, Sirsa, Surat, Dharwad, and Ginning Training Centre at Nagpur, generating total revenue of about Rs. 23.8 lakh.

Number of Samples Tested and Revenue Generated

Place	No. of Samples Tested	Revenue Generation (Rs.)
HQ	2361	10,90,321
Guntur	4813	6,23,928
Coimbatore	1790	3,14,483
Nagpur	1279	2,31,510

Place	No. of Samples Tested	Revenue Generation (Rs.)
Sirsa	496	30,130
Surat	154	23,800
Dharwad	251	61,850
Total	**11144**	**23,76,022**

MoU signed with

1. M/s. Atharva Health Care, Mumbai for consultancy for establishment of Absorbent cotton plant on July 15, 2013.
2. M/s. Bajaj Steel Industries for developing various ginning machines on July 18, 2013.
3. M/s. Clean Cotton Impex, Tirupur for production of Nanocellulose Technology on July 18, 2013.
4. M/s. Kankadhara Agricultural Innovations Pvt. Ltd for Production of Nanocellulose Technology on July 18, 2013.
5. M/s. Trytex Machine Company, Coimbatore for Manufacturing of Miniature Particle Board Machinery Technology on July 18, 2013.
6. M/s. Precision Tooling Engineers, Nagpur for Design and Development of Miniature Ginning Machines on August 8, 2013.
7. M/s. Millennium Rubber Technologies, Thrissur, Kerala for Development and commercial supply of the new DR ginning machine (hinged blade assembly) and self grooving rubber roller on October 17, 2013.
8. M/s. Phoenix Products, Belgaum for manufacturing Pedal Driven Banana Fibre Spinning System, "CIRCOT-Phoenix Charkha" on November 8, 2013.
9. Veermata Jijabai Technological Institute for joint collaboration in the areas of mutual interest of research, education and industry on February 3, 2014.
10. M/s. Applied Nanomaterials Ltd., Mumbai for Incubation facility for developing scalable and economically viable chemical methods to produce titania and silver nanoparticles on March 25, 2014.

5. EDUCATION, TRAINING AND EDP

Education

CIRCOT has permanent recognition from University of Mumbai for guiding students in Physics, Bio-Physics, Physical Chemistry, Organic Chemistry, Textile Technology and Microbiology for M.Sc and Ph.D. Dr. V. Mageshwaran, Scientist, CBPD has been recognised as a teacher of the University of Mumbai for M.Sc. degree (by Research) in Microbiology with effect from September 17, 2013. During the year 2013-14, four students were undergoing Ph.D. in Microbiology and one in Physics. Besides, three students from various colleges have undergone training in the field of microbiology and textile chemistry for their project work of M.Sc. degree.

A Memorandum of Understanding has been signed between CIRCOT, Mumbai and Veermata Jijabai Technological Institute (VJTI), Mumbai, on 3rd February, 2014 to establish and encourage joint technological and research activities and execute collaborative programs in the areas of mutual interest of research and higher education. Under the MoU, VJTI recognizes eligible scientists of CIRCOT as guides for M.Tech. and Ph.D. programme in the relevant disciplines. Publication of the joint research will be carried out and an opportunity will be provided to the eligible Scientist/Technical staff of CIRCOT to pursue postgraduate and doctoral degree at VJTI.

CIRCOT already has MoUs with ICT, Mumbai, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, UAS, Raichur and SNDT Women's University, Mumbai which has helped to foster teaching & research in relevant areas.

Training

The institute conducts regular training programmes on cotton quality evaluation for personnel from cotton trade and industry.

The Ginning Training Centre at Nagpur conducts training courses for gin fitters and other workers on technologies in ginning for the production of clean quality cotton and on the maintenance of various ginning and allied machines. Training for troubleshooting of technical problems in the ginning industry is also given. The Institute also organises customized training courses as per demand on the operation of High Volume Instrument (HVI) and Advanced Fibre Information System (AFIS) at the Headquarters, generally for a duration of three days. Special training programmes are also arranged for personnel sponsored from the industry on specific topics as per demand.

All courses comprise lectures with hands-on-training on the testing instruments. Field visits to Textile, Ginning and Pressing industries to get practical knowledge were also arranged. The course material provided to the trainees contains details of test methods and statistical interpretations of results.

Training imparted during the year,

(A) Training on Basics of Nanotechnology & their Applications

Three participants from Acharya N G Ranga Agricultural University, Hyderabad underwent training from April 22-26, 2013. The training consisted of both theoretical and practical aspects of nanotechnology.

Shri Ashok Kumar Bharimalla, Scientist explaining the participants

(B) Training on Quality Evaluation of Textile Fibres

Forty-two sponsored personnel from trade and textile industry were imparted training on fibre quality evaluation in five batches at the headquarters. .

(C) Training on Ginning and Baling for Fitters, Operators and Managers from Ginning Industry

One hundred and seventy-one persons distributed in 11 batches underwent training. Along with the subject oriented training, awareness on the need to produce contaminant free cotton was stressed.

(D) Training under Tribal Sub Plan (TSP)

A major activity undertaken this year, involving the Head quarters and four out of its six regional units. A brief about the training conducted by each unit is presented below.

TSP programme conducted by CIRCOT, Mumbai

A two day training *cum* awareness programme on two technologies *viz.* flexi check dam (rubber dam) and dyeing of cotton materials with natural dyes was organized by CIRCOT Headquarters, Mumbai in collaboration with KVK, Narayangaon and Junnar Forest department and held at KVK, Narayangaon on March 27 – 28, 2014 under TSP. The programme was inaugurated by Dr. S. K. Chattopadhyay, Director CIRCOT and was presided over by Krishibhushan Shri Anil Tatya Meher. Shri Arvind Apte, Deputy Conservator of Forests, Junnar region was the Chief Guest. All the dignitaries stressed about the importance of the programme, benefits of the technologies and asked the participants to take full benefit of the programme. The flexi (rubber) check dam technology evinced immense interest among the participants, majority of whom were tribal farmers. Lucid presentation in the local Marathi language generated enthusiasm and the farmers were keen to have the flexi (rubber) check dams installed in their areas. The flexi (rubber) check dam is of multi-fold benefits to the numerous farmers in the area who generally operate small land-holdings only. In the second technology, information about various sources of natural dyes including agricultural byproducts and colours obtained from these on cotton was provided. The participants were further educated about the various dye sources that can give almost similar type of colour and were encouraged to use the material easily available in and around their own villages. A practical demonstration of the dye extraction, mordant preparation, mordanting and dyeing methods for cotton in respect of two natural dyes *viz.* manjishtha which yields red colour and marigold flowers which produces yellow colour was also given. Shri R. R. Chhagani, Dr. R. R. Mahangade and Shri R. S. Narkar demonstrated various processes under the guidance of Dr. Sujata Saxena. About ten meter cotton fabric samples were dyed using these dyes. Post mordanting technique and soaping process using natural material for improving the fastness were also demonstrated. The participants, especially women, were very much interested in the use of materials locally available for dyeing process. Dyed samples were handed over to KVK staff for distributing to participants. On the second day, participants were given information about two technologies *viz:* 'Azolla for animal feed' and 'backyard poultry farming' by the KVK Narayangaon staff.

About 80 tribal people including many women participated in this programme. From CIRCOT, besides the Director Dr. S. K. Chattopadhyay, other personnel who participated were, Dr. Sujata Saxena, Er. Ashok

Kumar Bharimalla, Shri. R. R. Chhagani, Shri. S. V. Kokane, Dr. R. R. Mahangade and Shri R. S. Narkar. Besides, 16 KVK staff also participated.

Report of TSP programme of GTC, Nagpur

A four week skill development programme was organized for fourteen trainees belonging to different parts of Vidharbha, Maharashtra from February 26 to March 24, 2014. The group comprised of scheduled caste unemployed and underprivileged youths. They were imparted skill development on operation, maintenance and troubleshooting of machinery used in modern ginneries and was specifically aimed to equip them with skills to get job opportunities in cotton processing and by-product utilisation sectors.

The training was inaugurated by Dr. M. S. Kairon, former Director, CICR, Nagpur. Shri M. K. Sharma, President, M/s. Bajaj Steel Industries (BSI), Nagpur presided over the inaugural function and Shri G. H. Wairale, General Manager, Maharashtra Cotton Federation, Nagpur was the Guest of Honour. A leaflet titled "Skill Development Programme" at GTC under TSP was released by Dr. Pallavi Darade (IRS), Additional Commissioner, Tribal Development Commissionerate, Nagpur, during the occasion. .

In house lectures were given by the staff of GTC. Hands-on training were imparted at M/s. Bajaj Steel Industries, and M/s. Vinayak Ginning and Pressing Pvt. Ltd., Chimnajari, Nagpur. Training on the establishment of briquetting plant in rural areas for utilization of agro-residues were also given.

Training at Coimbatore

A demonstration for clean cotton picking was conducted on February 20, 2014 in collaboration with Sri Avinashilingam Krishi Vigyan Kendra, Coimbatore. Dr.P. Kumaravadivelu, Programme Coordinator and Head, Sri Avinashilingam Krishi Vigyan Kendra, Coimbatore was the Chief Guest. Dr. Sreenath Dixit, Zonal Project Director, Zone VIII (ICAR), Bangalore, in his inaugural address stressed the importance of clean cotton picking practices and the training programme imparted to the tribal farmers. Twenty-three farmers attended the training programme. He also released a booklet on Clean Cotton Picking Procedures in Tamil, prepared by Dr. S. Venkatakrishnan, Officer-in-charge, CIRCOT, Coimbatore. Dr. Usha Rani, Senior Scientist, CICR, Coimbatore distributed the kit to farmers and delivered a special address in Tamil regarding cotton cultivation and its economics for the benefit of tribal farmers. All the farmers were given demonstrations and lectures at the KVK cotton farm on the picking procedures. CIRCOT, Coimbatore unit and KVK staff were the resource persons for the training.

Training at Dharwad

The best harvest and post harvest management in cotton for value addition was conducted in association with Agricultural Research Station, Dharwad Farm, University of Agricultural Sciences, Dharwad on February 21, 2014. Cotton growing farmers belonging to scheduled tribes were identified with help of Department of Agriculture, GOK from three villages of Dharwad district, *viz.*, Mangalgatti, Kurubgatti and Lokur.

There were three sessions in the training. During the first, the farmers were given lectures followed by field session during which clean cotton picking methods, collection of clean picked cotton in the field in a cloth spread and filling this cotton to cloth bags were demonstrated to the farmers. Importance of each component of the kits was explained with demonstration of its wearing procedure.

Dr. I. S. Katageri, Professor of Genetics and Plant Breeding, stressed the importance of maintaining cotton, contamination free and its beneficial economics for farmers. He explained do's and dont's in cotton picking, storing and transporting from the field till the market. He also highlighted the importance of selecting proper varieties / hybrids suitable for the type of land and environment and based on their fibre qualities to get maximum profit. Balanced use of chemical fertilizers and pesticides were also stressed. Dr. S. B. Patil, Associate Professor of Entomology, explained the problems posed by various cotton pests and how they bring down the quality and yield of cotton. Information on Intergrated Pest Management was also given to the farmers. CIRCOT was represented by Dr. P. K. Madhyan, CTO, from headquarter and Smt. Vijayalaxmi Udikeri, Sr. Technical Assistant, CIRCOT unit, Dharwad who explained the various ways in which cotton gets contaminated while picking and after picking and discussed methods to prevent the same. The concluding session was honoured by the presence of Dr. B. M. Khadi, Director of Research and Dr. B. N. Patil, Associate Director of Research, UAS Dharwad as Chief Guests.

Training at Sirsa

An awareness programme for clean cotton picking and composting technology was demonstrated at the tribal village Subhash Nagar in Banswara District, Rajasthan on February 3, 2014. Fourty tribal farmers participated in the programme. The farmers were explained about the benefits of preparing compost from cotton stalks at their fields by Dr. Hamid Hasan, ACTO & In-charge, Sirsa Unit and Dr. Ranjeet Singh and Dr. G.L. Kothari from KVK, Banswara.

A demonstration *cum* awareness programme for the farmers of Bhilwara district in Rajasthan under ATMA and to some local farmers were organized at the Farmer's field at Shahpur Begu village, Sirsa on February

20, 2014. In all 35 farmers participated in the programme. The farmers were trained in the preparation of bioenriched compost from cotton stalk. They were also provided with information on agricultural practices with a view to enhance their income. Since most of them were marginal farmers, they were advised to prepare compost in groups. Resource person from CIRCOT was Dr. Hamid Hasan, ACTO, while, Shri Ram Ratan, Agricultural Development Officer, Dept. of Agriculture, Bhilwara (Rajasthan) and Shri Raja Ram, a progressive farmer of the same village were the other experts.

Field Demonstration for Clean Cotton Picking at GTC, Nagpur

In-Plant Training at M/s. Bajaj Steel Industries, Nagpur

6. LINKAGES AND COLLABORATION

The six Quality Evaluation Units of the institute are located within the premises of agricultural universities or other ICAR institutes and these serve as extension centres of the institute. The institute actively participates in the AICCIP meetings and provides feed-back to the breeders for improvement of cotton variety. The five quality evaluation units together with the Ginning Training Centre (GTC) at Nagpur and the Business Planning and Development (BPD) and Transfer of Technology Division (TTD) at the headquarters promote the technologies developed by the Institute and serve as windows for the technology transfer activities. The Institute has a strong linkage with other institutes like CICR, Nagpur, NIRJAFT, Kolkata, Indian Rubber Manufacturers' Research Association (IRMRA), Thane, Directorate of Water Management (DWM), Bhubaneswar, M/s. Kusumgar Corporates, Mumbai, under the National Agricultural Innovation Project (NAIP). Besides, the Institute also undertakes collaborative research programmes with other research bodies like the Navsari Agricultural University, Bombay Veterinary College, Department of Physics, IIT Madras, Institute of Chemical Technology (ICT) and even private organizations like M/s. Physics Instruments Co., Chennai.

The institute participates in various exhibitions and Kisan melas for propagating the technologies developed by the Institute.

The scientific community of CIRCOT officiates as resource persons in various committees and advisory panels of other academic and research institutions, such as SITRA, CCI, ICMF, CAI, etc. They participate in various seminars, symposia, conferences, workshops and training programmes. This serve as a platform for the exchange of their knowledge and expertise in different fields of research. Few scientists are experts in committees like the Technology Development Board (TDB) under the Department of Science and Technology (DST), for assessment of proposals for setting up/expanding cotton processing industry. Scientists are also invited by various organizations to deliver lectures as experts.

Regular training courses are conducted by the institute on Cotton Quality Evaluation including elementary statistics applicable to textile testing for personnel from the cotton trade and industry. At the Ginning Training Centre at Nagpur, theoretical and practical training skills are imparted on different aspects of ginning like maintenance of ginning machines, problem solving during various ginning operations, effect of clean cotton picking for better remuneration and utilization of biomass for preparing particle boards and briquettes. Tailor made courses are also organized both at the headquarters and in GTC, Nagpur depending on the need.

The technical expertise of the Institute is sought by the diversified stakeholders for queries related to cotton fibre, yarn, fabric etc. CIRCOT regularly brings out brochures and leaflets about various technologies /

processes developed for circulation in the public domain. The Institute undertakes consultancy services and contract research in specific areas for various individuals as well as for organizations.

Commercial Testing: The Institute undertakes commercial testing of cotton samples from trade and industries, educational institutes and state government bodies. Fibre, Yarn, Fabric and other miscellaneous tests are carried out generating significant revenue to the Institute. The details of commercial samples tested at CIRCOT, Mumbai during the period 2013-14 together with those of the previous plan periods are presented in table below.

DETAILS OF SAMPLES TESTED AT CIRCOT

Sr. No.	Type of Tests	Average during the X Plan (2002-03 to 2006 - 07)	Average during the XI Plan (2007-08 to 2011-12)	XII Plan	
				2012-13	2013-14
1.	Ginning, Fibre,Trash Content and Spinning	8438	3808	9000	10660
2.	Yarn	254	54	36	74
3.	Fabric	445	315	352	219
4.	Miscellaneous	516	210	388	191
	Total	9653	4387	9776	11144

Besides the above mentioned tests, special tests were carried out as per demand on samples received from private/government organizations and universities as listed below,

Sr. No.	Party's Name	Test
1	Anuradha Engg. College, Chikhli	Bursting strength
2	M/s. Bajaj Steel Industries, Nagpur	Linter
3	CIFE, Mumbai	AFM, SEM
4	College of Home Science, Mumbai	Colour Fastness

Sr. No.	Party's Name	Test
5	College of Veterinary and Animal Science, Thrissur	Free Gossypol content
6	M/s. Croda Chemicals (I) Pvt. Ltd., Navi Mumbai	TGA, Surface Tension
7	CSWRI, Avikanagar	Pilling
8	Delkon Textiles Pvt. Ltd., Faridabad	LOI
9	DKTE, Ichalkaranji	Kawabata
10	M/s. Dragon Sourcing, Mumbai	Moisture
11	M/s. ETCO Industries Pvt. Ltd., Parbhani	AFIS
12	Gogate Jogalekar College, Ratnagiri	SEM
13	M/s. Grasim Industries Ltd., Erode (TN)	Kawabata
14	Gurunanak Khalsa College, Mumbai	Lyophilization
15	M/s. Hanjer Biotech Energies Pvt.Ltd., Mumbai	Lignin
16	M/s. ICT, Mumbai	XRD, SEM,TGA
17	M/s. Indoco Remedies Ltd., Navi Mumbai	SEM
18	M/s. Ion Exchange, Navi Mumbai	AFM
19	M/s. IPCA Laboratories, Mumbai	SEM
20	M/s. Jalaram Ginning Factory, Ahmedabad	Paper
21	Kumarappa National Handmade Paper Institute, Jaipur	Instron
22	M. K. College of Pharmacy, Mumbai	Lyophilization
23	M/s. Watson Pharma Pvt. Ltd., Ambernath	SEM
24	M/s. Manjeet Cotton Pvt. Ltd., Aurangabad	Linter

Sr. No.	Party's Name	Test
25	Morarjee Textiles Ltd., Mumbai	Moisture Content
26	NIASM, Baramati, Pune	Particle size
27	M/s. Omya India Pvt. Ltd., Mumbai	SEM, XRD
28	Pratibha Syntex Ltd., Dhar (MP)	Kawabata
29	PSG College of Technology, Coimbatore	Kawabata
30	Pune Mahanagar Palika, Pune	Paper
31	R.A. Podar Medical College, Mumbai	Instron
32	M/s. Reliance Inspection Services, Mumbai	Moisture Content
33	M/s. Roha Dye Chem Pvt. Ltd., Mumbai	Lyophilization
34	M/s. S.B. Group of Textiles, Mumbai	Air Permeability Test
35	S.K.S.J.T. Institute, Bangalore	Kawabata
36	M/s. Shail Exports Pvt. Ltd., Mumbai	Protein content
37	SSM College, Komarapalayam (TN)	Kawabata
38	Technological Institute of Textile & Sciences, Bhiwani	LOI, FTIR, SEM
39	M/s. Trimurthy Stationery, Mumbai	Paper
40	VJTI, Mumbai	UPF, MMT
41	VJTI, Mumbai	Antibacterial activity

Exhibition and Publicity

Organized:

1. Awareness Meet / Business Meet on Calibration Cotton, Absorbent Cotton and Biogas Technology at Coimbatore on August 20, 2013.

2. Awareness Meet / Business Meet on Ginning Technology, Calibration Cotton and Linters at Guntur on September 19, 2013.

3. Exhibition organized during the visit of Dr. K.S. Rao, Hon'ble Union Minister for Textiles, and Smt. Panabakka Lakshmi, Hon'ble Union Minister of State for Textiles, Govt. of India to CIRCOT on October 11, 2013.

4. Entrepreneurship Development *cum* Awareness Programme on "Disintegration, Defibring of Husk, Segregation and Captive Retting of Coconut Fibre" at Mahila Kathya Kamgar Audyogic Co-operative Society Ltd., Vengurla, Maharashtra on December 5-6, 2013.

5. One day exhibition on " CIRCOT Technologies" for school and college students, on the occasion of National Science Day on February 28, 2014.

6. Awareness programme "Clean Cotton Picking" was conducted under Tribal Sub-Plan by CIRCOT Regional Station, Coimbatore on February 20, 2014.

7. Awareness programme on "Clean Cotton Picking" was conducted under Tribal Sub-Plan by CIRCOT Regional Station, Dharwad on February 21, 2014.

8. Awareness programme conducted at Krishi Vigyan Kendra, Narayangaon, Pune on "ICAR Flexi Check Dam Technology" and "Natural Dyes" under the Tribal Sub-Plan by CIRCOT, Mumbai on March 27 - 28, 2014.

9. Awareness programme at Krishi Vigyan Kendra, Banswara on "Clean Cotton Picking" was conducted under Tribal Sub-Plan by CIRCOT Regional Station, Sirsa on March 6, 2014.

Participation:

1. AGRITEX-2013 at HITEX Exhibition, Hyderabad on April 25-28, 2013.

2. Agriculture Exhibition in the "Kharif Farmers' Rally" organized by Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra on May 18, 2013.

3. Participated in the exhibition organised by NAIP on occasion of Agri-Tech Investors Meet at New Delhi on July 18 - 19, 2013.

4. Exhibition arranged by AgrInnovate India Ltd., New Delhi on October 19, 2013.

5. Kisan Mela and exhibition at Pimpri, Pune from December 11 – 13, 2013.

6. "Farm to Finish" expo organized by SIMA at CODISSIA Trade Fair Complex in Coimbatore from December 13 – 15, 2013.

7. Krishi Pradarshan at Baramati from January 18 - 20, 2014.

8. Krishi Vasant at Nagpur from February 9 – 13, 2014.

9. North East Agri Fair 2013 – 14 at Ranipool, Sikkim from February 25 - 27, 2014.

7. PUBLICATIONS

A. Annual Report

Annual report of the Central Institute for Research on Cotton Technology for the year 2012 - 2013 in English and Hindi

B. Research Publications

1. Shanmugam, N., Manisha Kurhade and Vivekanandan, M.V. – Banana Pseudostem Staple Fibre Spinning, Asian Textile Journal, Vol. 22, Issue 8, pp. 38-42, 2013.
2. Nath, J. M, Patil, P.G and Shukla, S.K - Instrumentation for Cotton Grading and Fibre Quality Evaluation - A Review, Cotton Research Journal, Vol.5 (2), pp. 17-33, 2013.
3. Patil P. G., Redij T. L., Sundaramoorthy, C., and Deshmukh P. S. - Economic Analysis of the Cotton Sector in the West and Central African Countries, Cotton Research Journal, Vol. 5 (2), pp. 57-70, 2013.
4. Arude, V. G., Manojkumar, T. S. and Shukla, S. K. - Development and Performance Evaluation of an Axial Flow Pre-Cleaners for on Farm Cleaning of Cotton, Cotton Research Journal, Vol. 5 (2), pp. 71-80, 2013.
5. Mageshwaran, V. and Kathe A. A.-Detoxification of Gossypol in Cottonseed Meal by Native Fungal Isolates under Solid State Fermentation, Cotton Research Journal, Vol. 5 (2), pp. 81 89, 2013.
6. Mageshwaran, V., Kathe, A. A. Ashtaputre, N. M, Hasan, H., Nagarkar, R. D., Pokiya, S. V. Kambli, N. D. and Balasubramanya, R. H. - Accelerated Process for the Preparation of Bioenriched Compost from Cotton Plant Stalks, Cotton Research Journal, Vol. 5 (2), pp. 104-113, 2013.
7. Lallan Ram, Dinesh Kumar, Vigneshwaran, N. and Archana Khewle - Effects of ZnO Nano Particle Containing Packaging on Shelf Life of Fresh Nagpur Mandarin *(Citrus reticulata Blanco)* Segments, Journal of Biological and Chemical Research, Vol. 30 (2), pp. 381 386, 2013.
8. Chattopadhyay, S. N., Pan, N. C., Roy, A. K., Saxena, S. and Khan, A. - Development of Natural Dyed Jute Fabric with Improved Colour Yield and UV Protection Characteristics, Journal of the Textile Institute, Vol. 104 (8), pp. 808-818, 2013.

9. Ambare, M. G., Nagarkar, R. D., Nachane, R. P. and Gurjar, R. M. - Changes in Properties of Paper on Exposure to Sunlight, Indian Pulp and Paper Technical Association (IPPTA J.), Vol. 25 (2), pp. 105-108, April- June- 2013.

10. Nair, A. U., Sheela, R., Vivekanandan M. V., Patwardhan B. A. and Nachane R. P. - Studies on Friction in Cotton Textiles: Part I - A Study on the Relationship between Physical Properties and Frictional Characteristics of Cotton Fibres and Yarns, Indian Journal of Fibre & Textile Research Vol. 38, pp. 244-250, Sept. 2013.

11. Banerjee, D., Chattopadhyay S. K., Chatterjee, K., Tuli Suneet, Jain N., Goyal I., Mukhopadhayay S. - Non-destructive Testing of Jute-polypropylene Composite using Frequency-Modulated Thermal Wave Imaging, Journal of Thermoplastic Composite Materials, May 2013, online publication.

12. Banerjee D., Chattopadhyay S. K. and Tuli Suneet - Infrared Thermography in Material Research - A Review of Textile Applications, Indian Journal of Fibre & Textile Research Vol. 38, pp. 427-437, December 2013.

13. Nath, J. M., Patil P. G., Shukla S. K. and Arude, V. G. - Gin Management Programme for Simulation of Cotton Cost: A Review 2013. Cotton Research Journal, Vol. 5(2), pp. 1-16.

14. Arude V. G., Obi Reddy, G. P., Chattopadhyay, S. K. - Development of GIS and GPS based spatial Cotton Fibre Quality Maps for Nagpur district of Maharashtra, Journal of Cotton Research and Development, Vol. 28. No.2, pp. 40-44, 2014.

15. Arude V. G., Manojkuamr T. S. and Chattopadhyay, S. K. - Development and Performance of Self-grooving Rubber Roller for use in Roller Ginning Machines, International Proceedings of Chemical Biochemical, Biological & Environmental Engineering. Vol. 64, pp.76-81, 2014.

C. Popular Article

1. Basak, S., Saxena, S., Arputharaj, A., Samanta, K. K., Mahangade, R. R. and Narkar, R. S. - Textiles for Health and Well Being, Textile Trends-June, Vol. 56 (3), pp. 25-29, 2013.

2. Patil, P. G., Gurjar, R.M. and Jadhav, P. D. - Present Status and Market Potential for Cotton Stalk Composite Boards in India, Cotton Research Journal, Vol. 5 (2), pp. 90-103, 2013.

3. Guruprasad R. and Chattopadhyay S. K., - Indian Cotton and the Needs of Spinning Industry, Cotton Research Journal Vol. 5 (2) pp. 215-221, 2013.

D. Papers presented in Conferences / Seminar

1. Asim Shaikh, Kathe, A.A. and Mageshwaran, V. – Reduction of Gossypol and Increase in Crude Protein Level of Cottonseed Cake using Mixed Culture Fermentation, Oral presentation at the 5th International Conference on Fermentation Technology for Value Added Agricultural Products held during August 21 - 23, 2013 at Khon Kaen, Thailand.

2. Chitranayak - Quality Evaluation and Spinning Potential of AICCIP Cotton Breeding Trials, presented at the Annual AICCIP Workshop held during April 8-10, 2013 at Udaipur.

3. Kartick K. Samanta - Surface Modification of Textile Using Plasma to Improve Adhesion Strength of Composite Material presented at the International Conference on Reinforced Plastics (ICERP-2013) held during April 4-6, 2013 at Mumbai.

4. Joshi, K. R. - *Aaj ke Badalte Parivesh Mein Rajbhasha* Hindi presented at the 74th Sangoshti Evam Hindi Kaaryashala held during April 24 - 26, 2013 at Solan, Himachal Pradesh.

5. Patil, P. G. – Cotton Contamination: Indian Scenario, presented at National Seminar on Advances in Cotton Ginning and Fibre Testing Technology organized by IFS and CIRCOT on February 1, 2014 at CIRCOT.

6. Patil, P. G – Ginning and Post Harvest Technology presented at the Industry Interaction on Exploring Opportunities for Enhancing Business Partnership in Cotton and Textile Sector in Africa organized by IL & FS held on March 7, 2014 at New Delhi.

7. Guruprasad, R. and Chattopadhyay S. K. – Angora Rabbit Hair Fibres: Production, Properties and Product Development, Textile Review, Texcellence '13 Conference Special Issue, May, 2013.

8. Mageshwaran, V. - Biodegradation of Gossypol in Mineral Medium by Fungal Cultures presented at the Conference on Biotechnology, Bioinformatics and Bioengineering held on June, 28-29, 2013 at Tirupati, Andhra Pradesh.

9. Dey, S.K. and Chattopadhyay, S.K. – Ramie a Natural Miracle Fibre for Woven and Knitted Textiles, Oral presentation at the International Conference organized by AATCC in Collaboration with TecniTex Nonwovens, Pvt. Ltd. on September 2, 2013 at Bengaluru.

10. Mageshwaran, V., Kathe, A.A., Shaikh, A. and D'souza Charlene. 2013 - Fermentation on Different Substrate to Improve Nutritional Value as Non-Ruminant Feed Supplement at the

54th Annual Conference held during November 17-20, 2013 at Haryana.

11. Chattopadhyay, S. K., Guruprasad, R. and Bindu Venugopal, - Futuristic Textiles Using Newer Blends of Cotton in the Proceedings of the Indian Cotton Conference 2013 organised by the Northern India Cotton Association Ltd., Bhatinda, Punjab on November 30, 2013.

E. Other Publications

1. CIRCOT News Vol. 15(2) October 2012 - March 2013
2. CIRCOT Leaflet No.72 – Nurturing Technologies to Grow as Business Endavours.
3. CIRCOT Leaflet No. 73 – Synthesis of Monodisperse Nano-Zinc oxide Particles by a Newer Chemical Route.
4. CIRCOT Leaflet No. 74 –Business Incubation Facility to Textile Entrepreneurs.
5. CIRCOT Leaflet No. 75 – Nanocellulose Production: Eco-friendly and Energy Efficient CIRCOT Technologies.
6. CIRCOT Leaflet No. 76 – Business Incubation Facility for Agropreneurs: A Pilot Plant for Manufacturing Particle Board from Cotton Stalk.
7. CIRCOT Leaflet No. 77 – Microbiological Testing Services for Textiles.
8. CIRCOT Leaflet No. 78 – Biogas from Textile Mill Waste.
9. CIRCOT Leaflet No. 79 – Cotton Linter.
10. CIRCOT Leaflet No. 80 – CIRCOT Calibration Cotton
11. CIRCOT Leaflet No. 81 – Cotton Processing Technology Developed by CIRCOT
12. Shweta Sarinika, Issue 2, Vol. 34, October 2012 – March 2013.
13. CIRCOT Leaflet No. 82- CIRCOT's Absorbent Cotton Technology for Absorbent Cotton Production
14. CIRCOT Leaflet No. 83 - Appropriate Technology for Indian Ginning Industry.
15. CIRCOT Leaflet No. 84 - *Kachra Rahit Swacha Evam Uttam Gunavattayukt Kapaas ka Utpaadan Aham Sujav*
16. CIRCOT Leaflet No. 85 - *Uttar Bharat mein Kapaas ki Sadhan Kheti mein Utpaadan va*

Gunvatta Badhane ke Tarike

17. CIRCOT Leaflet No. 86- CIRCOT's Small Machines for use by Cotton Farmers for Seed Purpose CLOY Gin and Acid Delinting Machine

18. CIRCOT Leaflet No. 87- CIRCOT's Better Management Practices for Contaminant Free Cotton

19. CIRCOT Leaflet No. 88- Utilization of Cotton Stalk for the Preparation of Particle Board – CIRCOT's Technology

20. CIRCOT Leaflet No. 89- Flexi Check Dam (Rubber Dam) Developed from Textile-Rubber Composite: A Novel Agrotextile Application

21. CIRCOT Leaflet No. 90- On Farm Seed Cotton Cleaning Machine (Axial Flow Pre-cleaner) CIRCOT's Technology

22. CIRCOT Leaflet No. 91- Accelerated Process for Composting of Cotton Stalk – CIRCOT's Viable Solution for Additional Income to Farmers and Soil Fertility Management

23. CIRCOT Leaflet No. 92- CIRCOT Mini Card for Sliver Production at Village Level

24. CIRCOT Leaflet No. 93- Alternative Uses of Cotton Stalks for Enhancing Farmer Income – CIRCOT's Approach

25. CIRCOT Leaflet No. 94- Machines for Cleaning of Mechanically Harvested Cotton – CIRCOT's Technologies

26. CIRCOT Leaflet No. 95- A Farmers Training Course on Cotton Quality Attributes, Value Addition and By-Product Utilization

27. CIRCOT Leaflet No. 96- Benefits of Cotton Value Chain to Farmers – A Case Study by CIRCOT

28. CIRCOT Leaflet No. 97- Value Addition to Crop By-Products by Use as Textile Dye – CIRCOT's Technology

29. CIRCOT Leaflet No. 98- CIRCOT's small machines for use by cotton farmers for seed purpose CLOY Gin and Acid Delinting Machine (Hindi)

30. CIRCOT Leaflet No. 99- CIROCT's Better Management Practices for Contaminant Free

Cotton (Hindi)

31. CIRCOT Leaflet No. 100- CIRCOT's Absorbent Cotton Technology for Absorbent Cotton Production (Hindi)

32. CIRCOT Leaflet No. 101- Utilization of Cotton Stalk for the Preparation of Particle Board – CIRCOT's Technology (Hindi)

33. CIRCOT Leaflet No. 102- Flexi Check Dam (Rubber Dam) Developed from Textile-Rubber Composite: A Novel Agrotextile Application (Hindi)

34. CIRCOT Leaflet No. 103- On Farm Seed Cotton Cleaning Machine (Axial Flow Pre-cleaner) CIRCOT's Technology (Hindi)

35. CIRCOT Leaflet No. 104- Accelerated Process for Composting of Cotton Stalk – CIRCOT's Viable Solution for Additional Income to Farmers and Soil Fertility Management (Hindi)

36. CIRCOT Leaflet No. 105- CIRCOT Mini Card for Sliver Production at Village Level (Hindi)

37. CIRCOT Leaflet No. 106- Alternative Uses of Cotton Stalks for Enhancing Farmer Income – CIRCOT's Approach (Hindi)

38. CIRCOT Leaflet No. 107- Machines for Cleaning of Mechanically Harvested Cotton – CIRCOT's Technologies (Hindi)

39. CIRCOT Leaflet No. 108- A Farmers Training Course on Cotton Quality Attributes, Value Addition and By-Product Utilization (Hindi)

40. CIRCOT Leaflet No. 109- Benefits of Cotton Value Chain to Farmers – A Case Study by CIRCOT (Hindi)

41. CIRCOT Leaflet No. 110- Value Addition to Crop By-Products by Use as Textile Dye – CIRCOT's Technology (Hindi)

42. CIRCOT Leaflet No. 111 - CIRCOT's Small Machines for use by Cotton Farmers for Seed Purpose CLOY Gin and Acid Delinting Machine (Marathi)

43. CIRCOT Leaflet No. 112 - CIRCOT's Better Management Practices for Contaminant Free Cotton (Marathi)

44. CIRCOT Leaflet No. 113 - CIRCOT's Absorbent Cotton Technology for Absorbent Cotton

Production (Marathi)

45. CIRCOT Leaflet No. 114 - Utilization of Cotton Stalk for the Preparation of Particle Board – CIRCOT's Technology (Marathi)

46. CIRCOT Leaflet No. 115 - Flexi Check Dam (Rubber Dam) Developed from Textile-Rubber Composite: A Novel Agrotextile Application (Marathi)

47. CIRCOT Leaflet No. 116 - On Farm Seed Cotton Cleaning Machine (Axial Flow Pre-cleaner) CIRCOT's Technology (Marathi)

48. CIRCOT Leaflet No. 117 - Accelerated Process for Composting of Cotton Stalk – CIRCOT's Viable Solution for Additional Income to Farmers and Soil Fertility Management (Marathi)

49. CIRCOT Leaflet No. 118 - CIRCOT Mini Card for Sliver Production at Village Level (Marathi)

50. CIRCOT Leaflet No. 119 - Alternative Uses of Cotton Stalks for Enhancing Farmer Income – CIRCOT's Approach (Marathi)

51. CIRCOT Leaflet No. 120 - Machines for Cleaning of Mechanically Harvested Cotton – CIRCOT's Technologies (Marathi)

52. CIRCOT Leaflet No. 121 - A Farmers Training Course on Cotton Quality Attributes, Value Addition and By-Product Utilization (Marathi)

53. CIRCOT Leaflet No. 122 - Benefits of Cotton Value Chain to Farmers – A Case Study by CIRCOT (Marathi)

54. CIRCOT Leaflet No. 123 - Value Addition to Crop By-Products by Use as Textile Dye – CIRCOT's Technology (Marathi)

55. CIRCOT Leaflet No. 124 – CIRCOT Study on Cotton Baling Press (Energy Consumption and Cost Economics)

56. Booklet on Advanced Fibre Information System (AFIS): Basics, Measurement Principle and Applications

57. Leaflet on Best Harvest & Post Harvest Management Practices in Cotton for Value Addition (Kannada)

8. IRC, RAC AND IMC MEETINGS

Institute Research Council (IRC) Meeting

The One Hundred and Thirteenth Institute Research Council Meeting was held on June 3-5, 2013 to discuss the core area-wise progress of research during April 2012 – March 2013.

Half-yearly Institute Research Council (IRC) Meeting

A Half-yearly IRC meeting was held on October 28 & 29, 2013 to discuss the progress of research during April – September 2013. The following four new projects were approved in different core areas with suggestions/recommendations in the project proposals.

Core Area II : Mechanical Processing, Technical Textiles and Composites

Composite from Waste Material

Core Area IV : Chemical and Biochemical Processing and Biomass and By-Product Utilisation

1. Multifunctional Durable Finishing of Apparel Grade Cotton Fabrics with nano ZnO
2. Low Temperature Technology for Preparation of Absorbent Cotton for Decentralized Sector

Core area V: Entrepreneurship and Human Resource Development

Marketing and Widening the Customer base of CIRCOT Calibration Cotton

Institute Management Committee Meeting (IMC)

The Seventy-fourth meeting of the Institute Management Committee were held on July 20, 2013. Confirmation of the minutes of the previous meeting and action taken on the recommendations of the previous meeting were discussed. The Heads of Divisions presented the progress of research made in the various core areas. The progress of works and the report on the Official Language Implementation were discussed in the meeting.

Dr. K.K. Singh, ADG (PE) releasing Annual Report for 2012-13

Dr. S. Sreenivasan, former Director, CIRCOT delebrating during the meeting

Research Advisory Committee (RAC) Meeting

The XX Research Advisory Committee has been newly constituted by the Council for a term of three years from 16.1.2014 (upto 15-1-2017) with the following members. The two members earlier nominated by the Agricultural Minister will continue in this committee upto August 2014. Apart from this, Director, CIRCOT and ADG (PE) will be the members in this Committee.

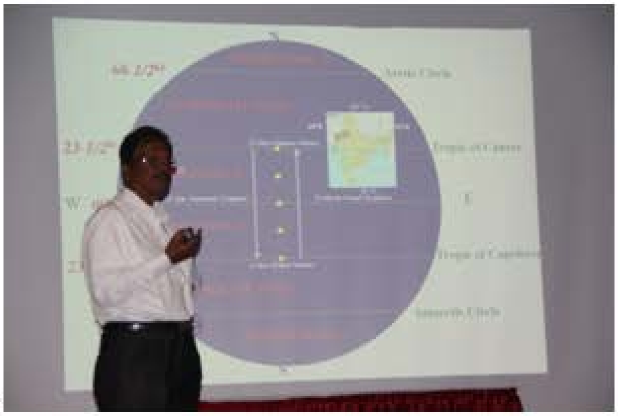
1	Dr. P. R. Roy, Consultant for various Textile Mills Field : Textile Technology	Chairman
2	Dr. A. Wadood, Professor & Chief Scientist, Birsa Agricultural University, Ranchi Field : Physics/Agricultural Physics	Member
3	Dr. U. S. Sarma, Adviser (R&D) & Former Director, Central Coir Research Institute, Ministry of MSME, Govt. of India, Kalavoor (P.O.), Alleppey (Distt.) Field : Organic Chemistry	Member
4	Dr. G. S. Nadiger, Research Adviser (BTRA) and Former Director of Laboratories (Textile Committee), Mumbai Field : Textile Chemistry (Nano & Plasma)	Member
5	Dr. (Mrs.) Niyati Bhattacharyya, Former Head, Deptt, of Textiles, SNDT Women's University, Mumbai and Former Sr. Scientific Officer, BTRA, Mumbai Field : Textile Processing, Dyeing and Finishing	Member
6	Dr. Y.S. Nerkar, Former Vice Chancellor, Mahatma Phule Krishi Vidyapeeth, Rahuri and Director, (Agricultural Research & Extension), Vasantdada Sugar Institute, Pune	Nominee of Hon'able Agricultural Minister
7	Shri Mani Chinnaswami, Progressive farmer and CEO, Appachi Cotton Pollachi Tamil Nadu	-”-

The Twentieth meeting (first meeting of the newly constituted committee) of the Research Advisory Committee (RAC) was held on March 21 and 22, 2014 to review the progress of research work during 2013-14 and to guide the institute in matters pertaining to the future thrust areas of research. The meeting also reviewed the Action Taken on the Recommendations of the QRT and the XIX RAC.

Two Institute publications, *viz.* **Advanced Fibre Information System (AFIS): Basics, Measurement Principle and Applications and CIRCOT Study on Cotton Bale Press - Energy Consumption and Cost Economics** were released by Dr. P. R. Roy, the Chairman of the RAC along with the other members.

Release of Institute Publications

On the concluding day, *i.e.* on March 22, 2014, Dr. A. Wadood, Member RAC delivered a lecture on Global Climate Change: Causes, Consequences & Solutions.



Dr. A. Wadood, Member RAC delivering his lecture

9. PARTICIPATION OF PERSONNELS IN CONFERENCES AND SEMINARS

Director, Scientists and Technical Personnel of CIRCOT participated in the following scientific/technical conferences and seminars besides attending meetings connected with the work of the Institute.

Sr. No.	Meetings / Conference / Seminar / Symposia etc.	Place	Date	Participant/s
1.	International Conference on Reinforced Plastics (ICERP- 2013)	Mumbai	04-04-2013 to 06-04-2013	Dr. Kartick Kumar Samanta
2.	Annual group meeting-2013 All India Coordinated Cotton Improvement Project	Udaipur	08-04-2013 to 10-04-2013	Dr. S. K. Chattopadhyay Dr. N. Shanmugam Shri Chitranayak Dr. Hamid Hasan Dr. R. D. Nagarkar Shri R. K. Jadhav Shri D. N. Moon
3.	Conference on "Fire Safety with Polymers"	Mumbai	19-04-2013	Dr. Kartick Kumar Samanta Shri Santanu Basak
4.	Workshop on Structural Audit & Jirnodhara Upgrading	Mumbai	20-04-2013	Shri S. N. Patil
5.	74th Seminar and Hindi Workshop	Solan	24-04-2013 to 26-04-2013	Shri Sunil Kumar Smt. K. R. Joshi
6.	Workshop on INDIA Nonwovens & Geotextiles Training	Mumbai	21-05-2013 to 23-05-2013	Dr. R. Guruprasad
7.	24th Hindi Seminar & Workshop	Kanyakumari	22-05-2013 to 24-05-2013	Smt. K. R. Joshi
8.	41st Joint Agricultural Research and Development Meeting	Parbhani	29-05-2013 to 31-05-2013	Dr. P. G. Patil

Sr. No.	Meetings / Conference / Seminar / Symposia etc.	Place	Date	Participant/s
10.	Pre-commercialization workshop on Flexi Check Dam (Rubber Dam) made of Textile -Rubber Composite for Watershed Application	Mumbai	30-05-2013	Staff of CIRCOT
11.	National Workshop on "Natural Dyes and Textile Industry"	Hyderabad	15-06-2013 and 16-06-2013	Dr. (Smt.) Sujata Saxena
12.	MDP Workshop on PME of Agricultural Research Projects	Hyderabad	18-06-2013 to 22-06-2013	Dr. (Smt.) Sujata Saxena
13.	Conference on Biotechnology Bioinformatics and Bioengineering	Tirupati	28-06-2013 to 29-06-2013	Dr. V. Mageshwaran
14.	National Conclave for Laboratories on the Theme "Innovative Practices in Laboratory Management	Bengaluru	16-09-2013 and 17-09-2013	Shri. R. S. Prabhudesai Shri. R. R. Chhagani Dr. R. R. Mahangade
15.	Workshop on NFBSFARA	Mumbai	27-09-2013 and 28-09-2013	Shri Arputharaj Dr. R. Guruprasad Shri Santanu Basak
16.	International Conference on Advances in Fibres, Finishes, Technical Textiles and Non-Wovens (AFFTTN)	Mumbai	01-10-2013 and 02-10-2013	Dr.(Smt.) Sujata Saxena Dr. Syamal Kumar Dey Er. V. G. Arude Dr. R. Guruprasad
17.	Techtextil INDIA Symposium - 2013 on Technical Textiles & Nonwovens	Mumbai	04-10-2013 and 05-10-2013	Dr. Syamal Kumar Dey

Sr. No.	Meetings / Conference / Seminar / Symposia etc.	Place	Date	Participant/s
18.	Data Digitilisation	Mumbai	23-10-2013	Shri M. Mohan Dr. M.V. Vivekanandan Shri Sunil Kumar Shri S.V. Kasabe Smt. T.P. Mokal Smt. S.M. Desai Shri P.V. Jadhav
19.	World Agricultural Forum Congress - 2013	Hyderabad	04-11-2013 to 07-11-2013	Dr. Syamal Kumar Dey
20.	Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR	Mumbai	02-12-2013	Shri V.M. Sable
			06-12-2013 and 07-12-2013	Dr. P.G. Patil Shri R.M. Gurjar Dr. (Smt.) Sujata Saxena, Dr. N. Shanmugam Dr. A.S.M. Raja Dr. N. Vigneshwaran Dr. S.K. Shukla Dr. (Smt.) Jyoti Mintu Nath Dr. Virendra Prasad
			09-12-2013 to 10-12-2012	Dr. Syamal Kumar Dey Shri V.G. Arude Shri Ashok Kumar Bharimalla Shri P.S. Deshmukh Shri Manik Bhowmick Shri A. Arputharaj Dr. Kartick Kumar Samanta Dr. R. Guruprasad Shri G.T.V. Prabhu
			11-12-2013 and 12-12-2013	Shri C. Sundaramoorthy Dr. Mageshwaran V. Shri G. Krishna Prasad

Sr. No.	Meetings / Conference / Seminar / Symposia etc.	Place	Date	Participant/s
				Shri T. Senthilkurnar Shri Shekhar Das Shri Santnu Basak Shri P. Jagajanantha Shri M. Mohan Dr. M.V. Vivekanandan
22.	National Seminar on Prospects in Improving Production, Marketing and Value Addition of Carpet Wool	Bikaner	31-12-2013	Dr. S. K. Chattopadhyay Dr. A. S. M. Raja Dr. S. K. Dey
23.	National Seminar on "Advances in Cotton Ginning & Fibre Testing Technology"	New Delhi	01-02-2014	Dr. P. G. Patil
24.	2nd National Seminar on "Standards in Technical Textiles: Role of Standardization in Health, Safety and Environment	Mumbai	25-02-2014	Dr. S. K. Chattopadhyay
25.	Sensitization-*cum*-Training Workshops on IPv6	New Delhi	27-02- 2014	Dr. M.V. Vivekanandan
26.	International Workshop on Natural Dyes 2014	Hyderabad	05-03-2014 to 07-03-2014	Dr. Smt. Sujata Saxena Dr. A. S. M. Raja

10. EVENTS AT CIRCOT

Pre-commercialisation Workshop on Flexi-Check dam (Rubber Dam) made of Textile-Rubber Composite for Watershed Application

A one day Pre-commercialisation Workshop on Flexi-Check dam (Rubber Dam) made of Textile-Rubber Composite for Watershed Application was held at CIRCOT on May 30, 2013. Dr. S.K. Chattopadhyay, Director, CIRCOT delivered the welcome address and Dr. S.K. Jena, Principal Scientist, Directorate of Water Management (DWM) gave the introductory address. Dr. A.N. Desai, Director, BTRA was the Special Guest and Dr. M.S. Kairon, former Director, CICR, Nagpur was the Guest of Honour. Shri Suresh Kotak, Chairman, Kotak Ginning & Pressing Industries Ltd., Mumbai was the Chief Guest of the function.

Dr. M.K. Talukdar, Vice President, M/s. Kusumgar Corporates, Mumbai and Co-PI of the NAIP project gave a talk on the Design and Development of Rubber Dams for Watersheds, apart from the addresses by Dr. P. Thavamani, Director, Indian Rubber Manufactures Research Association (IRMRA) and Dr. A. Kumar, Director, Directorate of Water Management, Bhubaneshwar.

There were three technical sessions *viz.* on the use of Flexi Check Dam (Rubber Dam) for Agricultural purposes, Requirements for making Rubber Composites used for Flexi Check Dam and Importance of Check Dam for Enhancing Agricultural Productivity. The programme ended with a fruitful discussion with the stakeholders.

Shri Suresh Kotak inaugurating the workshop

Peer Group Meet for Finalising CIRCOT Vison 2050

A One-day Meeting was organized at CIRCOT on July 09, 2013 at Dr. V. Sundaram Committee Room as per the directives of the Council for getting the inputs/suggestions from the local RAC Members and a Peer Group of Experts for appropriate modifications to be incorporated in the Draft Document of Vision 2050 of CIRCOT. The meeting was Chaired by Dr. R.P. Kachru, Former ADG of ICAR and the Chairman of RAC and attended by experts like Dr. K. R. Krishna Iyer (Member, RAC), Dr. S. Sreenivasan and Dr. A. J. Shaikh (all Former Directors of CIRCOT), Dr. R. H. Balasubramanya (Former Head, CBPD), besides other Scientists and Technical Officers. It was decided that the chapter on Challenges may be dealt under three categories *viz.*, Short Term Challenges (2013-2025), Medium Term Challenges (2026-2040) and Long Term Challenges (2041-2050). Also, in each of the three above categories not more than three challenges on priority to be included.

Sensitization Meet on Agri-Business Management

A Sensitization Meet on Agri-Business Management was held at Dr. V. Sundaram Committee Room on July 27, 2013 for sensitizing the scientists and ZTM-BPD staff on various issues related to Intellectual Properly and Technology Management and also on Agrinnovate India Limited, a company established to promote the development and spread of R&D outcomes through IPR protection and commercialization. Dr. Sanjeev Saxena, Principal Scientist, IP & TM Unit, ICAR was the expert speaker for the occasion. He delivered a talk on Challenges in Setting Partnerships among Industry and Public Sector.

Dr. Sanjeev Saxena Delivering a Talk

Business Development Programme on CIRCOT's Calibration Cotton, Absorbent Cotton and Biogas Technologies

The Zonal Technology Management and Business Processing & Development Unit (ZTM-BPD) of CIRCOT in collaboration with Sardar Vallabhbhai International School of Textiles & Management (SVPISTM), an autonomous institute under the Ministry of Textiles (Govt. of India) organized an one-day business development programme on **CIRCOT's Calibration Cotton, Absorbent Cotton and Biogas Technologies,** on August 20, 2013 at SVPISTM to improve the visibility & penetration of CIRCOT'S technologies among the stakeholders of Southern Region of India.

Dr. S.K. Chattopadhyay, Director, CIRCOT in the welcome address highlighted the activities of CIRCOT during the last eight decades, its role in improving the status of cotton & other natural fibres and about the opportunities for CIRCOT's Technologies among the business communities. Dr. N. Vigneshwaran, Senior Scientist and Co-PI of ZTM-BPD Unit of CIRCOT briefed about the role of this Unit in fostering the technology transfer, business incubation and commercialization activities among the budding entrepreneurs and industrialists.

Dr. K. Selvaraju, Secretary General of The Southern India Mill's Association (SIMA), Coimbatore was the Chief Guest of the programme. He highlighted the issues related to cotton and also explained about various dimensions and problems in textile industry supported by statistical data and informed that these issues are being taken up at the highest level by SIMA.

The thematic address was delivered by Prof. Russel Timothy Robert, Director, SVPISTM who highlighted the issues related to current scenario in textile industry, its relevance to this programme and also a brief about the mandated activities of the institute. The inaugural session concluded with a vote of thanks by Prof. Raj Kumar Ranganathan, SVPISTM.

The Chief Guest released a publication titled **An Overview of CIRCOT HVI Calibration Cotton Standards and Guidelines for Testing.**

There were three technical sessions, viz. Calibration Cotton, Absorbent Cotton and Biogas & Biomanures.

Dr. S.K. Chattopadhyay, Director, CIRCOT inagurating the Business Development Programme on CIRCOT's Calibration Cotton, Absorbent Cotton and Biogas Technologies

A Business Meet on Cotton Processing Technologies related to Ginning, Linter and Calibration Cotton

The meet was organised by the ZTM & BPD unit of CIRCOT, Mumbai and the Regional Unit of CIRCOT, Guntur on September 19, 2013 at A.P. Cotton Association Conference Hall, Guntur, Andhra Pradesh. The programme was inaugurated by Shri G. Punnaiah Choudhary, Chairman, M/s. A.P Spinning Mills Association. The meet was attended by Shri K. Haranadha Reddy, Chairman, Kallam Group of Industries, Shri Nageswara Rao, President, A.P Cotton Association, Dr. S.K. Chaturvedi, Dy. General Manager, CCI, Dr. Chenga Reddy, Principal Scientist (Cotton), ANGRAU, Dr. R. Veera Raghavaiah, Associate Director of Research (KZ) and Dr. S.K. Chattopadhyay, Director, CIRCOT, and other dignitaries from industry and institutes. A publication on **CIRCOT Calibration Cotton, Cotton Linter** and **Cotton Processing Technology developed by CIRCOT** was released during the inaugural session.

The aim of the programme was to create awareness about CIRCOT calibration cotton, Ginning and Linter technologies and sensitise the relevant stakeholders regarding its commercialization. The programme was attended by around 80 delegates from ginning & spinning industries, cotton associations, research institutes, farming and trading community. The scientists and technical officers of CIRCOT made their technical presentations followed by group discussion. The programme was well appreciated by the stakeholders, who provided their instantaneous positive feedback.

Publication being released during the Meet

Official Language Celebration

The Hindi Chetana Mass (Month) was celebrated during September 7-30, 2013. Dr. Vanmaali Chaturvedi, Renowned Poet & Author, and Shri Pawan Tiwari, Journalist were the Chief Guest at the inaugural function on Sept 7, 2013. Various competitions were organized during this period in which staff members participated enthusiastically. The concluding function was held on September 30, 2013 with the successful organization of a "Kavi Sammelan" in which nine established as well as budding poets participated and enthralled the gathering.

Official Language Hindi Celebration

Vigilance Awareness Week

Vigilance Awareness Week was celebrated at the Institute from October 28 to November 2, 2013. Dr. S. K. Chattopadhyay, Director CIRCOT administered the Vigilance Oath to the staff members on October 28. An essay competition on the topic, 'Promoting Good Governance - Positive Contribution of Vigilance' was held on October 30, 2013 in Hindi, Marathi and English. On the concluding day, Shri S.S. Giri, Additional Superintendent of Police, CBI, delivered a talk on the same topic and distributed the prizes to the following winners of the essay competition, in Hindi - Smt. N. M. Deshmukh, in Marathi - Shri S. N. Bandre and in English - Shri Anand Jadhav and Smt. V. V. Desai.

Communal Harmony Week

Communal Harmony week was celebrated in the Institute from November 19 - 25, 2013. On the concluding day, the Flag Day was celebrated. A patriotic song singing competition was also held and the Guest of Honour, Shri Ratnakar Ahire, Training Superintendent of Dairy Development Department, Government of Maharashtra distributed the prizes to the following winners, 1st prize - Smt. Prachi Mhatre, 2nd prize - Shri Sudhakar Chandanshive, 3rd prize - Shri Hasmukh Vesmiya.

CIRCOT Foundation Day

CIRCOT celebrated its 90th Foundation Day on December 3, 2013. Dr. K. K. Singh, ADG (PE) was the Chief Guest and Captain Vijay Bhushan Gulati was the Guest of Honour. Dr. S. K. Chattopadhyay, Director in his welcome speech gave a overall achievements and progress made in research and other developmental activities of the institute. He also congratulated the staff both present and past which have made this possible. Dr. K. K. Singh, ADG (PE) also congratulated everyone and praised the activities being carried out at the institute. Captain Vijay Bhushan Gulati son of former scientist Amarnath Gulati presented a slide show which refreshed the old memories of the institute. Shri Ashok Kumar Bharimalla, Chairman, Foundation Day Committee and PI, ZTM, BPD explained in short about the activities of the unit and expressed the institute meritorious achievement in receiving the best BPD unit award. Former Directors, Dr. Krishna Iyer, Dr. S. Sreenivasan and Dr. A. J. Shaikh shared their memories and their experiences and stories about the institute. Many of the retired employees also participated in lighting the memory lane. The function was a grand success. It will be cherished forever by CIRCOTians since about 40 retired staff of CIRCOT also attended the programme. Children of CIRCOT Employees who excelled in their Secondary and Higher Secondary Examinations were felicitated. A cultural programme was also organized on the occasion.

Capt. V B Gulati addressing the gathering on the occasion of CIRCOT Foundation Day Celebration

One Day Training-cum-Workshop on Extraction and Application of Natural Dyes

A one day hands on Training-cum-Workshop on Extraction and Application of Natural Dyes was organized at CIRCOT on January 23, 2014 for the students of fashion designing on the vast possibilities offered by Natural Dyes in colouration of textile. Besides, a general introduction on the technique, mordanting, dye extraction and application procedures have been covered in the workshop. Handouts to explain about various natural dyeing processes with common dyes have been provided to all the participants.

Entrepreneurship Development Programme on "Disintegration and Defibring of Husk, Segregation and captive retting of coconut fibre" at Mahila Kathya Kamgar Audyogic Sanstha, Vengurla, Maharashtra

An Entrepreneurship Development Programme on "Disintegration, Defibring of Husk, Segregation and Captive Retting of Coconut Fibre" was organized by ZTM – BPD Unit of CIRCOT under NAIP component II, Sub project – A Value and better marketability to enhance the economic returns of farmers at Mahila Kathya Kamagar Audyogic at Vengurla, Maharashtra on December 5 – 6, 2013. The programme was conducted to highlight the tremendous possibility available to entrepreneurs especially women to utilize the research methodologies developed in coconut fibre processing to improve the livelihood of the women in the rural area. A booklet/ pamphlet entitled "Disintegration Defibring of Husk, Segregation and captive retting of coconut fibre" was released by Dr. K. K. Satapathy, Chief Guest & Former Director NIRJAFT, Kolkata. The programme also received the attention of media. The clippings of the programme were published in three daily newspapers namely Tarun Bharat, Lokmat and Prahar on December 7, 2013. The technical session held on December 6, 2013 was also telecasted on television channels like DD Marathi and Zee 24 Taas on December 8, 2013.

Entrepreneurship Development Programme at Vengurla

NAIP Cross Cutting Workshop on 8 October, 2013

Business Development Programme Conducted at Bhatinda, Punjab

EDP on Absorbent Cotton held at CIRCOT on 25-26 September 2013

Training cum workshop on Natural Dyes

National Science Day Celebration

The institute celebrated the 24th National Science Day on 28th February 2014. CIRCOT organized two events *viz.*, an OPEN DAY and STUDENTS' COMPETITION FOR CREATIVE IDEA DEMONSTRATION in its campus at Matunga, Mumbai to foster scientific temper among school and college students. About 250 students from nearby schools & colleges participated in the OPEN DAY where they had the first hand information & demonstration on cotton ginning and spinning technologies, fibre and yarn testing and recent developments in nanotechnology. Also, they were enlightened about the latest research being undertaken at this Institute. The students' competition was organized by showcasing of scientific models / prototypes on the theme "to exploit the use of cotton & other natural fibres and their biomass utilization" under three categories *viz.*, school, Junior college and college. In total, thirteen teams participated in the competition to exhibit their scientific ideas.

In continuation, a popular science lecture on "Extra-terrestrial Intelligence" was delivered by physicist Shri Pradeep Nayak, Director of Khagol Academy, a study wing of Khagol Mandal. Dr. S.K. Chattopadhyay, Director briefed about the Institute's research and development activities and the essence of popular science lecture. Awards were given to the best exhibits for students' competition by the guest lecturer, Shri Pradeep Nayak.

Fig. 1: Students receiving Price for Creative Ideas Demonstration

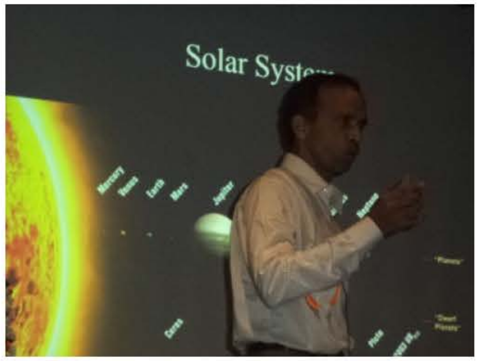


Fig. 2: Lecture by Shri Pradeep Nayak

Fig. 3 & 4: Students visiting Mechanical Processing Division and the exhibit venue

Internal Lecture

1. Experiences on the International Training Programme on Fermentation Technology (NRM) in the Lab of Dr. Len Holmes, Associate Professor, UNCEP, NC, USA during September 02 to November 30, 2013 – Dr. Mageshwaran Scientist, CBPD on December 26, 2013.

2. Technologies for Agri-business & Entrepreneurship Development: Some Case Studies, Dr. R.P. Kachru, Retd. ADG (PE), ICAR on January 03, 2014.

Dr. R.P. Kachru clarifying a point during the lecture

11. VISITORS TO CIRCOT

August 2013 (HQ, Mumbai)

1. Dr. Belayneh Admassu Yimer, Biotechnology Researcher – Team Leader
2. Mr. Kefyalew Negisho Bayissa, Biotechnology Researcher
3. Mr. Miesso Homba, Entomology Researcher
4. Mr. Seyoum Mengistu Tsegaye, Environmental Protection Agency of Ethiopia

August 2013 (To GTC, Nagpur)

1. Dr. N. K. Krishna Kumar, DDG, Horticulture, ICAR, New Delhi
2. Prof. P. L. Saroj, Director, Directorate of Cashew Research, Puttur
3. Dr. M. Anandraj, Director, Indian Institute of Spices Research, Kozikode, Kerala
4. Dr. C. D. Mayee, Former Chairman, ASRB, New Delhi

Director welcoming Dr. K. S. Rao Hon. Union Minister of Textiles

October 2013 (HQ, Mumbai)

1. Dr. K. S. Rao, Hon'ble Union Minister of Textiles
2. Smt. Panabaka Lakshmi, Hon'ble Union Minister of State for Textiles

Dr. K. S. Rao & Smt. Panabaka Lakshmi visiting the CIRCOT exhibits

November 2013 (to HQ and GTC, Nagpur)

Spinners Committee of International Textile Manufacturers Federation (ITMF)

1. Mr. Andrew Macdonald, Chairman, Spinners Committee (Brazil)
2. Mr. Walter Simeoni, Member, Spinners Committee (South Africa)
3. Mr. Enrique Crouse, Member, Spinners Committee (South Africa)

4. Mr. M. N. Vijayashankar, Member, Spinners Committee (Malaysia)
5. Mr. B. K. Patodia, Member, Spinners Committee (India)
6. Mr. Bashir Ali Mohammad, Member Spinners Committee (Pakistan) and former President, ITMF
7. Dr. Christian Schindler, Director General, ITMF (Switzerland)
8. Mr. Jose Sette, Incoming Executive Director, ICAC (USA)
9. Mr. Jaswinder Bedi (Kenya)
10. Mr. Mahesh C. Thakker, Special Invitee (India)

December 2013 (To GTC, Nagpur)

Shri M.P. Sharma, IO.F.S.,Senior Director, Ordinance Development Centre, Nagpur

January 2014 (To GTC, Nagpur)

Shri Vineet Mohota, Director, Gimatex Industries Pvt Ltd; Hinganghat, Maharashtra

February 2014 (To GTC, Nagpur)

Shri Ravi Padgilwar, Padgilwar Corporation, Nagpur

February 2014

Three Member Delegation from Deakin University, Australia comprising

1. Prof. Xungai Wang, Alfred Deakin Professor and Director for Australian Future Fibres Research & Innovation Centre (AFFRIC), Deputy Director Institute for Frontier Materials (IFM)
2. Ms. David Pardoe, Commercial Manager
3. Ms. Rangam Rajkhowa, Research Fellow

March 2014

Dr. V.N. Sharda, Member, ASRB

12. INFRASTRUCTURAL FACILITIES

CIRCOT Library

CIRCOT Library has been progressively upgrading its holdings of books, journals and electronic resources to provide state-of-the-art information to support research and projects undertaken by the institute. It contains the latest information on cotton fibre & fabric testing, finishing, cellulose composites, non-woven & technical textiles in the form of books, journals and online databases. Very good information on allied patents, standards and technical manuals are also available.

The CIRCOT Library book holding stands at an impressive 7612, and it has 8050 for Bound volumes of journals as on March 31, 2014.

The Library has renewed its Annual membership of ASTM and AATCC associations and annual subscription to online databases such as BIS standards (Textiles), ASTM standards (Textiles), AATCC Test Methods, EBSCO World Textiles and Indian statistical portal Indiastat.com.

Besides, being a member of JCCC- CeRA consortia of ICAR, the library can access a massive database on journal with links to full text at publisher sites at http://jgateplus.com.

The CIRCOT library has actively participated in the electronic document delivery system of JCCC sharing the "subscribed" journal resources within NARS. About 100 e-mail request for supply of full text article were received by the library and the same have been promptly obliged and sent online to the respective users.

The following Instruments / Equipment were procured:

1. HP Fax Machine
2. Digital Postal Franking Machine (Model IJ 40)
3. Canon photocopier (IR 2420)
4. Desk Side Paper Shredder (Model PS 225)
5. Biometric Print System
6. Laboratory IR Beaker Dyeing Machine
7. Hot air Oven
8. Material Handling Wheel Trolley for Cottonseed Bags
9. Humidifier

10. Digital Humidity Controller

11. DR Gin with Autofeeder & accessories

12. Rotary Vacuum Pump and Chiller

13. Laboratory Jigger (Small width of 200MM)

14. Samsung LED Monitor (Model S20C300DL)

15. Deep Freezer

16. Homogenizer (Model T 25)

17. Funnel Shaped Collector

18. Friction Spinning Collector

19. Projection System with Accessories (EPSON EB 910 W 3200)

13. PERSONNEL

LIST OF STAFF AT THE HEADQUARTERS

Scientific Personnel

Director (Acting)

Dr. S.K. Chattopadhyay, M.Tech. (Text.Engg.), Ph.D. (Tech), F.T.A., C.Engg., F.I.E., C.Text., F.T.I. (Manchester)

Head of Division

Dr. P.G. Patil, M.Tech. (PHE), Ph.D. (Engg.)

Principal Scientist

Shri R.M. Gurjar, M.Sc. (Textile Chemistry)

Senior Scientist

1. Dr. (Smt.) Sujata Saxena, M.Sc., Ph.D. (Organic Chemistry)
2. Dr. N. Shanmugam, M.Tech., MIE, D.T.T., C.Eng., Ph.D. (Tech) (Textile Manufacture)
3. Dr. A.S.M. Raja, M.Sc. Ph.D. (Textile Chemistry)
4. Dr. S.K. Dey, M.Tech. (Text. Engg.), Ph.D. (Engg.)
5. Dr. N. Vigneshwaran, M.Sc. (Agri.), M.B.A., Ph.D. (Agricultural Microbiology)

Scientist

1. Shri Vishnu Govind Arude, M. Tech. (Farm Machinery & Power)
2. Shri Ashok Kumar Bharimalla, M.Tech. (Farm Machinery & Power)
3. Dr. Virendra Prasad, M.Sc., Ph.D. (Organic Chemistry)
4. Dr. C. Sundaramoorthy, M.Sc., Ph.D. (Agricultural Economics)
5. Shri P. S. Deshmukh, M. Tech. (Farm Machinery and Power)
6. Dr. V. Mageshwaran, M.Sc., Ph.D. (Agricultural Microbiology)

7. Shri Manik Bhowmik, M.Tech. (Textile Manufacture)
8. Shri A. Arputharaj, M.Sc., M.Tech. (Textile Chemistry)
9. Dr. Kartick Kumar Samanta, M.Tech., Ph.D. (Textile Chemistry)
10. Dr. R. Guruprasad, M.Tech., Ph.D. (Textile Manufacture)
11. Shri G.T.V. Prabu, M.Tech. (Textile Manufacture)
12. Shri G. Krishna Prasad, M.Tech. (Textile Manufacture)
13. Shri T. Senthilkumar, M.Tech. (Textile Manufacture)
14. Shri Shekhar Das, M.Tech. (Textile Manufacture)
15. Shri Santanu Basak, M.Tech. (Textile Chemistry)
16. Shri P. Jagajanantha, M.Tech (Textile Chemistry)

Technical Personnel

Chief Technical Officer

1. Shri S. Sekar, B.Sc.
2. Dr. S.J. Guhagarkar, M.Sc., Ph.D.
3. Dr. P.K. Mandhyan, M.Sc., A.T.A., Ph.D.

Assistant Chief Technical Officer

1. Dr. R.D. Nagarkar, M.Sc., Ph.D.
2. Dr. (Smt.) Sheela Raj, M.Sc., Ph.D.
3. Shri M. Mohan, M.Sc., Dip.J.
4. Shri R.S. Prabhudesai, M.Sc., D.C.M.
5. Shri G.B. Hadge, M.Sc.
6. Dr. M.V. Vivekanandan, M.Sc., Ph.D.
7. Shri B.R. Pawar, M. Sc., L.L.M.
8. Dr. (Smt). N.M. Ashtaputre, M.Sc.

9. Shri R.K. Jadhav, M.Sc.
10. Shri S. Banerjee, M.Sc.
11. Shri C. M. More, M.Sc.
12. Shri R. R. Chhagani, M.Sc.
13. Shri H. S. Koli, M.Sc., L.L.B.
14. Shri D. N. Moon, B.Sc.
15. Dr. (Smt.) S.R. Kawlekar, M.Sc., P.I.M.R., Ph.D.

Sr. Technical Officer

1. Shri R.S. Pathare, B.Sc.
2. Dr. (Smt.) Sudha Tiwari, B.Sc., Ph.D.
3. Shri S. Vancheswaran, B.Sc.
4. Shri T. Venugopal, B.E.
5. Shri S.M. Gogate, B.Sc.
6. Dr. R.R. Mahangade, M.Sc., Ph.D.
7. Smt. P.S. Nirali, M.Sc.
8. Shri S.V. Kokane, M.A.
9. Shri P.N. Sahane, D.I.F.T.
10. Smt. Binu Sunil, M.Sc.

Technical Officer

1. Shri D.U. Kamble, B.Sc.
2. Smt. Bindu Venugopal, M.Sc.
3. Smt. N.A. Sonkusle, B.Sc.
4. Smt. C.D. Prabha, M.Sc.
5. Kum. C.P. D' Souza, M.Sc.

6. Smt. K.R. Joshi, M.A. (Hindi Translator)
7. Shri R.S. Narkar, M.Sc., D.C.I.A.
8. Smt. P.R. Mhatre, B.Sc., M.Lib.
9. Shri V.D. Kalsekar, B.Sc.

Senior Technical Assistant

1. Shri C.V. Shivgan, H.S.C., Cert. Wireman, Cert. Electrician, Cert. Elec. Supr. (PWD)., Cert. M. & A.W.(Technician)
2. Shri N.D. Kambli, M.Sc.
3. Shri M.G. Ambare, M.Sc.
4. Shri S. N. Patil, B.E.
5. Shri D.M. Correia, S.S.C., I.T.I., N.C.T.V.T. (Mechanic)

Technical Assistant

1. Smt. H.R. Pednekar, B.A., B.Lib.
2. Shri R.P. Kadam, M.Sc.
3. Smt. M.P. Kamble, B.A., M.Lib.
4. Shri A.R. Jadhav, B.Sc.
5. Shri Deepak Meena, B.A., M.Lib., M. Phil., PGDCA
6. Shri Krishna Bara, D.H.T.
7. Shri D. A. Salaskar (Driver)

Senior Technician

1. Shri S.K. Parab, Cert. Cot. Spin.
2. Shri D.M. Raje
3. Shri R.R. Gosai

4. Shri N.K. Shaikh
5. Shri Mahabir Singh
6. Shri S.V. Kokane
7. Shri M.M. Kadam
8. Shri S.G. Phalke

Technician

1. Shri D.G. Gole
2. Shri D.J. Dhodia
3. Shri Yogesh Nagpure

Administrative Personnel

Administrative Officer

Shri Sunil Kumar, B.A. (Hons.)

Assistant Finance and Accounts Officer

Shri S.V. Kasabe, B.Com, L.L.B.

Assistant Administrative Officers

1. Smt. S. Koshy, B.Com.
2. Smt. V.V. Desai
3. Smt. T.P. Mokal, M.A.

Private Secretary

Shri Venu Thanikal

Jr. Accounts Officer

Shri J.R. Mangale, B.Com.

Assistant

1. Shri K. Parleshwar
2. Smt. V.V. Janaskar, B.Com., M.A.
3. Shri R.K. Pallewad, B.A.
4. Smt. S.R. Shirsat, B.A.
5. Shri N.V. Kambli
6. Smt. N.M. Deshmukh, M.A., LL.B.
7. Shri S.D. Ambolkar

Personal Assistant

1. Smt. S.D. Dudam, M.A.
2. Smt. T.T. D'Souza

Stenographer Gr. III

1. Smt. U.N. Bhandari
2. Smt. R.R. Tawde, B.Com.
3. Smt. Viniya Rajesh Naik, B.A.

Upper Division Clerk

1. Shri P.V. Jadhav
2. Smt. S.G. Parab, B.A. (Sociology), B.A. (Hindi)
3. Smt. S.P. Paiyala
4. Smt. J.R. Chavkute

5. Shri V.M. Sable
6. Smt. B.D. Kherodkar
7. Shri S.S. Angane
8. Shri A. R. Gujar

Lower Division Clerk

1. Shri T.D. Dhamange, B.Com.
2. Shri S.N. Bandre
3. Smt. V.N. Walzade, B.A. (Telephone Operator)

Skilled Support Staff

1. Shri M.Z. Rathi
2. Shri M.B. Gurave
3. Shri B.R. Satam
4. Shri D.M. Chougule
5. Shri S.D. Gurav
6. Shri M.K. Ghadge
7. Shri D.B. Temgire
8. Shri C.S. Salvi
9. Shri K.T. Mahida
10. Shri M.M. Katpara
11. Shri M.A.A. Rashid
12. Shri G.N. Mayawanshi
13. Shri H.B. Vesmiya
14. Shri M.J. Sumra
15. Shri S.K. Bobate

16. Shri P.P. Patil
17. Shri R.G. Tak
18. Shri R.P. Karkate
19. Shri C.D. Acharekar
20. Shri M.K. Prabhulkar
21. Shri J.D. Sakpal
22. Shri V. Murugan
23. Shri S.D. Magar
24. Shri S.B. Worlikar
25. Shri S.R. Tondse
26. Shri V.B. Poojari
27. Shri M.N. Kamble
28. Shri S.S. Surkule
29. Shri S.P. Naik
30. Smt. Kamala Murugan
31. Shri D.K. Kasar
32. Shri S.R. Tondse
33. Shri D.R. Gawde
34. Shri S.M. Chandanshive
35. Shri P.E. Gurav
36. Shri Mahesh C. Solanki

LIST OF STAFF AT THE REGIONAL QUALITY EVALUATION UNITS

COIMBATORE

Chief Technical Officer : Dr. S. Venkatakrishnan, M.Sc., Ph.D., A.T.A., F.T.A.

Asst. Chief Technical Officer : Shri K. Thiagarajan, M.Sc.

Technical Officer : Shri M. Bhaskar, Dip. Ref. & Air-Cond.

Skilled Support Staff : Shri V. Subbaiah

DHARWAD

Sr. Technical Officer : Shri K. Narayanan, B.Sc.

Sr. Technical Assistant : Smt. V.G. Udikeri, B.Sc.

Skilled Support Staff : Shri C.J. Bagalkoti

: Shri A.F. Gudadur

GUNTUR

Chief Technical Officer : Shri S. Mukundan, M.Sc.

Technician : Shri Vijay Kumar Sutar

Skilled Support Staff : Shri R. S. Umare

NAGPUR

Sr. Scientist : Dr. (Smt.) Jyoti M. Nath, M.Sc., Ph.D. (Electronics & Instrumentation)

: Dr. Sujeet Kumar Shukla, M.Tech., Ph.D. (Mechanical Engineering)

Asst. Chief Technical Officer : Shri N.V. Bansode, M.Sc.

Sr. Technical Officer : Shri V.L. Rangari, M.Sc.

: Shri U.D. Devikar, M.Sc.

	: Shri S.L. Bhanuse, B.Sc.
	: Shri R. G. Dhakate, B.Sc.
	: Shri S.N. Hedau, B.Sc.
Sr. Technical Assistant	: Shri B.V. Shirsath, B.A., I.T.I.
T-1-3	: Shri C.L. Mundale
Technician	: Shri Umrao Meena
Assistant Administrative Officer	: Shri Yogesh Ram Pathare, M.B.A.
Assistant	: Shri S.A. Telpande, M.Com.
Stenographer (Gr. III)	: Shri R.D. Shambharkar, M.A.
Lower Division Clerk	: Shri R.G. Matel
Skilled Support Staff	: Shri M.P. Tohokar
	: Shri A.R. Chutale
	: Shri J.P. Patel
	: Shri R.B. Kautkar
	: Shri R.C. Rokde
	: Smt. M. M. Bhanddkar

SIRSA

Assistant Chief Technical Officer	: Dr. Hamid Hasan, M.Sc., Ph.D.
Sr. Technical Officer	: Dr. Jal Singh, M.Sc., Ph.D.

SURAT

Sr. Technical Officer	: Shri G.G. Mistry, B.Sc.
	: Shri M.B. Patel, B.Sc., L.L.B.
Skilled Support Staff	: Shri M.G. Sosa

DURING YEAR 2013-14

A. Appointment

1. Dr. A.S.M. Raja, Scientist, CSWRI, Avikanagar (Rajasthan) joined as Sr. Scientist w.e.f. 15 06-2013 through Direct Selection.
2. Dr. S.K. Dey, ACTO, NIRJAFT, Kolkata joined as Sr. Scientist w.e.f. 01-08-2013 through Direct Selection.
3. Shri P. Jagajanantha, was appointed as Scientist on 01-07-2013

B. Completion of Probation

The following scientists have successfully completed their probation

1. Dr. V. Mageshwaran, Scientist w.e.f. 04-11-2011
2. Shri Manik Bhowmick, Scientist w.e.f. 15-12-2011
3. Shri A. Arputaraj, Scientist w.e.f. 15-12-2011
4. Dr. Kartick Kumar Samanta, Scientist w.e.f. 20-04-2012

C. Promotion

Scientist

On the basis of the recommendations of the Selection Committee, the following scientists were promoted to the next higher grade with effect from the dates shown against their names.

Sl. No.	Name and designation of Scientist	Post to which Promoted	Effective Date of Promotion
1	Dr. S.K. Shukla, Scientist	Sr. Scientist	24- 07 - 2013
2	Dr. T. S. Manojkumar	Sr. Scientist	29- 12- 2007
3	Shri P. S. Deshmukh	Scientist (Gr. Pay)	20-03-2008
4	Dr. (Smt) Jyoti. M. Nath	Sr. Scientist	18- 11- 2008
5	Dr. N. Vigneshwaran	Sr. Scientist	10- 09- 2010
6	Shri Achchelal Yadav	Scientist (Gr. Pay)	16- 04- 2009
7	Shri Virendra Prasad	Scientist (Gr. Pay)	16- 04- 2009
8	Shri Sundaramoorthy	Scientist (Gr. Pay)	11- 08- 2009
9	Shri V. G. Arude	Scientist (Gr. Pay)	21- 05- 2010

Technical

Based on the results of the Assessment, the following Technical personnel were promoted to the next higher grade.

Sl. No.	Name	Post and Grade to which Promoted	Effective Date of Promotion
1	Dr. A.A. Kathe	Chief Technical Officer (CTO)	03-02-2012
2	Shri S. Sekar	-"-	-"-
3	Dr. S.J. Guhagarkar	-"-	-"-
4	Shri D.Radhakrishnamurthy	-"-	-"-
5	Dr. P.K. Mandhyan	-"-	-"-
6	Dr. S. Venkatakrishnan	-"-	-"-
7	Shri S. Banerjee	Asst. Chief Technical Officer (ACTO)	01-01-2010
8	Shri C.M. More	-"-	01-01-2011
9	Shri K. Thiagarajan	-"-	01-01-2010
10	Shri R.R. Chhagani	-"-	05-08-2011
11	Shri H.S. Koli	-"-	13-10-2011
12	Shri D.N. Moon	-"-	01-01-2012
13	Dr. (Smt.) S.R. Kawlekar	-"-	07-05-2012

D. TRANSFER

Scientist

Shri Chitranayak, Scientist transferred to NDRI, Bengaluru w.e.f. 10-06-2013 as Sr. Scientist.

Administrative

Shri S.N. Salve, Assistant Administrative Officer transferred to NRC Grapes, Pune w.e.f 01-08-2013 as Administrative Officer.

E. RETIREMENTS

Scientific

Shri U.N. Borkar, Sr. Scientist retired w.e.f. October 31, 2013

Technical

1. Smt. N.D. Nachane, Technical Officer T (7-9) on April 30, 2013.
2. Shri M.Y. Chandanshive, T-1-3 retired on May 31, 2013
3. Shri V.M. Kulmethe, Technical Officer T (7-8) on June 30, 2013.
4. Shri H.S. Bhabar, Technician took voluntary retirement on June 30, 2013.
5. Shri D. Radhakrishnamurthy, Chief Technical Officer retired on July 31, 2013.
6. Shri B.R. Jadhav, T-3 retired on July 31, 2013.
7. Shri A.R. Bane, T-3 retired on July 31, 2013.
8. Dr. A.A. Kathe, Chief Technical Officer on January 31, 2014.
9. Shri S.M. Sawant, T-1-3 on January 31, 2014.
10. Shri P. S. Panchbudhe, Technician on January 31, 2014.

Administrative

1. Shri B.D. Dhengale, Lower Division Clerk on August 31, 2013.
2. Smt. S.M. Desai, Assistant Administrative Officer took Voluntary Retirement w.e.f. November 21, 2013.
3. Shri A.P. Natu, Assistant on November 30, 2013.

4. Shri D.G. Kulkarni, Assistant Administrative Officer on December 31, 2013.

5. Smt. J.J. Karanjavkar, Assistant on December 31, 2013.

Skilled Supporting

1. Shri S.N. Gope, Skilled Supporting Staff on June 30, 2013.

F. Deputation Abroad

Sr. No	Name of the Programme	Period & Place	Participate Names
1	International Training on Fermentation Technology (NAIP Project)	02-09-2013 to 30-11-2013	Dr. V. Mageshwaran, Scientist was deputed to U.S.A (North Carolina)

G. ACCOLADES

The Institute bagged the Best BPD Award in NAIP Agri-Tech Investors Meet from Dr. K. Kasturirangan, Member, Planning Commission (Science & Technology) at New Delhi on July 19, 2013.

Dr. S.K. Chattopadhyay, Director receiving the Best BPD Award . Dr. N. Vigneshwaran, Co-PI, Shri Ashok Kumar Bharimalla, PI along with Shri Athavale, Business Manager, BPD are seen in the picture

December 3, 2013

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch