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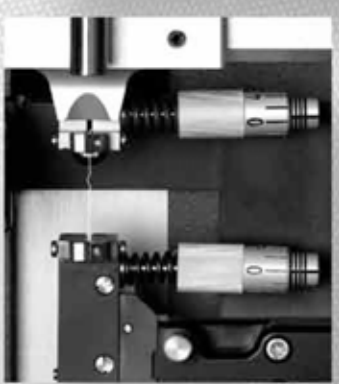

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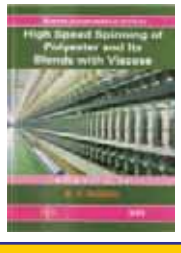

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Editorial

Rising India

Today I can confidently say a concerned Indian like me has transformed into a proud Indian with the revolutionising victory that we as the people have won for the development of better India. Yes, my friends I am talking of the victory of Anna Hazare struggle against corruption. A new landmark in the history of independent India, a new path is paved by the veteran anti- corruption campaigner Anna Hazare. His struggle against corruption was a gentle reminder of Mahatma Gandhi's Satyagraha. Hazare, who was on a 12-day fast, spearheaded what he called India's "second freedom struggle" by demanding a Jan Lokpal bill. The parliament broadly agreed to three key demands of his civil society group to battle corruption, boosting people's faith in him and his movement. Although Hazare's fast didn't achieve all its goals, it's a half-victory, Anna Hazare said. But the real victory lies in the fact that neither civil society nor parliamentary democracy lost in the end. India won, and its people won which I would majorly attribute to the younger generation or youth that we commonly say as it was for the drive inside them that the struggle became so huge. It is just the beginning of a rise of the country to become a super power with more responsible youth and common man.

Currently all over the country and particularly in *Maharashtra*, the 2 most talked about things are the *Anna Hazare satyagraha* against corruption, and the popular Ganesh festival celebrated by people of all faiths, social strata, economic backgrounds, caste, creed etc. Of course the complete humiliation of the world champion Indian boys in blue is a close third but we won't talk about it here. Poor guys have already been battered black and blue.

Ganesh Chaturthi is probably the most celebrated of all festivals in Maharashtra which was popularized in a big way by freedom fighter Lokmanya Bal Gangadhar Tilak as a show of unity against the British Raj when large gatherings where prohibited. Now after a 100 years and more, the festival is bigger than ever before. The fact that Ganeshji is the most loved and cutest of all Gods also furthers this religious fervour! The one glaring difference between then and now is the use of harsh material like plaster of Paris being used as opposed to the natural earth and clay people used to use then. Most of the idols were immersed in tanks or wells so as to not contaminate the natural water bodies. But with the increase in size and girth of the idol, Ganesh visarjan now happens mostly in lakes and seas polluting the water as mercury is released from the paints used to colour the plaster of Paris idols. It is totally ruining the environment. So my humble appeal to all and sundry is to switch to eco-friendly Ganpati idols and

do their bit for our environment. And trust me, Ganpatiji will have a big smile on his cute face if you take care of MOTHER EARTH.

As if the largest textile machinery trade show wasn't enough to draw participants at ITMA Barcelona 2011 (one of the largest textile and garment machinery exhibition in the world. The event is a showcase of the very latest technology and a vital meeting place for buyers and sellers from all over the world), here they will have an opportunity to attend a very special technical textiles conference. The Industrial Fabric Association's Advanced Textiles'11 continues to be a unique and sought-out European/U.S. platform on the future of technical textile applications. Technical textile innovations will be highlighted at IFAI's Advanced Textiles 2011 conference, with presentations on fascinating new research, which will also demonstrate in real-world terms how these innovative technologies can benefit your company's next generation of products. Topics to be covered by leading industry experts include an overview of the technical textile market and demands and challenges; an examination of specific end market needs such as performance apparel; bio-hazard/ extreme environment; electronic interactive materials; digital signage and complex materials applications. Its focus shall be on new developments in protective textiles including "Future Soldier Systems," "Protective Textiles in the Security Industry" and "Nonwovens-Based Heat and Flame Protection Materials", on smart and interactive textiles. The presentations will analyze this industry's success stories and bottlenecks and the pitfalls in the e-textiles area. They will also cover the development of a commercial smart textiles product. Delegates will go out with a new perspective on the industry's state-of-the-science advancements in technical textile applications. I wish good luck to the delegates showcasing our industry, visiting the exhibition and attending the conference.

The highly coveted Centre of Excellence (COE) under the Technology Mission of Technical Textile (TMTT)in Sportech has been awarded to the Department of Fibres and Textile Processing Technology, Institute of Chemical Technology, Matunga, Mumbai with a grant of Rs 24.50 crores. The announcement to this extent was made on August 25, 2011, by the Honourable Minister of Textiles, Shri Anand Sharma at the inaugural function of the event Technotex 2011 held between August 25 – 27, 2011, at the Bombay Exhibition Centre, Goregaon, Mumbai. In this venture the major collaborators of ICT are Kemrock Industries and Exports Limited, Kusumgar Corporates Private Limited and Reliance Industries Limited and JCT. An Expression of Interest has been extended by Textiles committee, Textile Association of India and Texan lab and have agreed to support with all there branches to co-operate in spreading awareness and training in Technical Textiles. Also, with the development of COE in Agrotech (SASMIRA) and COE in Geotextiles (BTRA) in the same vicinity in Mumbai having established linkages with each other, with this new COE, it is expected that the Technical textiles industry or rather the Textile industry as a whole would be chiefly benefited.

Prof. Ravindra Adivarekar
Editor, JTA

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Conductive Polymers

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Abstract
With the rapid development of the electrical and particularly the electronics industry, a need arose for flexible conducting and semiconducting materials. Conducting polymers offers an interesting alternative to coated or filled plastics and textiles. Conductive textile composites based on polypyrrole or polyaniline results in structures showing surface resistances 10-1000 ?/square. These textile composites have a considerable advantage over metal-coated fabrics because of their excellent adhesion and non-corrosive character [1]. Conductive polymers are organic polymers that conduct electricity. Such compounds may be true metallic conductors or semiconductors. It is generally accepted that metals conduct electricity well and that organic compounds are insulating, but this class of materials combines the properties of both. The biggest advantage of conductive polymers is their processibility. Conductive polymers are also plastics (which are organic polymers) and therefore can combine the mechanical properties (flexibility, toughness, malleability, elasticity etc.) of plastics with high electrical conductivities. Their properties can be fine-tuned using the methods of organic synthesis [2].

Key words
Semiconducting materials, Polymer gels, Sensing device

1. Introduction

Textiles are among the oldest materials known to mankind. In addition to their use as apparel, they were used in several early structural materials. With the rapid development of the electrical and particularly the electronic industry, a need arose for flexible conducting and semiconducting materials [3]. Flexible, highly conducting materials have been prepared by weaving thin wires of various metals such as brace and aluminum. Semi conductive textiles, including yarns and woven, non-woven and knitted fabrics, have been produced by impregnating textile substrates with conductive carbon or metal powders.

Many attempts have been made to functionalize polymer materials as so called 'smart' or 'intelligent' materials. Artificial muscle or intelligent actuators is one of the targets of such attempts. Historically, actuator materials have been investigated mainly in inorganic compounds. Particularly, triggers used for actuation are usually investigated in an electric field application because of the ease of control [4]. Polymer materials investigated from this point of view are very limited and have been known to generate much smaller strain than inorganic material.

On the other hand, polymer materials such as polymer gels have been known to generate huge strain by various triggers such as solvent exchange, pH jump, temperature jump etc., although the response and durability are rather poor and they have not been used in practical actuators. In the field of mechanical engineering, the development of micromachining procedure is facing the requirements of the technologies of micro fabrication and micro-device assembly, and there are high expectations of the emerging smart materials that can greatly simplify the micro fabrication process [5].

The concept of the mechanism is simple and can be applied to conventional polymer materials, including materials commonly used in the fibre and textile industries. The concept is also applicable to non-ionic elastomers that do not contain any solvent. The method made provides a promising way for developing future artificial muscle. Several concepts are successfully used for actuating gels.

Fig (1.1): Concepts of autonomic systems and materials. Three processes (sensing, processing and actuation) are incorporated in materials (in one system): (a) in autonomic materials, while they are separated and must be unified by a controlling system;

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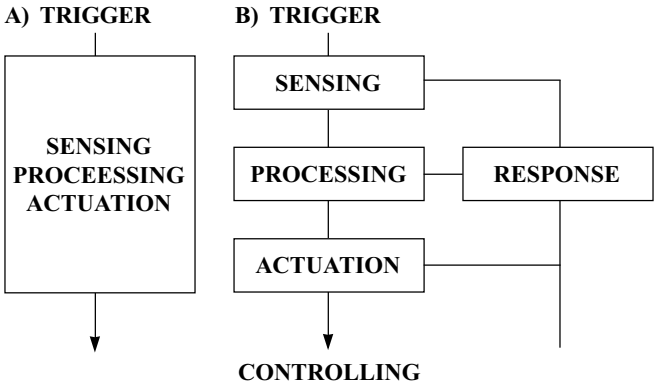


(b) in conventional autonomic systems.
Responsive to the electric field. Ionic gels have proved to be excellent electro active actuator materials [6].

1.1. Correlation of chemical structure and electrical conductivity

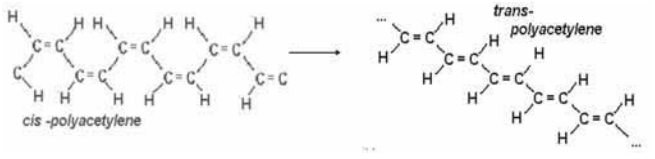
In traditional polymers such as polyethylene the valence electrons are bound in sp^3 hybridized covalent bonds. Such "sigma-bonding electrons" have low mobility and do not contribute to the electrical conductivity of the material. The situation is completely different in conjugated materials. Conducting polymers have backbones of continuous sp^2 hybridized carbon centers. One valence electron on each center resides in a p_z orbital, which is orthogonal to the other three sigma-bonds. The electrons in these delocalized orbital have high mobility, when the material is "doped" by oxidation, which removes some of these delocalized electrons. Thus, the p-orbitals forms a band, and the electrons within this band become mobile when it is partially emptied [7]. In principle, these same materials can be doped by reduction, which adds electrons to an otherwise unfilled band. In practice, most organic conductors are doped oxidatively to give p-type materials. The redox doping of organic conductors is analogous to the doping of silicon semiconductors, whereby a small fraction of silicon atoms are replaced by electron-rich (e.g. phosphorus) or electron-poor (e.g. boron) atoms to create n-type and p-type semiconductors respectively. Although typically "doping" conductive polymers involves oxidizing or reducing the material, conductive organic polymers associated with a protic solvent may also be "self-doped". The most notable difference between conductive polymers and inorganic semiconductors is the mobility, which until very recently was dramatically lower in conductive polymers than their inorganic counterparts. This difference is diminishing with the invention of new polymers and the development of new processing techniques [8]. Low charge carrier mobility is related to structural disorder. In fact, as with inorganic amorphous semiconductors, conduction in such relatively disordered materials is mostly a function of "mobility gaps" with photon-assisted hopping, polaron-assisted tunneling etc. between localized states.

The conjugated polymers in their undoped, pristine state are semiconductors or insulators. As such, the energy gap can be > 2 eV, which is too great for thermally activated conduction [9]. Therefore, undoped conjugated polymers, such as polythiophenes, polyacetylenes only have a low electrical conductivity of around 10^{-10} to 10^{-8} S/cm. Even at a very low level of doping (< 1 %), electrical conductivity increases by several orders of magnitude up to values of around 0.1 S/cm. Subsequent doping of the conducting polymers will result in a saturation of the conductivity at values around 0.1-10 kS/cm for different polymers. Highest values reported up to now for the conductivity of stretch oriented polyacetylene with confirmed values are of about 80 kS/cm. Although the pi-electrons in polyacetylene are delocalized along the chain, pristine polyacetylene is not a metal. Polyacetylene has alternating single and double bonds which have lengths of 1.44 and 1.36 Å, respectively. Upon doping, the bond alteration is diminished and conductivity increases. Non-doping increases in conductivity can also be accomplished in a field effect transistor (organic FET or OFET) and by irradiation. Some materials also exhibit negative differential resistance and voltage-controlled "switching" analogous to that seen in inorganic amorphous semiconductors [10].

The interest in the field of organic semiconductors originated from the suggestion that the transfer of ð electrons from molecule to molecule may play an important role in fundamental physical processes of living organisms. Very small but measurable electrical conduction was reported for anthracene in 1906. The common synthetic polymers are electrical insulators in general. A conducting polymer would however, be a much desired product for use as corona shield or as a separate layer in an insulation system in film/sheet form to prevent corona discharge and for providing a conducting surface for electroplating non-conductors or for use in printed circuit boards (PCB), electronic devices, photovoltaic devices, solar cells, batteries etc. A number of polymers are electrically conductive or can be made to be conductive by doping with an

electron donor or acceptor. Applications includes polymeric electrodes for lightweight batteries, variable transmission windows, electrochromic displays, sensors and nonlinear optical materials. The first of these electrically conductive polymers was polyacetylene. The other specialty polymers in this class include polyaniline, polythiophenes, poly (p-phenylene) and polypyrrole [11].

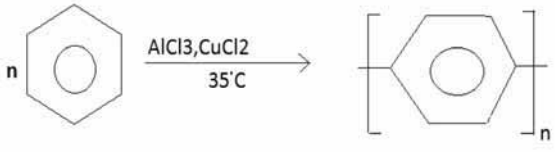
Polyacetylene with molecular weight upto 1 million can be prepared through a complicated process involving a metathesis polymerization (Durham process), as shown in figure below. The cis isomer of polyacetylene can be transformed to the more stable trans isomer by heating at 200^{0}C as follows



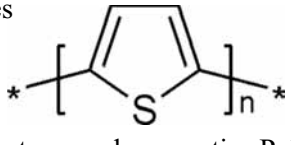
The trans-isomer has higher conductivity (4.4×10^{-5} S cm^{-1}) than the cis-isomer (1.7×10^{-9} S cm^{-1}). Conductivity is greatly increased by doping. For example, addition of AsF_5 increases conductivity to 400 S cm-1. Polyacetylene has a Tg in the range from -40^{0}C to 0^{0}C and good thermal stability (decomposition temperature above 420^{0}C), however it is easily oxidized. Applications include solar cells and batteries [12].

Polyaniline can be obtained by the electrochemical or chemical oxidation of aniline in aqueous acidic media using common oxidants such as ammonium peroxydisulfate.Polyaniline can exist in several oxidation states with vastly different conductivities (ranging from 10^{-11} to 10^2 S cm^{-1}). Only the emeraldine salt of polyaniline is electrically conductive.

Poly (p-phenylene) (PPP) can be prepared by the Freidel-Crafts polymerization of benzene



and polythiophenes



are related in structure and properties.Polypyrolle is obtained by electro polymerization of pyrolle as a highly colored, dense conducting film while polythiophenes can be polymerized by the anodic oxidation of thiophene. Unlike polyacetylene, polypyrrole and polythiophenes can be synthesized in the doped form and are very stable in air. Unfortunately, their conductivities are lower. Some polymers become conductive when illuminated.

1.2. Polymer materials as actuators or artificial muscle [13]

Polymer gel is an electro active polymer material. There are various types of electro active polymeric materials. As mentioned in the above section, polyelectrolyte is one of them and is most commonly investigated as an electro active gel. We will come back to discuss this material in more detail in the next section.

Ferroelectric polymer materials like PVD for its derivatives are mentioned, since they behave as ferroelectric materials. They are crystalline and the crystals show polymorphism by controlling the preparation method. Much detailed work has been carried out on piezoelectric and/or pyroelectric properties, together with their characteristics as electro active actuators. These materials have long been mentioned as typical electro active polymers. Through these materials, it is considered that the strain induced in the polymer materials is not large. The electrostrative coefficient is known to be small for polymers. These are non-ionic polymers and the induced strain originates from the reorientation or the deformation of polarized crystallites in the solid materials.

There is another type of electrically active polymer that is known as the electro conductive polymer, in which polymer chains contain long conjugated double bonds, and this chemical structure adds electro conductive properties to the polymers. In these cases, the electrically induced deformation is considered to have originated from the electrochemical reactions such as the oxidation and reduction of the polymer chain. For the deformation, some additives such as dopants have been known to be necessary for effective actuation. Therefore, the electrical actuation of these materials has been investigated in the presence of water, similar to the case of polyelectrolyte gels.

1.3. Peculiarity of polymer gel actuator

Polymer gels differ in various ways from hard solid polymer materials. The polymer chains in the gel are usually considered to be chemically or physically cross-

linked and to form a three-dimensional network structure. For instance, polymer gel is usually a matter swollen with its good solvent, and the characteristics are diversified from a nearly solid polymer almost to a solution with very low polymer content but still maintaining its shape by itself. This extreme diversity in physical properties widens the function of the gel. From the standpoint of the actuator, the gel behaves like a conventional solid actuator or biological muscle, or like a shapeless amoeba. The gels also have various actuating modes, symmetric volume change with swelling and de-swelling, asymmetric swelling behavior, symmetric deformation and asymmetric deformation. The strain induced in the gel can also be extremely large, depending on the cross-link structure in the gel.

1.4. Triggers for actuating polymer gels

As can be expected from the diversified physical characteristics of the gel and the wide variety of the actuating modes, there are various triggers for the actuating polymer gels. The triggers can be classified into two categories, chemical triggers and physical triggers. As chemical triggers, solvent exchange includes jumps in solvent polarity (e.g. from good solvent into poor solvent), in pH (e.g. in weak polyelectrolyte gel from a dissociated condition into an associated condition) and in ionic strength (utilizing salting-out or coagulation).These two types accompany swelling and de-swelling of the solvent and the deformation is usually symmetric as far as the gel has a homogeneous structure. Temperature jump, which is a physical trigger, can also induce symmetric deformation in particular polymer gels where the solubility has a critical transition temperature. Typical examples are the gels of poly(vinyl methyl ether) and poly(*N*-isopropyl acryl amide). These gels have high water absorption at low temperatures and de-swell at the characteristic critical temperature around 30—40 °C. The transition temperature can be controlled by changing chemical structure. In the case of urease immobilized gel, the addition of urea, a substrate of urease, induces swelling and deswelling by utilizing the pH change induced by the enzyme reaction.

A physical trigger such as light irradiation is useful for actuating a gel in which the light induced reversible isomerization occurs and the isomerization accompanies physical strain. In this case, the change is usually asymmetric and the gel bends toward or against the direction of the irradiation, depending on the photo induced reaction.

In the case of electric field application, the gels usually bend, because the field application induces asymmetric charge distribution and hence the asymmetric strain in the gel. Asymmetric charge distribution can easily be induced in polyelectrolyte gels, and this is why polyelectrolyte gel has mainly been investigated as on electro active polymer material.

Magnetic field application can also induce a strain in a gel when a structure or species sensitive to the magnetic field is contained in it. The gel was found to be sensitive to the super para magnetic field gradient and induced strain very sensitively. Zryhni and his coworkers investigated the same materials and found discontinuous deformation of the gel by controlling the magnetic field.

1.5. Electro active polyelectrolyte gels

As pointed out in the previous section, polyelectrolyte gels have been investigated as electro active actuator materials. The concept originates from the presence of electro active ionic species in the gels. The ionic species can to be sensitive to the magnetic field gradient and to induce strain very sensitively, and the structure change in the gel. Zryhni and his coworkers investigated the same materials and found discontinuous deformation of the gel by controlling the magnetic field.

1.5.1 Electro-active polymer gels as artificial muscle

Amongst the polymeric actuator materials mentioned above, polymer gel has an important property as a huge strain generating material. As mentioned in the previous section, the electric field is one of the most attractive triggers for practical actuation. Electro activity has been mentioned in connection with polyelectrolyte gels, since they contain ionic species. However, ionic species are not only sensitive to an electric field, but also usually electrochemically active, and accompany electrolysis on the electrodes. Electro chemical reactions often result in increased current and heat generation. These processes only dissipate energy, and do not contribute to strain generation. Thus, electrochemical reactions are an undesirable process in most cases. In spite of their many difficulties for practical actuators, polyelectrolyte gels and related materials still remain at the forefront of electro active polymer materials.

To overcome difficulties in polyelectrolyte, such as electrochemical consumption on the electrodes, the electro active properties of the non-ionic polymer gel have been investigated.

1.5.2. Poly (acrylic acid) gel

Among polyelectrolyte gels, poly (acrylic acid) (PAA) gel was the first polyelectrolyte investigated as an electro active polymer gel. Shiga et al. found that PAA gel can be deformed by DC electric field application in the presence of salt. A PAA gel rod was immersed in the saline aqueous solution. The platinum electrodes were apart from the gel surface, and the DC field was applied from both sides of the gel. Shiga et al. found a slow bending motion of the gel, the magnitude of bending depending on the salt and its concentration. They also found an asymmetric deformation of the gel, when the field was applied apart from both ends of the gel rod. In this case, the gel shrinks at one end and swells at the other end. The motion is explained by asymmetric swelling behavior under the field.

1.5.3. Poly (2-acrylamido-2-methylpropanesulfonic acid) gel

Poly(2-acrylamido-2-methylpropanesulfonic acid) (PAMPS) gel was found to undergo worm-like motility. The principle of this deformation is based on an electro kinetic molecular assembly reaction of surfactant molecules on the hydrogel, caused by both electrostatic and hydrophobic interactions and resulting in anisotropic contraction to give bending towards the anode. When the field is reversed, the surfactant admolecules on the surface of the gel lift off and travel away electrically towards the anode. Instead, new surfactant molecules approach from the opposite side of the gel and form the complex preferentially on that side of the gel, thus stretching the gel. Surfactants such as *N*-dodecylpyridinium chloride (Cl_2PyCl), adsorb within a second and is easily calculated to give a complex formation ratio less, explaining that the quick and large bending under an electric field is dominated only by the surface complexation and shrinkage of the gel.

1.5.4. Perfluorosulfonate ionomer gel

A hydrogel of Perfluorosulfonate ionomer (Nafion of DuPont) film, thickness of *ca.* 0.2 mm, was found to be an effective electro active material. This material can be actuated by a DC field application of low voltage such as 3 volts. Success was attained by the development of the chemical deposition of the electrode on the membrane surface. The principle of the deforming mechanism is somewhat similar to the case of other polyelectrolyte gels. That is, the membrane requires the presence of water and salts, and an encounter of electrochemical consumption is principally inevitable. However, the response time and durability are much higher than with the other gel materials. Moreover, the actuating process is not seriously affected by electrochemical reactions, provided the operating conditions are adequately controlled. Improvement of the efficiency can be considered to originate from the chemical structure of the membrane, and the coexistence of the strong hydrophobicity and strong hydrophilicity in a polymer chain.

1.6. Electro active non-ionic polymer

Reviewing the above-mentioned materials, one of the serious defects of polyelectrolyte gels is the electrochemical consumption on the electrode under an electric field application. The electrochemical consumption causes poor durability of the polyelectrolyte gels and limits their application fields.

Therefore, it was tried to utilize non-ionic polymer gels as actuating materials with large deformation. The results show that the idea works in a far more efficient manner than expected, but the mechanism turned out to be not the same as expected initially. The feature will be described below in a little detail.

1.6.1. Strain in the direction of the field

Poly (vinyl alcohol)—DMSO gel is prepared by combining physical cross linking and chemical cross-linking with glutaraldehyde (GA). After the chemical cross-linking, the physical cross-links are eliminated by exchanging solvent into pure DMSO. The chemically cross-linked gel thus obtained has an electronically homogeneous structure. Therefore, the PVA—DMSO gel has no intrinsic polarization in its structure, and electro strictive strain generation is expected by applying a DC electric field. The results agree with this expectation, and the strain is proportional to the square of the field. The strain observed reached over 7% in the direction of the field. The response time is very fast, the large strain is attained within 0.1 s, and the shape of the gel is instantly restored by turning off the field. The current observed is around 1mA at 250 V/mm, which is much smaller than those of polyelectrolyte gels. The current can be depressed by further purification of the polymer and solvent. This performance is much faster than conventional polyelectrolyte gels. We can demonstrate the electro-activated quick strain in the flapping motion by amplifying the strain by 300 times. It is suggested that the flapping motion be accelerated up to 10 Hz, though the demonstration was carried out at 2Hz.

1.6.2. Electrical orientation of solvent

The strain induced in the direction of the field cannot be explained by the electrostatic attractive force between the electrodes. The effect of the electrostatic field was expected to be less than 25% of the observed strain under our experimental conditions.

Initially, it was expected that the orientation of solvent molecule under an electric field lead to the strain generation in the gel, through the changes of interactions between solvent and solute polymer, which forms the gel network. In order to observe the effect of the electric field on the orientation of the solvent, DMSO, Raman spectroscopy was employed. The molecule has a strong dipole moment, and can be expected to orient along the field direction. It is oriented very efficiently even in relatively low electric fields, but the orientation decreases over the maximum field intensity. The deformation of the gel becomes greater in the region of the higher field than that of the maximum orientation, suggesting that the solvent orientation is not directly related to the deformation of the gel.

1.6.3. Bending and crawling motion accompanying huge strain [14]

In observing the contraction along the direction of an electric field, brass plates were used as electrodes. The strain in the perpendicular direction of the field was also observable. In these measurements, the bending deformation of the gels was prevented or completely depressed.

When carefull observed the gel deformation was solvent flow and some asymmetric deformation was suggested in the gel. But conventional electrodes or a thin metal sheet of 10 m thickness did not lead to any effective deformation. Very thin gold electrodes whose thickness was 0.1m were used and both surfaces of the gel covered with the thin metal sheet. The metal sheet is soft enough and does not disturb even a slight deformation of the gel.

By applying a DC electric field to the gel, the gel bent swiftly and held the deformation as far as the field was on (The bending was completed within 60 ms, and the bending angle reached over 90 degrees). By turning off the field, the strain was released instantly, and the gel resumed its original shape. The curvature turned out to be proportional to the square of the field.

Taking the gel size (length 1 cm, width 5mm and thickness 2mm) into account, and assuming the gel volume does not change in the deformation, the strain in the gel can be estimated to be over 140% in length. The electric current observed in this motion was less than 30 Aunder the field of 500V/mm.

This response and the huge strain attained in the PVA—DMSO gel is the largest value among the electro active polymer gel materials reported so far. The low current suggests that there is much less energy loss in this motion compared with the conventional polyelectrolyte gels. The energy loss as heat was much less than that of Nafion or Flemion membrane overall, therefore it is far less when the size (thickness and surface area) of the gel is taken into account [15].

The gel could also show a crawling-type deformation. This is a novel type of motion. The crawling motion was observed when a naked gel was placed on an electrode stripe array. The motion was completed in *ca*. 1 second.

1.7. From electro-active polymer gel to electro-active elastomers with large deformation

Non-ionic polymer gel swollen with dielectric solvent is shown to be extremely deformed, as is the non-ionic polymer plasticized with non-ionic plasticizer. The mechanism suggested for the gel actuation was 'charge-injected solvent drag', and that for the plasticized polymer was 'asymmetric charge distribution of injected charge'. The latter mechanism can be applied to the non-ionic elastomers in which the motion of the polymer chain is relatively free and so is the migration of the injected charges. The migration of the injected charge and the balance of the charging and discharging rates must be a critical factor to the deformation provided the electrostatic interaction is a major factor in the actuation. The experimental results on polyurethane elastomers support the concept described above. In addition to our expectations, some novel features of the motion are being clarified in detail, such as memory effect, bending direction control, and so on.

2. Applications [16]

Conductive polymers have wide area of application:

- Static dissipation
- EMI shielding
- Resistive heaters
- Military application

- Commercial display
- Batteries
- Organic solar cells
- Organic light emitting diodes
- Actutators
- Electrochromism
- Super capacitors
- Bio sensors
- Flexible transparent display
- Composite structures

3. Conclusion

In this paper, various types of electro active polymers were introduced. Some of them have a long history as electro active materials. Recently, however, polymer gels and/or elastomers, which have no intrinsic polarization in their structure and do not contain any ionic species either, have been found to show huge strain by applying electric fields with a low electric current. Energy dissipation occurring as heat is much less than the conventional polyelectrolyte materials. The concepts of 'charge-injected solvent drag' and 'asymmetric charge distribution of injected charge' are proposed as a possible mechanism of the huge deformation. These concepts can be applied to various non-ionic conventional polymers. The author strongly expects that the concepts expand the field of actuator to that of practical artificial muscle, and contribute to the development of the micro-machine or nano-machine in the future.

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The Role of Secondary Heater in Deciding Yarn Characteristics in Texturising Machine

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Abstract
The role of secondary heater is very often a disputed matter. The temperature is kept by the PTY manufacturers depending upon their end use. Experimental works were carried out with latest POY, latest texturising machine reveals the fact that there is marginal difference found the denier, tenacity and elongation. The main area is HCC % which is known to all. No difference in fabric width was found nor in dye uptake although the same is very often doubted by the end users. The bulk variation starts only at the difference of 20°C between the primary and secondary heater. There is no remarkable difference in dye uptake also. The X-Ray and intrinsic Viscosity (IV) also do not show any difference as there is no change in molecular structure. This experiment is an ideal guideline for the PTY manufacturers.

Key words
Heaters, Machine Parameters, Tension values, TKD, Yarn bulk

1. Introduction

In Industrial practice the difference between Primary and secondary heater is maintained about 20°C depending on end use. The temperature is being kept in most cases with assumption basis and with practical experience. As such no supporting data is available in this area. For the different end use, different temperature (2nd) is being maintained. Hence vigorous studies are being conducted between the temperatures of secondary heater vs. all yarn properties.

The role of primary heater is to mobilize the molecules and give the desired yarn properties with the help of draw ratio and D: Y & the secondary heater makes the texturised yarn stable for further process. It is also studied whether any structural changes take place with the variation of secondary heater.

2. Materials and Methods

Latest Himson mc. of model AX4N, close heater with latest amenities was used. The parameters kept: Speed > 900 MPM, Primary Heater (PH) temp – 200°C, Secondary heater (SH) temperature varying at a difference of 5 °C from 140 °C to 170 °C i.e. at 7 stages. Draw Ratio (D:R) – 1.70, D/Y – 1.65, Stabilising over feed (SOF) – 4.5% (fixed), Cycle per minute (CPM) – 450 +/-2.5%, oil roll rpm- 4. Take up value was changed as per the SH to maintain uniform package hardness (3.65 to 4.35).

POY - Den > 132.4 , Breaking strength (gms) 285.26, Elongation at break (%) 126.08 , Tenacity of the yarn – 2.15 , U% = 1.67 , D/F on dynafil – M, Mean 41.76, Min – 36.47, Max- 51.65 , spin finish % 0.44.

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3. Results & Discussion

3.1. Tension

During texurising process tension values were taken on each position to know the perfection of thread path. The results displayed in table no 3.1

Table 3.1 : Tension values

T1 CN	T2 CN	T3 CN	T2/T1
32-34	22-24	10-11	0.647- 0.75

The table 3.1 shows that there was consistency in tension values. No variation in tension was found which proved the excellent POY properties and steady yarn path in the machine.

3.2. The physical inspection of PTY spools

All the PTY packages were inspected after doffing and no fault such as b.f., loops, hardness variation, cross

winding was found. No bulk variation was found up to the temperature difference of 15°C within the SH. It has been explained in table 3.2.

The table 3.2 has shown how the bulk variation occurred gradually as the difference in heater temperatures were widened.

Table 3.2 : Variation in bulk with heater temperature

Standard Package	Comparison Package	Bulk diff	Standard Package	Comparison Package	Bulk diff
140 °C	145 °C	No	150 °C	155°C	No
	150 °C	No		160°C	No
	155 °C	V.slight		165 °C	No
	160 °C	slight		170°C	slight
	165 °C	slight	155 °C	160 °C	No
	170 °C	found		165 °C	No
145 °C	150 °C	No		170°C	No
	155°C	No	160°C	165°C	No
	160 °C	V.slight		170°C	No
	165 °C	slight	—	—	—
	170 °C	slight	—	—	—

From the table 3.2 it is very clear that within a difference of 15 °C in 2nd heater temperature, there is almost "no" to very slight difference in bulk. For the difference of 20 to 25°C the bulk variation starts. For the difference of 30°C, good difference in bulk is found. It is because of the fact that higher the 2nd heater temperature, higher will be the set yarn and hence less bulk.

The properties were checked at MANTRA lab as per ASTM standard. It is found that there is hardly any difference in denier and tenacity values, because all these properties were decided at the stage between input and intermediate roller where simultaneously draw was done in high temperature followed by cooling and formation of bulk. The HCC value is decreasing with the increasing of secondary heater temperature as the thermoplastic yarn gets more relaxations with less temperature and gets more stable with higher temperature.

3.3. Boiling water shrinkage

The boiling water shrinkage was taken at a temperature of 100 °C for the common duration for all and the findings are given below in table 3.4.

Shrinkage % value reduces as the 2nd heater temperature increases. But at each point of temperature, the value does not decrease. There is no significance difference in X-Ray and IV value which shows no diffraction in molecular orientation.

The snarl per meter also shows decrease as and when 2nd heater temperature increases as it gets more set.

Table 3.3 : The physical properties of PTY Spools.

2nd Heater tempt	Den with oil	Den without oil	Breaking strength (gm)	Elongation at break (%)	Tenacity of the yarn (g/d)	HCC%	Oil Content (%)
140 °C	76.6	76.37	292.9	20.74	3.8	39.6	0.31
145 °C	76.6	76.02	303.31	22.24	3.9	36.1	0.76
150 °C	76.9	76.45	305.4	22.67	3.9	35.9	0.58
155 °C	77	76.65	307.5	21.58	3.9	34.7	0.45
160 °C	77	76.63	316.67	22.77	4.1	32.4	0.48
165 °C	76.7	76.29	306.46	21.06	3.9	37.2	0.53
170 °C	76.7	76.33	299.99	21.42	3.9	32.9	0.48

Table 3.4 : Boiling water shrinkage

Sample No.	2nd heater Tempt	Boiling water Shrinkage(sh) %	Intrinsic Viscosity(IV) Value	X-Ray order factor	Orientation angle at peak 25.5	No of snarls per mtr.	
						Pirn 01	Pirn 02
	140 °C	11.2	0.591	0.41	15.6	69	68
2	145 °C	6	0.592	0.37	18.9	63	64
3	150°C	5.6	0.592	0.39	16.4	63	64
4	155 °C	6	0.591	0.41	15.98	65	63
5	160°C	6	0.591	0.38	17.2	63	57
6	165 °C	3.6	0.593	0.37	17.2	58	60
7	170 °C	2	0.592	0.4	16.4	57	58

*3.4. *TKD Value (* Tube knitting dyeing)*

TKD was done at serial order as well as in match with each other. Very slight difference found between 140°C and 165 °C. Slight differences found between 140 °C and 170°C. The difference was because of difference in surface appearance.

3.5. The yarn sample Vs. Fabric width

The cloth was woven on ordinary loom and the pirns were wound at single position keeping everything at identical condition. The fabric was woven at single loom and at a sequence where the comparison was made with each 2nd heater temperature.

The width variation within the sample i.e. say sample no 1, 2 etc are found within 0.5 inch and no significant difference was found between sample no 01 to 07.

3.6. Fabric Dyeing report

The whole fabric was dyed and no difference in Dye uptake was found. However between samples no 1-7 and that of 1-6, a wrinkle was found. It was found that lesser the 2nd heater temperature better was the cloth feeling for the obvious reason of softness as lesser temperature gives higher bulk.

Conclusion

- There is no significant impact on denier and tenacity with the variation of secondary heater temperature.
- The HCC and boiling water shrinkage value decrease as the secondary heater temperature increases.
- The dimensional stability improves with increase of secondary heater temperature such as in the case of snarl value.
- In IV and X-Ray value no difference was found and it can be said that there is no change in structural value within this experiment.
- There is as such no significant width variation found in grey and finished fabrics with the total difference of 30 °C even though the bulk variation was observed. The cloth feel is better with lesser 2nd heater temperature.
- In TKD value, slight darker was found at the temperature difference of 25 °C and above.

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Recent Advances in Shrinkproofing of Wool

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Abstract
The most commonly used method to confer dimensional stability on articles made of animal hair fibre is the INS/CSIRO chlorine/Hercosette treatment. This process releases environmentally hazardous organic halogen compounds (AOX) and exceed the maximum permitted limit stated by many countries. Hence there is a need of completely AOX free shrinkproofing treatment for wool. Proteolytic enzyme treatment can be used as an eco friendly alternative for the chlorination stage. Plasma and UV/Ozone treatments are the dry processes and have ability to replace chlorination step. Application of biopolymers like chitosan, sericin and casein can be used as alternative to the synthetic resins. These biopolymers with suitable cross linking agents can form the inter fibre bonds and can be used as stand-alone shrinkproofing process.

Keywords
Biopolymers, chlorine/Hercosette, environmental pollution, enzyme, plasma, shrinkproofing, UV/Ozone

1. Introduction

Apart from dyeing, shrink proofing processes are the most common chemical treatments applied to wool. In the absence of any preventative treatment, almost all types of woven and knitted wool products will shrink, although the propensity to do so varies widely. For centuries felting property of wool fibres has been used in manufacturing unique products from wool or animal hairs by mechanical agitation and compression of the fibres in warm, moist conditions. These felts are used for polishing and de-burring of metals and optical surfaces etc. Other uses of wool felts are manufacturing seals, gaskets, washers, air and liquid filters etc. Woollen spun fabrics are often finished with a less drastic felting process described as milling or fulling [1].

For most of the past century, the need to reduce or completely eliminate shrinkage of fabrics as a result of felting has become a necessity for the woollen fabrics to make them easy care and machine washable. For truly machine washable wool fabrics both relaxation shrinkage and felting shrinkage should be eliminated. Relaxation shrinkage, which is due to the release of mechanical stresses introduced into the fabric during manufacture is reversible and governed by tensions imposed during spinning, weaving, knitting and making-up. Felting shrinkage is due to the fibre movement and interlocking of fibres during mechanical agitation, due to the directional frictional effect. Hence felting shrinkage is irreversible and is the important factor in producing machine washable wool [2].

Today, nearly 75% of the overall production of machine-washable wool is carried out at the stage of wool top being the base material for yarn production. State-of-the-art so far is the Chlorine/Hercosett treatment, a continuously operating combined process using chlorination as a preliminary step to polymer coating of the fibre with a polyaminoamide (Hercosett). This process uses large amounts of water as well as dangerous substances, which leads to significant wastewater pollution with organic halogen compounds (AOX). For example 1200 t of "Superwash" quality wool production requires use of environmentally hazardous substances like: 150 t sodium hypochlorite; 220 t resin; and 165 t other auxiliaries (sulphuric acid, wetting agent, defoamer, etc.) [3]. Chlorinated organic substances are recognized as being mostly toxic, and a number of countries have established maximum concentration levels for these compounds in effluents. Since the AOX generation during conventional shrinkproofing of wool exceeds the permitted levels by up to 40 mg/l, an environmentally acceptable, chlorine-free process for imparting full machine washability is required [4].

Newer developments focus on the application of eco friendly wet processes like enzymatic processes, dry processes like plasma or UV/ozone treatments and biopolymers like chitosan, sericin and casein in combination with these treatments or stand-alone shrinkproofing process [3-66].

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2. Mechanism of Felting Shrinkage in Wool

It is the distinctive cuticle or scale cell structure of wool fibres that is primarily responsible for felting by fibre entanglement, causing a corresponding shrinkage of wool fabrics, most particularly in laundering. The overlapping cells that make up the cuticle are tightly cemented to each other and to the underlying cortex. For Merino wool, the exposed length of each cell is 10-20 μm, and the cuticle is 0.5-1.5 μm thick. These scale cells have raised edges and often several ridges or false edges, the pattern varying quite a lot between sheep breeds. Several frictional mechanisms (Fig. 2.1) are likely to be operative in the dynamic situation when a fibre assembly such as a wool fabric is subjected to mechanical action. Differential frictional effects (DFEs) operate according to the direction in which a fibre is pulled over another surface. If the fibres are lying in the same direction (Fig. 2.1a) then, movement in either direction will create minimum friction and chances of interlocking are less. Differential friction (Fig. 2.1b) between fibres against scales will be maximum and so the tendency to felt. In case of movement between fibres with scales (Fig. 2.1c) friction will be minimum, hence chances of interlocking. If fibres are moved on plain surface against the scale (Fig. 2.1d) the friction will be maximum as compared to movement in the scale direction (Fig. 2.1e). During laundering or mechanical agitation in warm and moist condition, slight movement of these fibres results in fibre interlocking. This causes irreversible felting shrinkage in the woolen garments [1].

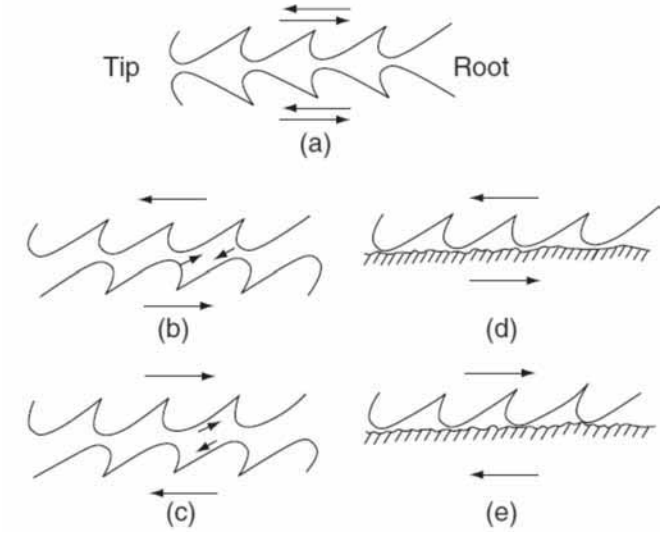

Figure 2.1 : Differential friction in wool: (a) between fibres lying in same direction; (b) between fibres against scales; (c) between fibres with scales; (d) on plane surface against scales; (e) on plane surface with scales.

3. Commercial Shrinkproofing Treatments

To make the woollen garments machine washable, three anti-felting processes are commercially practiced: subtractive (oxidation, reduction) are targeted to reduce the rough surface, either by partial removal of the scales by chemical treatment, additive (synthetic resin layer) coating the scales with a polymer, or by preventing their contact through spot welding by deposition of polymer aggregates that keep the fibers at a fixed distance from each other. Table 3.1 shows the commercial shrinkproofing processes used for wool fibres [2]. Wet chlorination is the most common wool surface oxidation treatment. The primary modification sought is either to alter wool fibre surfaces so as to facilitate polymer adhesion or alternatively to oxidize some CYS in the exocuticle in order to alter fibre swelling (in water) and other viscoelastic properties of the scale cells. Dry chlorination, i.e. exposure of wool products and typically knitwear to chlorine gas in sealed vessels has been a major technology. Wet chlorination, on the other hand, continues to be used in several variations up to the present day, according to whether a mild preparatory treatment of fibre surfaces is required for subsequent polymer applications, or a more thorough oxidation of the wool epicuticle is sought as a stand-alone shrinkproofing process [1, 6]. A major survivor of all these chlorination processes is the use of the sodium or potassium salt of dichloroisocyanuric acid (DCCA) [1, 7]. Davidson [8] shown that the treatment of wool materials in a mixed bath containing peracetic acid and sodium hypochlorite gives a high degree of

Table: 3.1 : Commercial shrink resist processes for wool

Trade name	Type of process
Basolan DC (also called Orced, Fichlor and CBD)	Controlled acid chlorination (potassium dichloroisocyanurate, DCCA)
Dylan	1. Chlorine/permanganate (Dylan Z)
	2. Permonosulphuric acid (Dylan XCS and XB)
	3. Permonosulphuric acid followed by DCCA(Dylan XC2 or XB2)
Kroy	Continuous controlled acid chlorination, sodium hypochlorite and hydrochloric acid
Dry chlorination	Chlorine gas
W.I.R.A.	Peracetic acid and sodium hypochlorite
I.W.S. WB7	Potassium permanganate in a saturated solution of sodium sulphate
Irnel 2000	Electrical discharge
Negafel	Sodium hypochlorite and formic acid under controlled conditions at low temperatures

unfeltability together with soft handle, good colour, and slight increase in weight.

Potassium permanganate ($KMnO_4$) is a well known strong oxidant. Normally $KMnO_4$ would diffuse right through wool fibres and readily oxidize all the accessible CYS. In a concentrated solution of a salt (NaCl or Na_2SO_4) however, wool swelling is suppressed, so that the $KMnO_4$ reacts mainly with the high densities of CYS in the epicuticle. At the termination of this reaction, the black near-surface deposits of manganese have to be cleared by a bisulphite rinse, which rapidly dissolves them. Permonosulphuric acid is another oxidant used in shrink proofing of wool and also known as Dylan treatments. The treatment is given in 10% H_2SO_5 at pH 0.46 and terminated by a reductive step with sulphite or bisulphite, which is thought to yield a useful improvement to the primary oxidation in terms of shrinkproofing performance [1]. Andrews et al [9] studied the chemical changes in the cuticle of oxidized wool and it was found that, the extent to which cystine is modified varies with the shrinkproof treatment. The analyses suggest that, although treatments with permanganate/salt, permonosulfuric acid, and hypochlorite at pH 4.2 effects marked changes in the chemical nature of the cuticle, they are not as severe as dry chlorination or acid chlorinations with either hypochlorite or bromate/salt.

Full machine washability by an oxidative treatment is not possible without excessive damage to the fibre. To eliminate this excessive fibre damage over the years there has been a considerable increase in the use of polymers in combination with these oxidative processes for shrinkproofing [1]. Feldtman and McPhee [10] shown that, a useful criterion for spreading polymer on the wool fibre is that ã, (the critical surface tension) of wool must be greater than $ã_e$ of the applied polymer. The best pretreatments are those which increase the critical surface tension of wool from 45 dyne cm (normal wool) to 65-70 dyne cm. One of the first to be widely adopted for continuous treatment of tops was the chlorine/*Hercosett* process. *Hercosett 57* is a polyamide epichlorhydrin resin, and another successful polymer, *Dylan GRC*, is a similar cationic resin suitable for application to wool tops [1].

Third method of shrinkproofing is a simple and versatile treatment, which is inter-fibre bonding. Not surprisingly, the potential drawback of these processes is the loss of flexibility and soft handle. The types of resin that have found popularity include polyurethanes with free isocyanate groups (*Synthappret LKF*, and its bisulphite adduct Synthappret *BAP*, Bayer), self-crosslinking polyacrylates, and a variety of silicones. Refinements to treatments are constantly being made, with particular attention to improved curing and fabric handle. *Synthappret LKF* is a trifunctional polyether-based urethane prepolymer containing terminal isocyanate groups. It is supplied as a solution in perchloroethylene and applied to the fabric by padding from perchloroethylene, followed by curing in saturated steam for an hour. Solvent-based processes of this general kind have been popular because they are versatile and can be applied to batches of garments in drycleaning machines. Their continued use is in doubt due to increasing restrictions on chlorinated solvents. *Synthappret BAP* is a water-soluble bisulphite adduct of a trifunctional isocyanate-terminated urethane prepolymer and is applied by padding from aqueous solution with bicarbonate as a curing assistant. The curing process typically dries the fabric at 150 °C for about 3 min. in a stenter. All polymer applications to fabrics depend for their shrinkproofing action on forming interfibre bonds. These must be sufficiently strong to withstand domestic laundering, so that adhesive forces are the most relevant to shrink-resist efficiency [1].

4. Enzyme and Polymer in Combination

Protiolytic enzymes can be used to replace the oxidative processes like pretreatment using chlorination and will be an eco friendly alternative. Protiolytic enzymes that can stand the alkaline range are generally obtained from extremophiles, and account for ca. 70% of the overall market. Queiroga et al [11] details the isolation and application of enzymes from non-extremophiles source (as is actual wool on the living animals) for better shrink resist properties than the commercial enzymes. Enzymatic methods for treating wool, used alone or in conjunction with an oxidative chemical step have had little commercial value. A fact that is attributable to their relatively high costs and their tendency to damage wool by causing weight and strength losses. To overcome this disadvantage Lenting et al [12] suggested pretreatment of wool with hydrogen peroxide at alkaline pH in the presence of high concentrations of salt. Use of salt suppresses the swelling of wool fibres, thus avoids the penetration of enzyme in fibre core and restricts the action on the surface of wool fibres. Rybicki et al suggested enzymatic pretreatment and chitosan deposition on wool fabric as a new ecological method for shrink-proofing of wool fabrics. Based on the results, it was concluded that enzymatic pretreatment itself

greatly improved the shrinkproofing property by partial destruction of the fiber scales, and the post application of chitosan enhanced the shrinkproofing and ensured an increased dyeability of wool fabrics by reactive dyes [13, 14]. In another study [15] it was found that enzyme activity is dependent on surface energy of the fibre and surface energy can be increased by LTP treatment or chitosan deposition on the untreated wool fibres. Chitosan deposition also found to reduce the felting shrinkage. Demir et al [16] studied the synergetic effect of plasma+ enzyme+ chitosan treatment on the shrinkage properties of knitted woollen garment, it was found that the area felting shrinkage can be reduced upto 8% which can be acceptable at industrial level. Jovancic et al [17] found that enzyme application in alkaline peroxide treatment bath enhances wool wet ability and effectiveness of subsequently applied chitosan biopolymer due to formation of ionic bonds between the new sulphonic groups generated on the wool fiber surface and chitosan which contribute to the shrink resistance of H_2O_2 + enzyme/chitosan treated wool.

As enzyme treatment causes weight and strength loss of wool fibres, other possible solution for this problem is that either the enzyme has to be controlled (for example, diffusion control by enzyme immobilization) or the enzyme has to be specially "designed" (for example, by genetic engineering) in such a way that only a distinct part of the substrate is altered like scales on wool fibre surface [18]. Silva et al [19, 20] studied the diffusion of native subtilisin and bigger molecular weight polyethylene glycol (PEG)-subtilisin into the wool fibres. It was found that, the alkaline peroxide pre-treatment improves the enzyme diffusion on wool. Subtilisin-PEG, the big protease, hydrolyzed just the cuticle layer of wool thus resulting in the higher tensile strength and lower felting of the fibre; on the other hand native subtilisin penetrates deep into the fibre core and causes more strength loss.

Another way of recovering the strength loss of wool is to cross link glutamine and lysine protein residues in the wool fibre using transglutaminases (TG) enzymes to form covalent bonds. Transglutaminases (TG) belong to a class of enzymes known as aminoacyltransferases that catalyze calcium-dependent acyl transfer reactions between peptide-bound glutamine residues as acyl donors and peptide-bound lysine residues as acyl acceptors, resulting in the formation of intermolecular e-(g-glutamyl)lysine crosslinks [21,22]. Wool fibres contains, 450(μmol/g) of glutamine - $(CH_2)_2$-$CONH_2$ and 250(μmol/g) of lysine - $(CH_2)_4$-NH_2, so there is a fare chance of cross linking between glutamine & lysine initiated by TG [23]. This covalent isopeptide crosslink is stable and resistant to proteolysis, thereby increasing the resistance to chemical, enzymatic, and mechanical disruption [24]. de Souza et al [25] studied cytotoxicity, genotoxicity, and mutagenic effect of TG from B. Circulans and found that these enzymes are safe for food application and has a potential for its industrial use. McDevitt et al details [26] the method of treating wool with a proteolytic enzyme, either preceding or preferably, simultaneously with a TG. This combine process was found to improve shrink resistance and was able to retain the mechanical properties of wool fibres. Plasma and electron-beam processes as pretreatments for TG enzymatic processes were studied [27] and it was found that chemical etching or the removal of the epicuticle layer by physical etching, leads to increased formation of cross-links or incorporation of primary amine compounds. Routinely used biological detergents contain proteases and damages wool fibres during laundering. Wool garments previously treated with TG are likely to have increased resistance to domestic washing and thus provide increased longevity [28]. Transglutaminase could remediate wool damage following hydrogen peroxide and protease anti-felting finishing, resulting in an increase in wool fabric strength and a decrease in alkali solubility [29]. The microbial transglutaminase (mTG) is used as a bio-catalyst to repair the wool damages caused by chemical or enzymatic treatments. The knitted wool fabrics treated with mTG after pretreatment of H_2O_2 and protease displayed 7.5 % of area shrinkage and about 22.3 % recovery in tensile strength when compared with those treated without mTG [30]. Agricultural Research Service (ARS) process, providing bleaching, biopolishing, and shrinkage control by peroxycarboximidic acid oxidation and selective enzyme digestion of wool scales can cause 10 to 18% strength loss. After ARS processing 3 to 5% fabric strength was regained with application of transglutaminase (TG) [31]. Hossain et al [32] developed a bioprocess for machine washable wool, combining the advantages of both protease and transglutaminase in a simultaneous enzymatic treatment. This process reduced the felting tendency of woven wool fabrics by 9% at the expense of only 2% weight and tensile strength loss. The microbial transglutaminase (mTG) isolated from *Streptoverticilium mobaraense*, when applied to wool either alone or following a protease treatment, resulted in an increase in wool yarn and fabric strength

(up to a 25% increase compared to a control) [33].

Transglutaminase has ability to cross link the protein and many researchers used this to graft natural proteins on to wool fibres. Gembeh et al [34] investigated the covalent binding of a primary amine to wool through TG-catalysed reactions. It was found that, TG initiates the cross-linking of the protein and covalent binding of reduced carboxymethylated *ê*-casein with wool. Griffin et al [35] incorporated pancreatic digest of milk casein (Tryptone) and putrescine into wool fibres using TG, which was found to reduce felting shrinkage, retaining the fibre mechanical properties. In another study [36], 4% (owf) casein, a protein found in milk, was used as a surface-coating material and cross linked using mTG on $KMnO_4$ pretreated wool fabric. It was found that area shrinkage was reduced to 4.57±0.15%, which is well acceptable to industrial level. Hossain et al [37] studied the grafting of nordihydroguaiaretic acid, which is a bi-functional phenolic compound on the wool fabric, through a laccase enzyme catalyzed reaction in an aqueous-ethanol mixture. The treated wool was found to be giving better shrink resistance, crease recovery angle, tensile strength, strong antioxidant activity and UV-protection properties. TG mediated grafting of silk proteins led to a significant effect on the properties of wool yarn and fabric, resulting in increased bursting strength, as well as reduced levels of felting shrinkage and improved fabric softness [38]. Keratin hydrolysates (KH) and their lyophilized powders (KP) were applied to fine jersey wool fabric bleached by peroxycarboximidic acid in the first step of the ARS process using TG. This treatment minimized felting shrinkage to 5.21% and fabric weight change to 0.26% and maximized dry burst strength to 4.7% loss and increase in fabric whiteness to 17.8 whiteness index units as compared to the ARS processed fabric [39]. In another study [40], mTG-mediated crosslinking of gelatin on the surface of wool was studied and it was found that mTG reduced the area shrinkage of $KMnO_4$-pretreated fabric from 6.53 ± 0.06 to 1.92 ± 0.15%, which was more effective than that treated with gelatin alone.

An enzyme in wool anti-felting is a most promising area in order to achieve high-grade, comfortable and washable effects. With the environmental consideration, enzymes consumption in wool industries will have a rapid increase. This will call for a simple, low cost technique in enzyme production. Enzyme is a special protein; its activity can easily be affected by temperature and other chemical reagents, hence stability and the specificity of enzymes need to be enhanced. The wool mills should find a proper process to keep enzymatic fabrics quality stability [41].

5. Plasma and Polymer in Combination

For shrinkproofing of wool, a plasma-induced surface oxidation as well as a direct coating of the fibres by plasma polymerization also found to reduce, but not to eliminate, felting. Since plasma polymers deposited on wool fibres are known to decrease the dye uptake by the fibre, a plasma polymerization does not meet the requirements for treatments at the stage of top. Therefore, generation of non-shrinkable wool has been mainly concentrated on the plasma-induced surface oxidation [4]. The increase in surface area after plasma treatment of the fiber, is from $0.1m^2/g$ to $0.35m^2/g$. These physiochemical changes decrease the felting/ shrinkage behavior of wool from more than $0.2g/cm^3$ to less than $0.1g/cm^3$ [42]. Sadova [43] proved that, glow-discharge plasma treatment enhances the diffusion of dyes into fibers upon dyeing and decreases the felting ability. This treatment did not impair the physicomechanical, heat-insulation, and thermal properties of wool. Lee et al [44] studied the effects of afterglow, ultraviolet radiation, and heat from an electric glow discharge on wool felting shrinkage, yarn strength, and grafting of polymers. Under the conditions of treatment, it was found that heat and ultraviolet radiation have little or no effect on wool felting shrinkage and yarn strength. Afterglow like glow discharge makes wool yarn shrink resistant, stronger and was found to induce grafting of polymer. Pavlath et al [45] shown that even if afterglow area does not emit visible radiation, still contains active particles capable of initiating a multitude of chemical reactions. When wool was exposed to the afterglow of various gases, a considerable amount of shrink proofing effect (SPE) was observed. Naebe et al [46] examined the effects of atmospheric pressure plasma pre-treatment on the shrink resistance of wool fabric treated subsequently, by the pad/dry method, with an aqueous emulsion of the amino-functional polydimethylsiloxane, SM 8709. Optimal shrink resistance (with no impairment of fabric handle) was obtained after a low-level plasma treatment (1-3 s exposure time), using 5% of the polymer emulsion. The main impact of the plasma pre-treatment was to enhance the distribution of polymer both on and between fibres and to improve adhesion of polymer to the fibre. Thorsen et al [47] studied the effect of corona discharge under a variety of voltages, frequencies, temperatures, and gaseous environments on

shrinkproofing of wool. Optimum temperatures to give shrink resistance were between 100 and 140°C. Substantial shrink resistance was obtained with an exposure time as short as 2 sec. and oxygen was found to give better results as compared to air and nitrogen mediums. Shrink resistance was found to increase with increase in voltages and frequencies. To achieve the shrink resistant properties top stage treatment was suggested instead of fabric stage, because in fabric the gaseous reactants did not penetrate adequately. In another study [48], it was found that incorporation of Chlorine gas in the air-corona field markedly increases shrink resistance properties of wool. An air/chlorine volume ratio of about 14/1 was found to give excellent results. A pilot-scale corona reactor that produces a high-power corona for rapid treatment of wool or mohair top was built and tested. The maximum production rate was 43 lb/hr for a 2 sec treatment time. Power consumption of the 14X24 in. corona cell was 4.5 kw at 16,150 V-2070 Hz but it was greatly reduced with fractional reductions in voltage [49]. The influence of RF glow discharge (GD) treatment on the shrink resistance properties of knitted wool fabric and wetting properties of keratin fibres were studied [50]. It was found that, Even short exposure times are found to be enough to decrease drastically the advancing water contact angle and, therefore, to increase the shrink resistance effect. Slight differences were observed between the air and nitrogen plasma treatments. The time elapsed after the plasma treatment promotes an increase of the advancing contact angle and a decrease of chitosan adsorption. The anti-felting mechanism of plasma-treated wool was investigated [51] by analyzing the surface of Ar-plasma-treated wool using XPS. It was suggested that intermediate cystine oxides, i.e., S (O)-S and S $(O)_2$-S groups generated on the wool fiber surface, have a strong affinity with water. In addition, carboxyl and sulphonic acid groups produced on the fiber surface during plasma treatment may also increase surface hydration and thus may play some part in the felting behavior of wool fiber. Subsequently, cohesive force is exerted by hydrogen bonding between these groups and water molecules on the fiber surfaces. This interaction results in a decrease in the flexibility of the individual fibers in the assembly. This limits the unidirectional movement of the fibers and thus improves the anti-felting behavior of the wool fibers. Mori et al [52] studied the shrinkproofing of wool fabrics using a dielectric barrier discharge (DBD) apparatus by varying the power and flow rate of air. It was found that shrinkproofing, dyeing yield and water-absorbing properties increased to a greater degree with the increase in the treatment time. It was concluded that, hysteresis of shearing property at large shear angle (2HG5), becomes larger with the treatment time and can be related to the improvement in shrinkproofing.

Complete shrinkproofing of woollen garments can not be achieved using plasma treatment alone and hence this requires an additional coverage of the fibre surface to further decrease the difference in coefficient of friction by masking the scale edges. Since commercially available resins do not show the expected positive influence on the felt free performance of plasma-treated wool, new resins have been tailored for the plasma-treated fibre surface. Two different wool-compatible resin types have been developed by BAYER, allowing the generation of machine-washable wool after GD or BD treatment. One type consists of a water-dispersible isocyanate-bearing resin which is able to permanently coat each individual fibre. The differences in the degree of felting after different plasma-only treatments can be equalized by the resin application, to an extent which meets the value for Chlorine/ Hercosett treated samples. The second resin is a polyurethane type which does not coat the fibre completely, but is deposited at the scale edges instead. This also results in significantly decreased shrinkage behavior. DBD treatment of tops followed by application of one or both resins guarantees the specifications set by the Woolmark Company in their Technical Method 31 (TM 31) [4]. In another study [53], wool and wool/nylon blend dyed knitted fabrics after LTP treatment was subjected to softener and chitosan biopolymer treatment and it was found to satisfy the industrial standard of shrinkproofing. Erra et al [54] found that, LTP treatment increases the surface adsorption of chitosan polymer and machine washable wool can be achieved by combination of LTP and chitosan application. In another study [55], it was found that LTP and chitosan can reduce the dyeing time with acid dyes and reduces the felting shrinkage in wool. European Commission Environment Life Programme recently completed the project 'SuperWool - Sustainable, AOX-free Superwash Finishing of Wool Tops for the Yarn Production' with the innovative AOX-free plasma technology. Trials showed that the new process gives acceptable results for fine wool (socks, underwear etc). However there were still problems with coarse wool, which showed mingling after the washing process. The treatment of wool tops with low-temperature plasma and alternative resin systems has turned out to be considerably better for the environment

compared to the conventional Chlorine-Hercosett process; it is also economically very promising. This new approach not only leads to an AOX- and wastewater-free process, but can also drastically reduce the felting tendency of the material. Substituting plasma treatment for the chlorine-Hercosett process also gives advantages regarding the physical health of the operators. Since no hazardous chemicals e.g. chlorine, sulphuric acid or volatile organic compounds are needed, air contamination is significantly reduced and the risk of industrial accidents is lowered. The contamination of water bodies will also be reduced in developing countries that do not possess appropriate water treatment plants. Social benefits are strongly aligned with the outlined economical advantages, since the new technology could preserve employment in the textile industry in highly industrialised countries. The environment-friendly plasma process has the potential to define a new best available technique (BAT) and could therefore replace the chlorine-Hercosett process worldwide. This would affect some 10 installed Hercosett plants in the EU (Germany, UK, Italy, France and the Czech Republic) as well as about the same number of plants in Asia [3]. Based on the above project Richter International a Canadian company launched there woollen products with plasmawool® brand [56]. The result has led to the development of a completely AOX-free shrinkproofing process for wool tops and has thus opened up a new possibility for the wool industry to have an environmentally acceptable, plasma-based shrinkproofing process in the near future.

6. UV/Ozone and Polymer in Combination

Apart from using plasma as a dry processing technique for fibre surface modifications researchers are working on surface modifications using high energy UV rays or using ozone. Bradley et al [57, 58] found that, ultra violet (UV) ozone treatments oxidize the surface proteinaceous di-sulphide sulphur to sulphonic acid groups and treatments also lead to oxidation of surface carbon species. The data presented indicate that the UV ozone treatment used is capable of producing surface sulphur and carbon chemistry of the type usually obtained industrially by wet chemical methods which have the disadvantage of producing chlorinated effluent. Bradley et al [59] studied, the physicochemical properties of wool fibre surfaces using new UV ozone dry treatment. It was found that the treatment results in surface oxidation and increases surface polarity which promotes aqueous wetting, dyeability and shrink resistance. Xin et al [60] studied the dyeing behavior of UV-treated wool samples. It was found that, the dyeing properties of wool were enhanced by UV radiation due to the increased diffusion coefficient of the dyes in the treated wool fibres. UV/H_2O_2 with a protease enzyme method can be used for weakening surface fibers and provide a rapid, effective, anti- pilling treatment for wool [61]. In another study [62], it was found that, modification of wool fabric with ecologically acceptable UV-assisted treatments are effective in reducing pilling and shrinkage with an acceptable loss in weight and strength of the fabric. After treatment of wool fabric with safe oxidizing agents (hydrogen peroxide and SMPP) or proteolytic enzymes (papain or savinase 16L type EX) makes these treatments environmentally friendly alternatives to chlorination of wool. Osman et al [63] studied the chitosan absorption on UV\Ozone treated wool fabrics. It was found that, UV\Ozone treatment enhances the wet ability, chitosan adsorption and dyeing characteristics of the fabric.

7. Application of Biopolymers

Polymer deposition on wool fibers to coat the scales is one method to prevent laundering-shrinkage of wool fabrics by felting. Lim et al [64] in their polymer review described different methods of applying chitosan biopolymer on the wool fabrics to achieve the shrinkproofing properties. In a two-step application, chitosan solutions in dilute acids were padded on wool fabrics and dried. The chitosan-deposited fabrics were further treated with cross-linkers, such as glyoxal or glutaraldehyde, which react with chitosan as well as with functional groups on the wool, e.g., lysine, arginine, histidine, or serine residues. In a single-step application, mixtures of chitosan solution and cross-linkers, such as glyoxal, glutaraldehyde, or DMDHEU, were padded on the fabrics, dried, and then cured. Both application methods improved resistance to laundering-shrinkage of the fabrics. In another study wool fabrics were pretreated with hydrogen peroxide (H_2O_2) either under alkaline or acidic conditions. The purpose of the pretreatment was to increase the number of cysteic acid groups (–SO_3H) by the oxidation of the disulfide bonds on wool fibers and, consequently, increase the anionic charges on the fiber surface, which could enhance the sorption of chitosan with cationic charge. It was found that both acidic and alkaline H_2O_2 treatments generated similar amounts of cysteic acid groups on the fibers. The pretreated fabrics were padded with chitosan (MW 70,000) solution in dilute acetic acid and dried at room temperature. The laundering shrinkage measurements revealed that the best shrink resistance was obtained

from the wool fabric pretreated with H_2O_2 under alkaline condition. It was concluded that the shrink resistance and chitosan sorption were related to the hydrophilicity rather than the cysteic acid content of the wool. Alkaline H_2O_2 pretreatment generates more hydrophilic fibre surface than acidic H_2O_2 pretreatment and hence shows better shrink resistance properties. Effect of chitosan MW on the shrink resistance of H_2O_2 pretreated (at pH 9.0) wool fabrics was studied. It was found that, the higher molecular weight chitosan gives better shrink resistance. To promote the sorption of chitosan on wool fabric, fabric was first pretreated with an anionic surfactant sodium lauryl sulfate (SLS) at different pH conditions. In an acidic condition (pH 2.2), the highest adsorption of SLS on wool was observed. This was explained by the formation of a double layer of SLS on the wool surface. The protonated amino groups of wool at acidic pH are ionically linked by SLS, and the second layer is formed by hydrophobic interaction between the hydrocarbon chains of SLS. Finally, the fiber surface acquires a substantial amount of negative charge. All SLS pretreated fabrics were treated with chitosan (MW 70,000) solution. The lowest laundering-shrinkage was obtained from the fabric pretreated with SLS at pH 2.2. In another study [65], citric acid was used as a cross linking agent for biopolymer chitosan on potassium permanganate pretreated wool fabric. It was found that the surface crosslinks of the oxidized woollen fibers were relatively coarse, which was undesirable for shrink-proofing and yet beneficial for the antimicrobial and antiseptic effects of the woolen fabrics. A new process for feltproofing of wool fibers based on the biopolymer sericin is reported [66]. The susceptibility of wool to sericin has been enhanced by creation of new active sites along the wool keratin molecules, such as cysteic acid and S-cystine sulphonate residues, by pretreatment with hydrogen peroxide and sodium sulphite. The sericin-combining capacity of wool has been even enhanced by carrying out the reaction in the presence of different cross linkers namely dimethylol dihydroxy ethylene urea, dimethyl dihyroxy ethylene urea, and epichlorohydrin, which are able to link sericin with the available sites of wool. The felting resistance of wool tops treated with the system H_2O_2 / Na_2SO_3/sericin/ECH (felt ball density 0.045 g /cm^3) was close to that of the machine washable wool obtained commercially (felt ball density 0.039 g /cm^3).

8. Conclusion

The most widely used even today shrink-resist finishing for wool is the chlorine-Hercosett process. However, this effective process, releases adsorbable organic chlorides (AOX). Extensive efforts have been made to find environmentally acceptable alternatives to this process. Proteolytic enzyme treatment can be use to modify the cuticle layer of wool fibres, but problem with enzyme application is the strength and weight loss. This problem can be tackled by using either high molecular weight enzyme or crosslinking the wool protein using transglutaminase enzymes. To make enzyme treatment industrially viable low cost production techniques are needed. Dry processes like plasma technology and UV/Ozone treatment have also shown the potential to replace chlorination stage. Biopolymers can be used instead of synthetic resin to mask the scales after pretreatments like enzyme or plasma treatments. Biopolymer with suitable crosslinking agents has shown the potential as stand-alone shrinkproofing treatment. Use of these eco friendly techniques could replace the chlorine/ Hercosette process in near future as an environmentally acceptable shrinkproofing processes.

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An Eco-Friendly Herbal Finish for Bed Linen

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Abstract
Environment pollution appears to be a necessary evil of all development. In addition mosquitoes are not only a nuisance as biting insects, but are also involved in transmitting disease to humans and animals. So an eco-friendly approach to control mosquito is warranted. Lemon grass is a bio degradable, anti allergic, cost effective mosquito repellent commonly available. Hence the cotton fabric was treated with Lemon grass oil and leaf. The results reveal that the treated sample has good mosquito repellency. The wear study results show that the lemon grass oil finish was effective up to five washes and the lemon grass leaf extract treated sample was effective up to three washes.

Key Words
Finishing, Mosquito repellent, Lemon grass oil, Lemon grass leaf, Padding, Wear study

1. Introduction

Environmental considerations are now becoming vital factors during the selection of consumer goods including textiles all over the world. However due to increased awareness of the polluting nature of textile effluents social pressures are increasing on textile processing units. Awareness about eco-friendliness in textiles is one of the important issues in recent times since textiles are used next to skin and are called second skin. Owing to the demands of global consumer the researches are being carried out for new eco-friendly processes.

Natural finishes comprises of those substances that are obtained from plants and animals. Environment consciousness also ranks high on the selection criteria of the consumers with high buying potential. Natural finishes have many advantages such as non toxic, non irritant, biodegradable, cost effective, easy availability, etc. Concern for the green environment along with public awareness led to the innovation of many new natural finishes [1].

Moreover the mosquitoes are big menace in both rural and urban areas. They indirectly affect the economy of the nation. Mosquitoes are the major cause for the transmission of many viral diseases. The amount of money spend to the synthetic mosquito repellent is also too high [2]. Considering the above fact this study mainly focuses on mosquito repellent finishes using natural sources. The following are the objectives of this study

- To find out the availability of the natural mosquito repellent finishes.
- To optimize the various parameters for finishing.
- To study the effect of natural mosquito repellent finishes
- To evaluate the finished samples after wash, both subjectively and objectively.

2. Methodology

2.1. Selection of Fabric

Hundred per cent cotton fabric with plain weave having basket variation of about 6 meters was purchased. Then the material was desized with detergent [3]. One meter of the fabric was kept aside as untreated. The desized cotton material was finished with plant sources (2 meters each) by using padding mangle.

2.2. Selection of source

Cymbopogan spices contain several plants that are used throughout the world as insect repellents. They are rapidly growing grasses with distinctive aromatic foliage, leaves flat, often very coarse [4]. Cymbopogan citrate (lemon grass) is one such spices used as mosquito repellent in India [5]. Hence in this study lemon grass leaf and lemon grass oil were selected for finishing.

2.3. Pilot study

For the pilot study one meter of cotton fabric was used to find out the optimization of lemon grass oil and lemon grass leaf, lemon grass leaf extraction time,

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finishing time, type of binder, temperature and finishing technique.

2.4. Final study

Based on the results of the pilot study lemon grass oil and ethanol was selected in the ratio of 1:15. For lemon grass leaf extract the combinations selected was lemon grass leaf 100g, water 1000ml, temperature 60^{0}C and time 1 hour.

2.5. Finishing

The durability of the finish can be enhanced when the herbal extracts are applied on cotton fabrics directly by pad-dry-cure method with binding agent citric acid [6]. Hence padding mangle was used to finish both the samples. The treated samples were cured in room temperature and dried in shade.

2.6. Wear Study

Plain weave cotton fabric is used for bed spreads due to its absorbency, texture and durability. Therefore the treated samples were converted into bed spreads. The edges were folded and machined.

2.7. Evaluation

Evaluation of unfinished and finished samples were made by subjective evaluation such as visual inspection, objective evaluation such as mechanical, physical, comfort properties and mosquito repellent test.

2.8. Nomenclature

The nomenclature used for various samples are given in Table 2.1 below

Table 2.1 : Nomenclature

S.No	Sample	Nomenclature
1	UF	Unfinished sample
2	LGO	Lemon grass oil treated sample
3	LGL	Lemon grass leaf treated sample

3. Results and discussion

3.1. Subjective Evaluation

The visual inspection depicts that unfinished sample was found to be excellent in general appearance. The lemon grass oil treated sample was visually identified as soft and smooth in texture and medium in lusture. The lemon grass leaf extract treated sample had good general appearance and low lusture.

3.2. Objective Evaluation

3.2.1. Fabric count

The fabric count for the unfinished (UF) and finished samples (LGO and LGL) of both warp and weft direction were discussed below.

Table 3.1 : Fabric count

S.No	Sample	Mean no of yarn per inch	
		Warp	Weft
1	UF	84	29.6
2	LGO	83.2	29.8
3	LGL	83.6	29.4

Statistically it was proved that there was no significant difference for the finished samples along both warp and weft direction.

3.2.2. Gram per Square Metre

The gram per square metre for the unfinished (UF) and finished samples (LGO and LGL) are discussed below

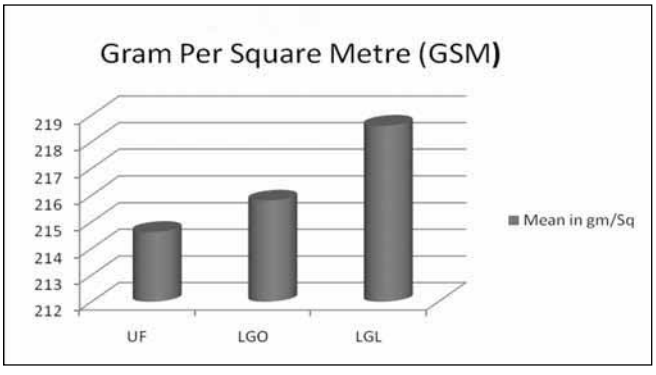

Figure 3.1 : GSM of fabric

The above fig - 3.1 shows that GSM had increased 55 per cent and 1.85 per cent in LGO and LGL samples respectively when compared with UF sample. The sample LGL had more GSM than the other sample because of the reaction of lemon grass leaf. Statistically also proved that there was a significant difference at 1 per cent level for the finished sample.

3.3. Drapability

The drapability of the unfinished (UF) and finished samples (LGO and LGL) are presented in the table below :

Table 3.2 : Drapability

S.No	Sample	% Gain / loss from the original sample
1	UF	-
2	LGO	4.47
3	LGL	-22.38

The table 3.2 depicts the drapability of UF, LGO and LGL samples. The sample LGO had more drape of about 4.47% and LGL had decreased drape by – 22.38% when compared with UF sample. The LGO had more drapability when compared with the LGL sample because of the reaction of lemon grass oil. Statistical analysis proved that there was 1 per cent level of significance.

3.4. Thickness Guage

The fabric thickness for the unfinished (UF) and finished samples (LGO and LGL) are listed below

Table 3.3 : Thickness Guage

S.No	Sample	Mean in mm	% Gain / loss from the original sample
1	UF	0.62	-
2	LGO	0.66	6.45
3	LGL	0.61	-1.61

The table 3.3 depicts that sample LGO had increased in thickness about 6.45 per cent and LGL had decreased thickness by 1.61 per cent respectively when compared with UF sample. The sample LGO had more thickness when compared with LGL sample. Statistically proved that there is a significant difference at 1% level for the finished sample.

3.5. Tensile Strength

The tensile strength for the unfinished (UF) and finished samples (LGO and LGL) along both warp and weft direction are given below.

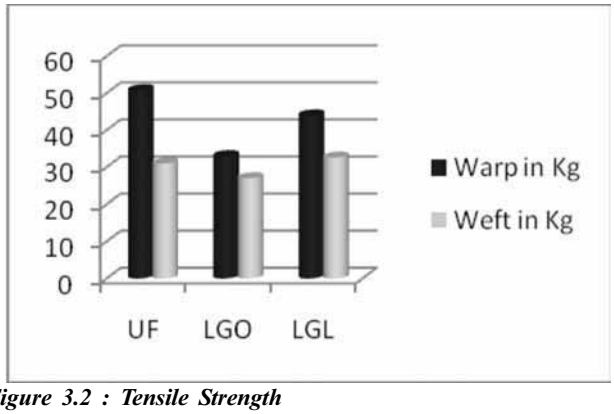

Figure 3.2 : Tensile Strength

From fig 3.2 the finished samples LGO and LGL had decreased in tensile strength along warp direction when compared with unfinished sample about –35.04 per cent and –13.39 per cent respectively. The finished samples LGO had reduced in strength and LGL had increased in strength when compared with UF sample in weft direction. The reason for increase in strength of LGL sample was the reaction of lemon grass leaf extract in fabric.

3.6. Mosquito repellent test

- From the cage test it was identified that the lemon grass oil and lemon grass leaf treated samples had good mosquito repellency.
- The cone test proved that the treated samples had good repellency against mosquitoes.
- Field test confirmed that the finished samples repel mosquitoes efficiently.
- The wear study reveals that the lemon grass oil finish was effective up to five washes and the lemon grass leaf extract treated sample was effective up to three washes.

Conclusion

Lemon grass is natural plant source. It is non-toxic, non allergic, biodegradable, cost effective and easily available. It will not cause any harm to humans even to kids and pregnant women. It can be used any where i.e both indoor and out door purposes. It smells pleasant and is non irritant to human beings. It will not cause any skin rashes and irritation. It is used as room spray for repelling mosquitoes and can be applied on clothes, body, etc. to protect our self from mosquitoes. Lemon grass was acceptable by every one worldwide as insect repellent.

From the research it can be found that there is no much reaction in the fabric after it has been finished. In general appearance the LGO treated sample has slight off white colour and LGL treated sample has dull colour one, the LGO finished sample has soft and smooth texture. There is no difference in lusture, for the treated samples (LGO and LGL). There was no significant difference in fabric count, tensile, strength (weft) and elongation (warp) when compared to untreated one. It has slight difference in tensile strength (weft), gram per square metre, thickness, drapability, stiffness and abrasion when compared to unfinished sample. It is a user friendly textile. Lemon grass oil and lemon grass leaf extract has excellent insect repellent property.

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A Comparative Study on the Performance of Commercial Hospital Bedlinen and Multilayered Bedlinen Developed

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Abstract
Few Hospitals are providing uncomfortable tough mattress, covered by water proof coated fabric cover, over which simple single layered cotton bedspread is used, which makes the patient highly uncomfortable due the strain on the contact areas and excessive heat generated. Excess compression in the contact area damages the blood vessels, leading to bedsores of different degrees with unbearable pain. In an effort to produce a pressure reliving mattress and bed sheet, a survey was carried out in various hospitals to analyze about the causes for pressure sores and the type of support surfaces used. A pressure relieving support surface was developed with super soft polyurethane foam with horizontal and vertical drill holes connected to an air circulation device to give enough air circulation and pressure distribution to more area. Single layered and multi layered bed sheets were developed using fibers like Lyocel, Cotton, Polypropylene and Micro polyester fibers in different weave structures. The multilayered fabrics are tested for the required comfort properties separately and also in combination with the mattress with air circulation device. Apart from bedspreads, wearable medical textile products for immobile patients in wheel chair are also developed using the multilayered fabrics.

Key words
Pressure ulcer, support surfaces, multilayered bed linen, Pressure distribution

1. Introduction

The hospital bed sheets are functional textiles which are expected to fulfill the comfort and hygienic properties such as moisture management, thermal conductivity, breathability, wettability, wickability, natural stretch, dimensional stability and antimicrobial activity. The commercially available bed sheets are commonly produced from plain woven cotton, polyester fibres and their blends. The moisture absorbency and heat transportation properties of these plain woven fabrics are not very good, hence the body fluids and body heat are not absorbed and transmitted quickly and thus it makes a moist laden atmosphere conducive for growth of microorganisms like bacteria, fungus and virus. Hence, the high frictional and the poor absorbent plain woven cotton bed sheets are the main cause for frictional festers and pressure ulcer in patients.

Multi layered fabrics consist of different layers of the fabrics which has the ability to complement and maximize the essential comfort properties for a bed linen. Presence of more number of layers may reduce pressure, temperature, shear and friction developed on body and also enhance the moisture and moisture vapor transport property. The problem of moisture transport through fabrics is crucial, e.g. sports garments. These consist of inner layer of special PET fibres (e.g. Coolmax which has a special shape that enhances wickability) to keep a dry contact surface between the human body and the garment. The outer layer transports sweat away from the internal layer and transfers it to the atmosphere. This technique can be applied to bed sheets and hospital beddings to achieve effective water management property. Various research works have been carried out to analyse the functional properties of layered fabrics. To know how heat and water are

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transported through each fabric, measurements of their physical properties like heat conductivity, vapor diffusivity, air permeability etc. are required to be measured and J.P. Fohr *et al* have simulated a mathematical model to determine heat and water transfer through layered fabrics [1].

T. Yasuda and M. Miyama [2] found that, when liquid water contacted a fabric, such as in the case of sweating, the surface wettability of fabric played a dominant role in determining the water vapor transport rate through layered fabrics. In such a case, the wicking characteristics, which determines how quickly and how widely liquid water spreads laterally on the surface of or within the matrix of the fabric determines the overall water vapor transport rate through the layered fabrics. J. H. Wang and H. Yasuda [3] designed an experimental apparatus to permit simultaneous measurement of temperature change and moisture flux through fabrics during the transient period after one set of fabrics has been exposed to humidity and temperature gradients. Markus Weder *et al* [4] used neutron radiology to study the moisture transport in textiles for the first time and analyzed water transport properties in a layered composite.

Jintu Fan and Xiao-yin Cheng [5] investigated heat and moisture transfer through clothing assemblies consisting of porous fibrous battings sandwiched by inner and outer layers of thin covering fabric and found that the water content accumulates with time and water content is higher at the outer regions than at the inner regions of battings.

Martha Molly Adler *et al* [6] developed a technique to study moisture transport and concluded that vapor diffusion is the major mechanism of moisture transport between two layers of fabrics at low moisture levels for all fabrics. Wicking did not begin until the moisture content was high, more than 30% above regain for the woven samples. In an attempt to overcome the problems faced by the bedridden patients and people confined to wheel chair, multilayered bed linens were developed using different varieties of fabrics. The following objectives were considered in this work:

- To conduct a survey in various hospitals to understand about the causes of pressure ulcers and also the treatment methods followed.
- To compare the existing commercially used hospital bed sheets with other single and multilayered fabrics developed using the special fibers and fabric structures.
- To develop a pressure relieving support surface which distributes the body pressure to more area and gives enough air circulation.
- To develop a multilayered bed sheet engineered with the necessary comfort characteristics like thermal conductivity, breathability and moisture management property.
- To develop wearable medical textile products for patients in wheel chair using the multilayered fabrics.

2. Materials and Methods

2.1 Hospital Survey

A questionnaire was prepared and survey carried out in various hospitals to analyze about the type of support surfaces and bed linen used, probable causes for pressure sores, common areas of attack, percentage of people affected, time taken for a patient to develop pressure ulcer, the type of preventive measures adopted in hospitals, approximate expenditure for treatment, the awareness or knowledge of the family members to nurse the pressure ulcer patients etc. The existing hospital bed linens used in hospitals were collected and tested for comfort and hygienic properties.

2.2 Design of Support Surface

When the pressure on any part of the body increases beyond 33mm mercury level, blood circulation is arrested which leads to bed sore development. To avoid excessive pressure, area of contact of the body with the bed has to be increased to distribute pressure exerted by the weight of the body to more area. This objective is achieved by developing a super soft polyurethane bed or recron filled bed with the required thickness with the criteria that the bed should not compress more than half of its original thickness. More area of contact can also be ensured by using knitted fabric in the top layer. The knitted fabric ensures good elongation, confirmation to body contour and reduced shear on the body. The mattress is designed with horizontal and vertical drill holes which are connected to an air circulation device to ensure a mild air supply to the body.

2.3 Collection of Hospital Bed linens and Fabrication of Bed sheets with single layer fabrics

Commercially used hospital bed linen, collected from various hospitals were found to be made of 100% cotton yarn of count range from 16s, 20s, 30s, 40s Ne which

are bleached or vat dyed in blue or green colour. Special fibers like lyocell, micro polyester, polypropylene and cotton were selected to suit different climatic condition and fabrics were produced with the weave structures like 1 up 3 down twill, pile, sheared terry, knitted fleece and single jersey, plaited knitted structures which are expected to provide a soft and flexible support surface. Two fabric samples were developed from lyocell fibre with twill and terry pile structures. One sample is developed using cotton with terry pile structure which is widely used as a highly absorbent cushion cover. The fleece fabric made of cotton-polyester blend which is used as quilted bed spread for babies is also developed. A single jersey Cotton knitted fabric with a special cool finish for excellent water management property and a plaited knitted fabric made of cotton and polypropylene having climate control property and a micro- polyester twill fabric is also developed.

2.4 Fabrication of Bed sheets with multi layered fabrics

Multilayered fabrics were developed with different combinations of fabrics which complement and maximize the essential comfort properties of a bed linen. Lyocell fibre is selected for constructing the multilayered combination, because of its good breathability, moisture absorption, dry and cool micro climate on the skin, smooth fibre surface, low wet cling effect and no electrostatic charging. Ultimately it might offer relief to people who suffer from skin diseases. Micro polyester is preferred because of its improved moisture management property like wetting, wicking and moisture vapor transmission.

Considering the moisture management property as the key factor, various fabric combinations were analyzed among which five combination of fabric layers were selected and tested for comfort and hygiene characteristics. The multilayered fabrics selected are,

- Lyocell twill with lyocell pile fabric
- Micro polyester twill with Lyocell pile fabric
- Cool finished single jersey knitted fabric with Lyocell pile fabric
- Cotton pile with knitted fleece fabric
- Polypropylene - cotton bilayered knitted fabric with sheared cotton terry fabric

The above single layered and multilayered fabrics were tested for the required comfort properties individually and also with the mattress with air circulation device using standard testing methods.

3. Results and Discussion

Based on the data collected from the survey, it is understood that at least 50% of bedsores can be prevented by using simple measures to relieve pressure and decrease vulnerability to injury. To prevent bedsores the following steps are to be taken

- Relive pressure on vulnerable areas.
- Reduce shear and friction

Table 2.1: Yarn and Fabric parameters

Sample No	Fabric type	Yarn count	Ends /cm	Picks /cm	Fabric weight g/m²	Fabric thickness (mm)
1	Hospital Bed Linen-1 Cotton	20	60	60	143	0.22
2	Hospital Bed Linen-2 Cotton	30	124	64	138	0.19
3	Hospital Bed Linen-3 Cotton	40	132	76	123	0.15
4	Hospital Bed Linen-4 Cotton (vat dyed in blue)	40	136	72	137	0.16
5	Hospital Bed Linen-4 Cotton (vat dyed in green)	16	18	13	208	0.40
6	Lyocell Pile	30	24	18	240	0.31
7	Lyocell Twill	30	30	22	150	0.14
8	Cotton Terry pile	30	16	16	590	0.5
9	Cotton(cool finish) Single jersey	30	20wpi	25cpi	150	0.15
10	Fleece Cotton-polyester blend	30	10wpi	12cpi	400	0.40
11	Cotton/Polypropylene plaited Single jersey fabric	30	18wpi	17cpi	220	0.20
12	Micro- polyester Twill	32	30	22	70	0.14

- Minimize irritation from chemicals
- Keep the skin clean and dry

By keeping these requirements in mind, the mattress and bed sheets were designed and tested for the comfort characteristics.

3.1. Air Permeability

Fig. 3.1 shows the air permeability values of the five commercially available hospital bed linen samples and seven single layered fabrics samples developed. All the commercially used bed linen has lesser air permeability when compared to the twill and terry pile structures developed from lyocell fiber. This may be due to the lower porosity of these fabrics due to higher cover factor and the blocking of the fabrics. Fig. 3.2 shows the air permeability of multilayered fabrics. From the figure it is clear that the multilayered fabric having Lyocell twill with Lyocell pile combination has higher air permeability followed by the fabric with micro polyester and lyocell pile fabrics, the reason being fabric with lower picks per cm gives higher air permeability due to less fabric cover. Twill fabrics give higher air permeability than plain fabrics due to the fabric cover differences. Fleece combination has the minimum air permeability which may be attributed to the compact structure of fabric having higher polyester content and hence lesser number of pores of lower cross sectional area available for air passage. The air permeability of a fabric is not much affected by the type of fiber, but it depends on the yarn and fabric parameters like twist, count, ends per inch, picks per inch and the fabric structures etc.

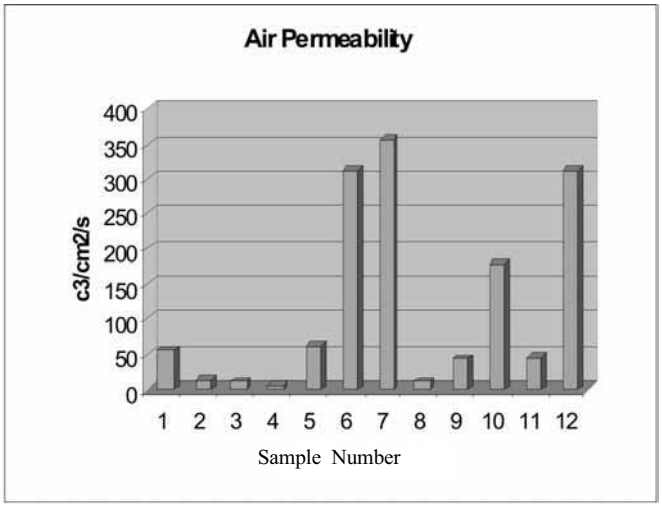


Fig.3.1 Air permeability of Single layered fabrics

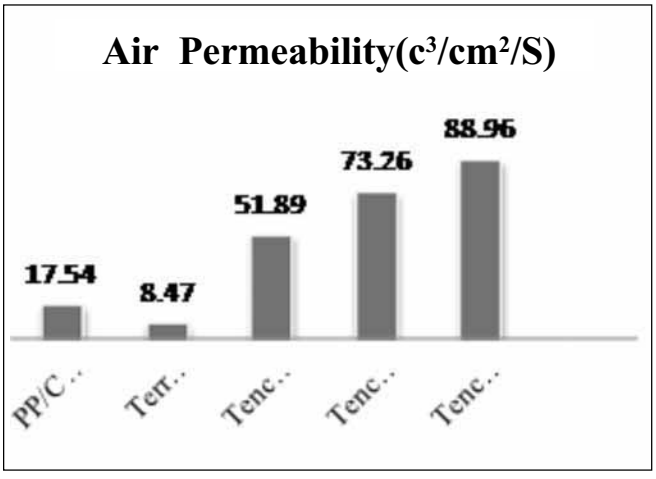


Fig.3.2 Air permeability of Multilayered fabrics

The higher air permeability of Lyocell combinations might be due to the open weave structure of both the layers of fabric. Since the cotton terry and fleece fabrics are with high cover factor, air permeability is reduced and the above two combinations could be recommended for cold climatic conditions.

3.2. Thermal conductivity

Thermal properties of textile materials especially thermal conductivity have always been the major concern when the comfort properties of clothing are concerned. Fig. 3.3 shows the test results of thermal conductivity in $W/m^2/K$ for the twelve different single layered fabrics which is a measure of amount of heat transferred through fabric and it takes place through air pore, interlaced regions of warp and weft, and through unsupported warp and weft yarns. Among the single layered fabrics, thermal conductivity is high for 40s count hospital bed linen and cotton/polypropylene

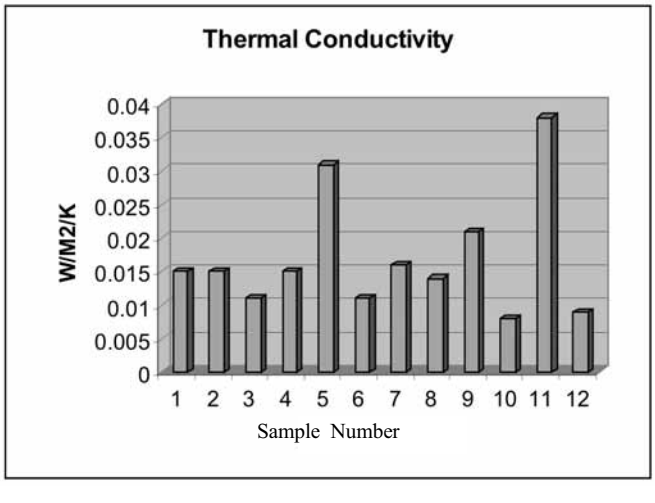


Figure 3.3 : Thermal conductivity of Single layered fabrics

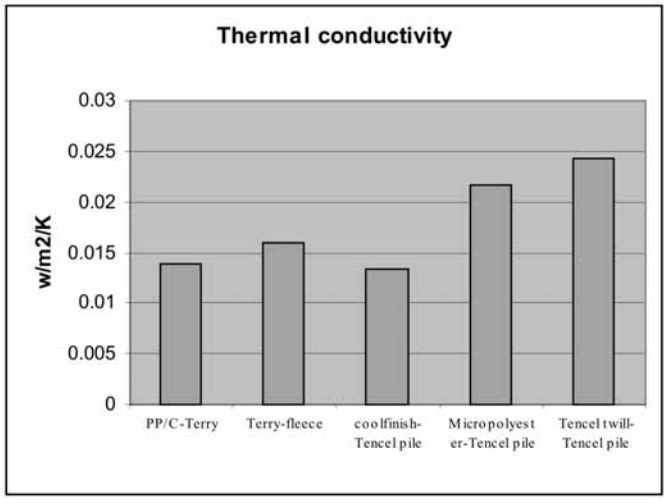


Figure 3.4 : Thermal conductivity of Multilayered fabrics

plaited single jersey fabric. Micro polyester and fleece shows reduced thermal conductivity proving its suitability for winter climate. This may be due to the fact that the thermal insulation increases with the increase in polyester content and cover of the fabric. All other fabrics show moderate thermal conductivity. Amongst the multilayered structures, Lyocell twill and pile combination and micro polyester twill and lyocell pile combination has very good thermal conductivity. This shows that these two combinations can conduct away the heat from the body easily and keep the patient cool.

The polypropylene/cotton and fleece terry combinations showed lower thermal conductivity. This may be attributed to the greater thickness of fabric having higher polyester content and cover of the fabric. Fabric thickness is the most important factor governing the thermal insulation. Other factors affecting the thermal insulation are fibre type, bulk density, fibre arrangement. The clo value which is a measure of thermal insulation offered by the fabric seems to be less for the Lyocell twill and Lyocell pile combination which shows that insulation offered by these fabrics is less. This character seems to be very much applicable to bed sore preventive fabrics. The other two combinations with polypropylene- sheared terry and double sided pile and fleece fabrics can be recommended for winter because of its higher clo value.

3.3. Water Absorbency

Fig. 3.5 and Fig. 3.6 show the water absorbing capability of single and multilayered fabrics in terms of the time taken to completely absorb one drop of water by the surface of the fabric.

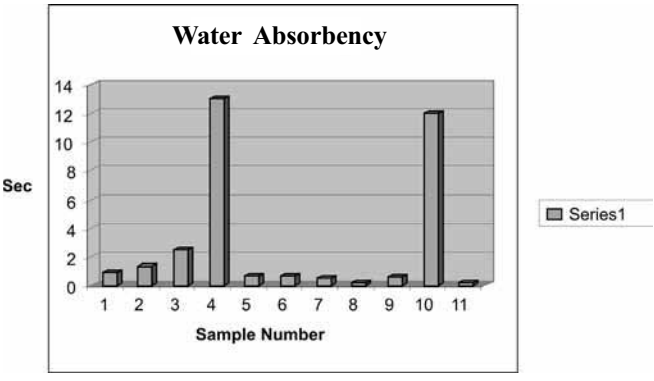


Figure 3.5 : Water absorbency of Single layered fabrics

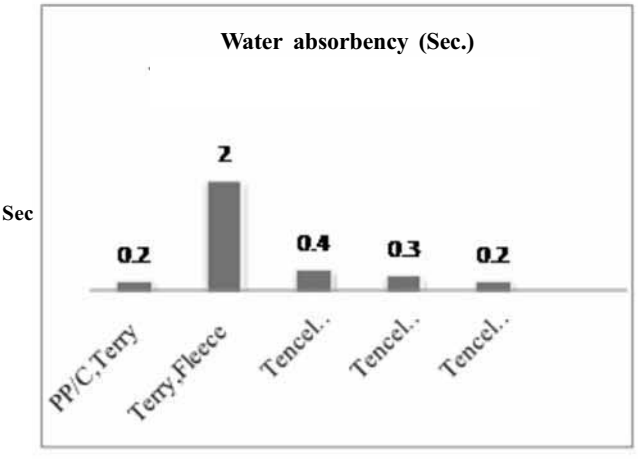


Figure 3.6 : Water absorbency of Multilayered fabrics

Lyocell twill and lyocell pile fabrics showed excellent absorbing tendency owing to the higher moisture content of these fibers. There is a strong polar attraction between lyocell and water. Its higher water retention than the liquid holding capacity may be due to the strong hydrophilic attraction between water and fibers and water retention in the fibrillar spaces of the fibers. From the test results it is clear that amongst the single layered fabrics, all fabrics except hospital bed linen made of 40s Cotton (vat dyed in green color) and Cotton-polyester blend Fleece showed very poor absorbency. The inability of the fleece to hold water is associated with lower water wettability. Other hospital bed linens exhibited moderately slower absorbing property. Amongst the multi layered fabrics all four combinations except knitted fleece, exhibits very good water absorbency resulting in immediate transfer of moisture to inner layers and ensures dry feel. This property is essential to keep the patient dry and avoids problems due to wet skin.

3.4. Water spreading Diameter

Fig. 3.4 shows the extent to which a water drop spreads on the fabric which is an indicator of its drying rate. Amongst the hospital bed linen fabrics, bed linen made of 20s and 30s cotton fabrics showed maximum spreading dia. Lyocell twill, cool finished single jersey and polypropylene- cotton plaited fabric also showed excellent water spreading diameter. Lyocell fabric gives an excellent water management property in comparison to the specially finished knitted fabric. Amongst the combination fabrics, Lyocell pile and real cool finish combination immediately spreads the drop to maximum extent and proves its water management ability.

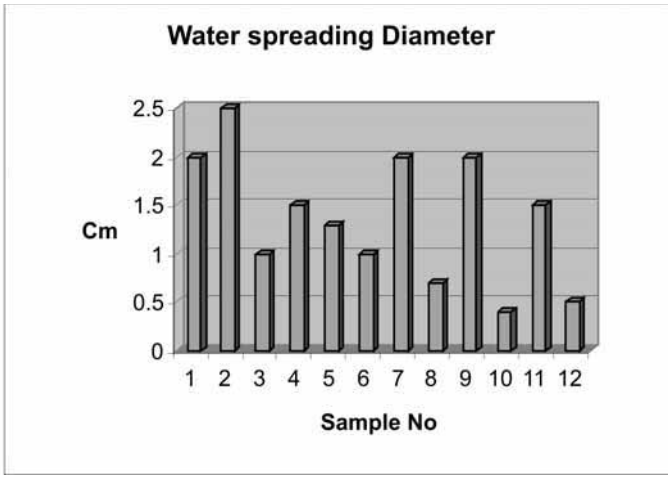


Figure 3.7: Water spreading dia of Single layered fabrics

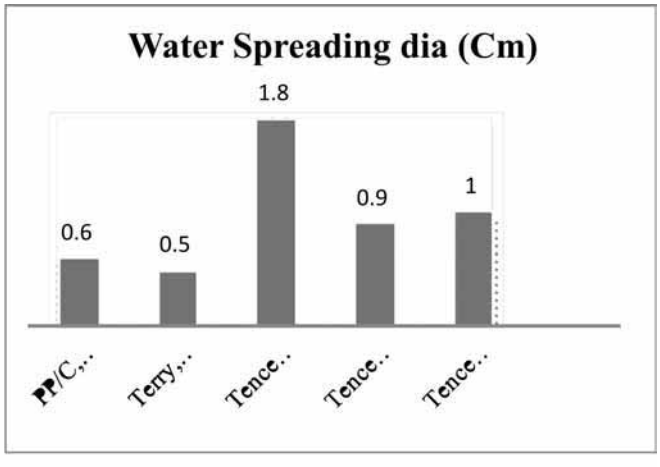


Figure 3.8: Water spreading dia of Multilayered fabrics

Lyocell pile/Lyocell woven and Lyocell pile/micro polyester combinations are also very good in water management property. The other two combinations with terry and fleece fabrics absorb the drop without spreading the water effectively.

3.5. Wickability - Transverse Wicking

Transverse wicking indicates the ability of the fabric to wick away the sweat developed on the skin of the body. Fig. 3.7, depicts the time taken by the first layer of fabric to wick away the moisture to the second layer, for all the combinations of fabrics. From the above test results, it is clear that all the four combinations wicks away moisture quickly to the second layer except the fleece and terry combination.

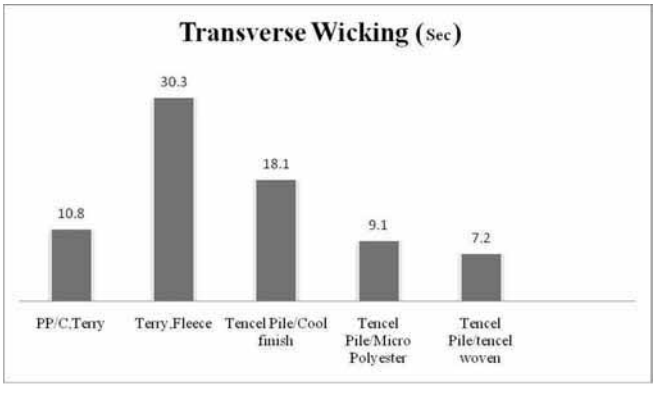
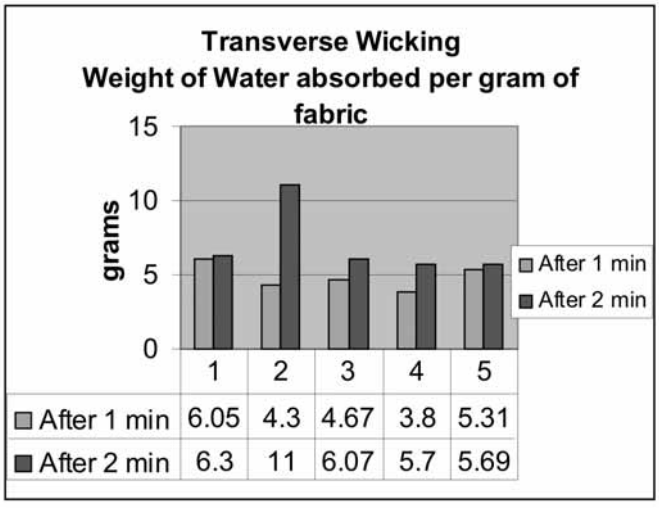


Figure 3.9: Transverse Wicking of multilayered fabrics

Fig. 3.10 (a) & (b) shows the rate of wicking after 1 and 2 minutes. The weight of water absorbed per unit weight of fabric, and unit area of fabrics are calculated for all the combinations of multilayered fabrics.

The cotton terry fabrics absorbed more amount of water compared to all other fabrics. The lyocell combination fabrics attained its maximum absorption value within one minute where as all other fabrics except polypropylene-cotton plaited and terry combination exhibited slow absorption.



	1	2	3	4	5
After 1 min	6.05	4.3	4.67	3.8	5.31
After 2 min	6.3	11	6.07	5.7	5.69

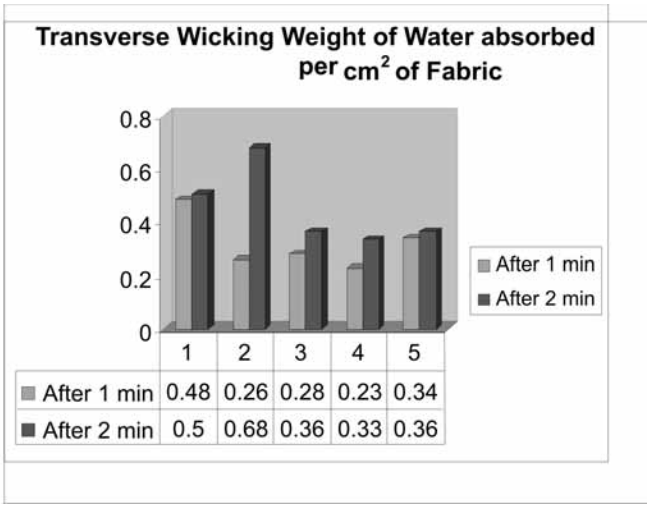


Figure 3.10(a),(b): Rate of Transverse Wicking of multilayered fabrics

The lyocell combination absorbs water to almost five times to six times the weight of the fabric.

3.6. Wickability - Vertical Wicking

The Lyocell pile and Lyocell woven combination takes lesser time because of its micro fibrillar structure and higher affinity for water. Micro polyester also shows higher wicking tendency due to more inter fibrillar capillary space. The fleece fabric takes more time because of its compact structure and hydrophobic nature of polyester.

3.7. Water vapor Permeability

Moisture vapor transfer is the ability of the fabric to transfer the perspiration in the form of moisture vapor through it. It is measured in terms of amount of water vapor passing through a square meter of fabric per day. A fabric with low moisture vapor transfer is unable to transfer sufficient moisture, leading to sweat accumulation and hence discomfort. The single layered fabric shows almost equal values of water vapor permeability except the terry pile structures. The moisture vapor transfer is higher for plain woven fabrics as compared to that for twill woven fabrics

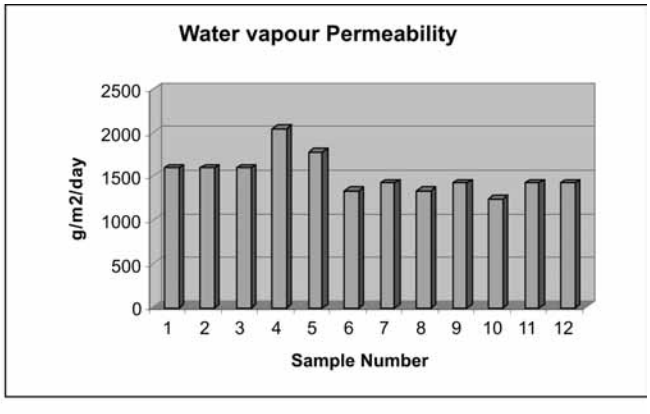


Figure 3.11: Water vapor permeability of multilayered fabrics

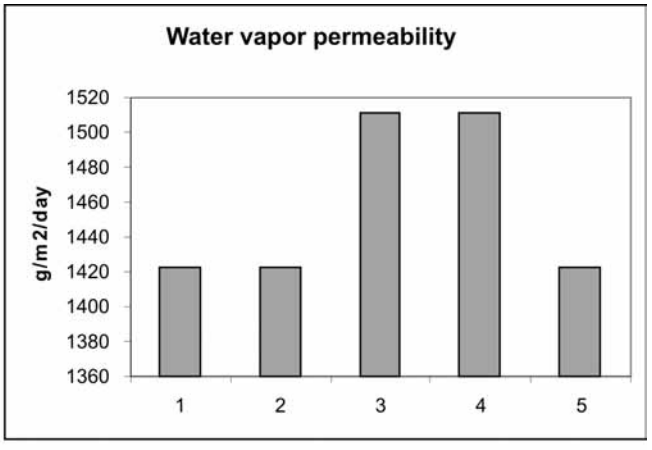


Figure 3.12: Water vapor permeability of single layered fabric

The micro polyester - lyocell combination and cool finished knitted fabric- lyocell combination has higher water vapor permeability compared to other combinations. This may be due to the presence of special finish and micro inter fibrillar spaces in the micro polyester fibre. Again the fleece fabric shows lesser water vapor permeability owing to the reason that moisture vapor transfer of the fabric decreases with the increase in polyester content of the fabric.

3.8. Coefficient of Friction

The static and dynamic coefficient of friction is measured for all single layered fabrics and hospital bed linen are measured and is shown in Fig.3.13.

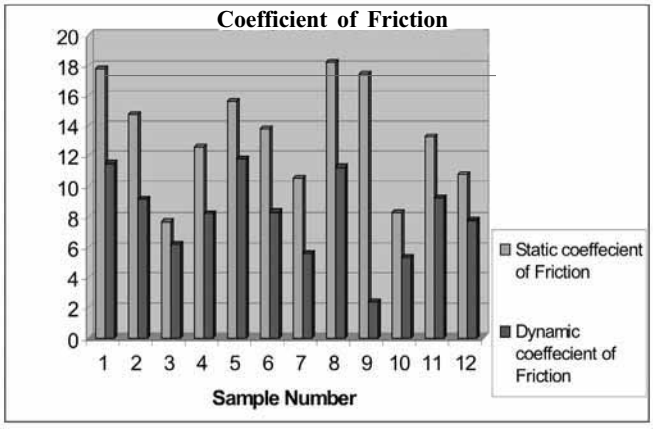


Figure 3.13: Co efficient of friction of single layered fabric

Among the hospital bed linen fabrics, 40s count cotton bed linen has less coefficient of friction due to its finer yarn count. The cool finished knitted fabric shows minimum dynamic friction and maximum static friction. The lyocell fabric has lesser coefficient of friction

compared to other fabrics due to its smooth structure. Polyester fibers have higher coefficient of friction as compared to lyocell.

3.9. Compressibility of the mattress

The compression test indicates the thickness of fabric after applying load for a particular duration. Table 3.2 reveals that, Lyocell pile/ lyocell twill and Lyocell pile/ micro polyester combination seems to compress less and regain its original thickness when unloaded. This compression resiliency gives a soft, resilient support surface to the body

Table 3.2 : Compressibility of mattress

S.No	Combination	Initial thickness (cm)	Final thickness (cm)
1	Lyocell pile, Lyocell woven	9.2	8.9
2	Lyocell pile, Micro polyester	9.1	8.8
3	Lyocell pile, Cool Finish	9.4	8.7
4	Terry, Fleece	9.2	8.7
5	Polypropylene/Cotton, Sheared terry	9.1	8.75

3.10. Effect of the developed mattress and bed sheet on body Temperature

When a patient lies for a long duration on the bed, unbearable heat is generated on the patient's body. This excessive heat creates restlessness to patients. The raise in temperature is measured on the patient's body while lying on normal hospital bed and also on the new mattress developed with different combination of fabric. Temperature is also measured on the mattress with and without air circulation system. Body temperature raises from 39 to 40°C on the rexin covered hospital bed.

From the Table 3.3, it is clear that, there is a considerable reduction in the temperature when compared to normal hospital bed. Lyocell pile and Lyocell woven fabric shows a notable reduction in the body temperature, ensuring cool feeling to the patients.

Table 3.3 : Temperature of body parts

S.No	Samples	Temperature before air supply (°C)	Temperature after air supply (°C)
1	Lyocell pile, Lyocell woven	36	35.3
2	Lyocell pile, Micro polyester	36.4	35.6
3	Lyocell pile, Cool Finish	39.2	37
4	Terry, Fleece	38.1	36.4
5	Polypropylene/Cotton, Sheared terry	37.8	36

With air circulation system, the reduction in temperature confirms the efficiency of the mattress in preventing bed sores.

An analysis of all the test results as shown in Fig 3.14 ensures that the lyocell woven and lyocell terry combination proves to be an excellent combination for bed sore prevention in all aspects like air permeability, thermal conductivity, moisture vapour management followed by the micro polyester- lyocell combination and cool finished knitted- lyocell pile combination.

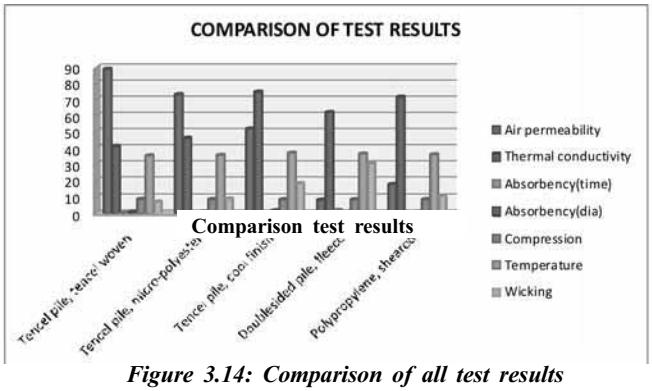


Figure 3.14: Comparison of all test results

From the test results, the best combination of fabrics for bed sheet and mattress in bed sore prevention is,

- Lyocell woven-twill : Top layer
- Lyocell pile (2 layers) : Middle layer
- Polyurethane foam (with air circulation system) : Bottom layer
- Recron fibre fills (quilting with knitted fabric) with air circulation system acts as a suitable pillow.

4. Product Development

4.1. Wheelchair Cushion

The same concept of multi layered fabric with super soft polyurethane foam mattress attached with air circulation system is extended to wheel chair cushion also. The soft and flexible PU foam deforms and matches with the contour of the body there by increasing the area of contact which reduces the point pressure developed on the seat of the body. The multi layered cover made of lyocell in combination with air circulation system provides better comfort and thermal properties. Fig 4.1 shows the wheel chair cushion made of super soft foam with different multilayer combinations.

4.2 Recron fibre fill quilted cushion

Fig. 4.2 shows the recron fibre filled cushions which could be used in wheel chairs, normal chairs, and also as pillow in the bed. The cushion cover is made of 100% lyocell knitted fabric with open structure to ensure good air permeability. The knitted structure elongates well and matches with the body contour, reducing the shearing force exerted on the skin of the patient. This cushion is also provided with air circulation system which takes away the heat generated in the seat and ensures cool feeling.

4.3 Heel pads & Elbow pads

Fig 4.3(a) & (b) shows the heel pad and elbow pad made of multi layered fabric along with recron filled cushion as the support surface. These pads protect the heels and elbows from point pressure and provide relief on the contact areas. As velcro is employed as the fastener, these pads could be used on people with varying sizes of hands and legs.

Fig: 4.3 (a) Heel pad

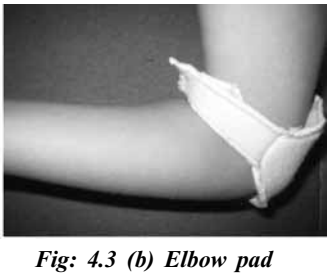


Fig: 4.3 (b) Elbow pad

5. Conclusion

From the survey conducted among 200 patients in various hospitals at Coimbatore, it was concluded that one of the causes for bedsore formation is the hard mattress used in the hospitals which increases the pressure on the body, generates excessive heat and lacks in moisture management property. It was also realized that at least 50% of the bedsores can be prevented by using simple measures like proper support surface. A pressure relieving support surface was developed using super soft polyurethane foam mattress which distributes the body pressure to more area and reduces the point pressure. The mattress is provided with horizontal and vertical drill holes and connected to an air circulation device to ensure a mild air supply to the body.

A multilayered bed sheet made of lyocell woven and lyocell terry combination proves to be an excellent combination for bed sore prevention in all aspects like Air permeability, Thermal conductivity and Moisture management followed by the micro polyester- lyocell combinations. The other combinations made of knitted fleece and terry can be recommended for cold climatic conditions. Apart from bed spreads, medical textile products like wheelchair cushion, arm crutch pad; heel pads and elbow pads are also developed to help the patients confined to wheel chair. Field trials were carried out in hospitals using the above developed products and the results are encouraging towards bedsore prevention.

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Golden Period for Textile Industry

Shri Yogesh Kalia
Head of Export Marketing (Apparel), Alok Industries Limited

Today, I am heading direct export marketing team (apparel) with Alok Industries Limited - The largest textile house in India.
After spending some good number of years in Industry, I am feeling that industry is lacking skilled man power day by day.
Few years back Mr. Anand Mahindra of Mahindra & Mahindra was requesting IT companies to spare some mechanical engineers for their industry. He said this in lighter note but made a point on general trend in the industry. There are few important areas which need to be looked into:

- Many students use B. Tech. as basic graduation to go for Post Graduation in management not to pursue the career in the textile industry.
- The young generation like to do white collar job rather doing technical jobs.
- An age old syllabus is not helping students know the actual working machinery and technology in the industry.
- Most of the faculty itself is not aware of modern changes happening in Industry.
- Many Textile Graduates do not have the patience of learning their jobs. They tend to make career by changing companies.
- Students go to plants for training without even knowing what they have to look for and how they have to gain systematic knowledge.
- There is a real shortage of experienced technical hands in industry.
- Industry is expanding but it is not supported by enough good technicians.
- The marketing of textiles needs strong techno-commercial abilities rather than purely technical or purely commercial people. This needs the basic study pattern change as well as hands on experience.

The Future??

- Textile industry in India is expanding at a rate much faster than ever before.
- The current share of India's textile trade is merely 3.5% of the world which on a positive note calls huge potential.
- It is expected to go beyond 6% by the year 2014.
- Big expansion plans are being made in India and major investments/expansions are happening all over place.
- Industry needs good technically skilled people. For meeting this requirement, Govt/ institutes have to put their heads together - devise the plan to improve the syllabus and methods of education.
- Emphasis has to be on entrepreneurship rather than preparing the students for jobs.
- Industry also has to encourage the in-course training by providing proper infrastructure and providing training opportunities. For this institutes and the industries have to have close relationship.

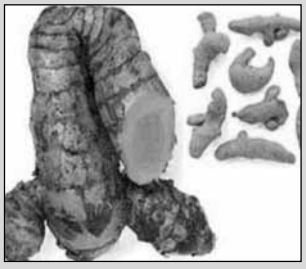
To sum up, there is golden time ahead for the textile industry. All we need is to put in place the correct strategy and infrastructure to harness this opportunity.

Yogesh Kalia is a graduate from National Institute of Technology (Formerly known as Dr. B. R. Ambedkar Regional Engineering college) - Jalandhar in 1994. After completing B. TECH. (Textile), he started his career as Apprentice Engineer in the Sulzer weaving section of JCT Limited, the flagship company of Thapar group. The experience was a combination of mechanical Engineer and Textile Engineer together. He looked after the production and maintenance of machines during these years. For three years, he gained the experience of weaving technology. This formed the basis of his technical abilities. Next few years, he started working as technical assistant to plant head. During this time, he learnt the management of a mill, technical and commercial aspects of the mill. In the mean time, he pursued a Masters Diploma in Business Administration from SIMS Pune through distant learning. This helped in understanding the

- *Budgeting*
- *Inventory control*
- *New Projects and their viabilities*
- *Production Planning*
- *Manpower Planning*

Spending hours standing in the plants, trying to learn every bit from highest official seniors to a worker, a jobber, a fitter, and an engineer, finally he switched to export marketing in the year 2000, where all his previous experience came as an added advantage.

Herbal Dyes: Growing Concept of Natural Dyes

In recent years, an interest in natural dyes has been mainly manifested as conservation and restoration of old textiles with replacement of synthetic dyes (which uses violent technology) by natural dyes for textiles, food, safety and so forth by using mild chemistry. Natural dyes have been used since ancient times for coloring and printing fabrics. Natural dyes can be sorted into three categories: natural dyes obtained from plants (indigo), those obtained from animals (cochineal), and those obtained from minerals (ocher). The majority of natural dyes are from plant sources – roots, berries, bark, leaves, flowers, fruits and wood, fungi, and lichens occurring freely in nature.

There are three major types of natural dyes

- Substantive dyes, which require no mordants.
- Vat dyes, which does not require any mordants.
- Mordant dyes, which require auxiliary substances to become attached to the fiber.

Herbal Dyes

Some natural dyes even have some therapeutic values for which the raw materials find use in ayurvedic medicines and these dyes are known as herbal dyes. All herbal dyes are natural dyes but all the natural dyes are not herbal dyes. Herbal dyes are obtained from different parts of the plant such as bark, flower, fruit, seeds, leaves, roots etc. The content or amount of dye present in the plants varies greatly depending on the season as well as age of the plants. There are also several factors which influence the content of the dye in each dye-yielding plant. Herbal dyes are further classified on the basis of the plant part used, habit, medicinal properties, ayurvedic formulation, color, botanical family and chemical component present. Herbal dyeing is a natural dyeing method that uses only medicinally rich botanical herbs eg Turmeric which has therapeutic (medicinal) such as anti-inflammatory, antioxidant, anti-inflammatory, anti-platelet, antibacterial and anti-fungal, digestive disorders, osteoarthritis, atherosclerosis, anticancer, liver problems and for the treatment and curing of skin diseases and wound healing, vitiation of blood, edema and ulcer.

Herbal Garments developed has immense medicinal value and it is a genuine answer to pollution and artificial textiles as it safeguards the environment, prevent pollution and promote eco-friendliness. The idea is that immunity levels are raised when using these medicinal textiles and the body reaches a certain mental and physical equilibrium. The healing values of herbal treated textiles and its usage is based on the principle of touch. By coming in contact with herbal cloth, the body loses toxins and its metabolism is enhanced. This herbal textile can resist and fight diseases like hypertension, heart ailments, asthma and diabetes depending upon the herb used to make the dyes. In herbal textile we can produce all kinds of hues of reds, yellows, browns, orange and greens. But since some of these herbal dyes are not fast hence they require mordants while dyeing and are called as adjective dyes.

Herbal dyes can be applied on pillow cover, bed sheet, duvet cover, curtain cloth, belts, scarf, apparels, medical applications and wound dressing for getting medicinal value.

Sequence of applications in dyeing with herbal dyes

Extraction of plant material → Dyeing & Printing → Fastness Properties (Testing of treated substrate for medicinal value)

To popularise herbal dyeing extraction of pigment from their potential resources, large scale production and development of commercial herbal dyes, standardization of processes for various textile substrates are essential. There are certain specifications that are to be followed; they are color, appearance, optical density, water soluble matter, pH of water extract, ash content, color component & its tinctorial value and total & suspended solid content.

Advantages of herbal dyes

- Herbal dyes bearing Eco-mark are ecofriendly and acceptable in today's world.
- Herbal dyes do not cause any harm to human skin and no hazards are anticipated in their manufacturing, rather dyes act as health cure.
- Fastness can be achieved by the use of proper mordants.
- Saves environment.
- The encouragement of cultivation of dye yielding plants and trees will boost agro-based activities in rural areas leading to rural development and employment.

Limitations of herbal dyes

- The yield of color from vegetable dye plants is very low. The research shows that yield of coloring matter varies from 0.3% to 4% in the plant.
- The process of dyeing is complicated mainly due to non-availability of technical know-how and trained personnel.
- Seasonal & Bulk production
- Mass destruction of plant species affects the biodiversity which may harm the environment.

By scientific understanding and analysis of the chemical structure of the herbal dyes one can certainly work out a suitable method for their application on different substrates – a challenge for any enlightened dyer for working out suitable standardized applications of herbal dyes on textiles with eco-friendliness.

– By Chet Ram Meena

The Textile Association (India)

TAI - Ahmedabad Unit

Managing Committee Meeting

The Textile Association (India) Ahmedabad Unit organized its 12th Managing Committee Meeting on 4th Aug,2011 at 6.30 pm at the Meeting Room of Dinesh Hall, Ashram Road, Ahmedabad. Shri T. L. Patel, President welcomed all the Managing Committee members in the meeting. In the said meeting Shri D. R. Mehta, President, Shri K. D. Sanghvi, Chairman of TAI central office and Shri J. B. Soma, Publisher of JTA were the special invitees. Shri T. L. Patel welcomed and offered bouquets to the Special Invitees. The Managing committee meeting conducted as per the agenda. After discussion of official agenda Shri T. L. Patel requested to Shri D. R. Mehta to express his views as a national president of TAI in our Managing Committee meeting. Shri D. R. Mehta conveyed his thanks to the members for unity of TAI-Ahmedabad Unit. He also said I never seen this type of presence of managing committee member in the meeting at any TAI unit so far. He specially thanked to Shri T. L. Patel & V. A. Trivedi for given proper guidelines and whole hearted support towards the successful World Textile Conference held in Mumbai.

Presence at Texcellence' 11

All office bearers, Trustee and some of the Managing Committee Members of Ahmedabad Unit attended 6th National conference texcellence'11 held on 4-5th Aug,2011 at AMA, Ahmedabad. The conference organized by the Textile Review and TAI-Ahmedabad Unit was one of the Supporting organizations. The conference inaugurated by Shri B. B. Swain, IAS, Industries Commissioner, Govt. of Gujarat, Gandhinagar where special address delivered by Shri Pradip Karia, CMD, Pradip Overseas Ltd., Ahmedabad.

Meeting with Textile Committee

Shri D. R. Mehta, President, Shri K. D. Sanghvi, Chairman of TAI central office and Shri T. L. Patel, President & Shri V. A. Trivedi, Hon. Secretary of TAI-Ahmedabad Unit attended a meeting as special invitees organized by The Textile Committee on 5th Aug,2011 in its office. Shri A. R. Rane, Dy. Director of Textile Committee, Ahmedabad highlighted on various scopes in textile industries during the meeting. He also mentioned that in the textile industries there is a job opportunity for the technical persons. Shri D. R. Mehta also had given some positive suggestions for this overview for the technical persons in the textile fields. The meeting was very much interactive.

Brain Storming Session

Ahmedabad Municipal Corporation arranged a Brain Storming Session on 12th Aug,2011 at Standing Committee Room, Wing-C, Sardar Patel Bhavan, AMC, Ahmedabad. The meeting was organized about planning for effective implementation of the plastic Manufacturers, Usage & Waste Management Rule 2011. The Textile Association (India) Ahmedabad Unit was invited to the meeting. From Association Shri K. J. Patel, Trustee & Shri H. C. Shah, Mng. Committee Member attended the same.

Governing Council Meeting

The Textile Association (India) Ahmedabad Unit hosted 6th Governing Council Meeting of TAI on 27th Aug,2011n at Hotel Sunset Inn, Mount Abu, Rajasthan. Most of GC members from all over India were present. Besides the meeting TAI-Ahmedabad unit also arranged Sightseeing at Mount Abu and Ambaji Mata temple darshan for the all GC members and their family members. Every member enjoyed very well.

Award & Prize distribution function

The Textile Association (India) Ahmedabad Unit arranged Award & Prize distribution function on 22nd Sept,2011 at Dinesh Hall, Ashram Road, Ahmedabad. Like every year this year also Association has given 22 medals prize from the " Shri B. A. Shah Education & Welfare Funds" to encourage the children & grand children of members who are top performers of SSC, HSC, Graduate, Post Graduate and Diploma Holders. Also Association has given 3 medals prize to the ATA students who have successfully completed two year diploma course in 2010 on Chemical Processing, Spinning and Weaving group.

Besides, the above prize distribution function Association also arranged "Award Distribution Function" of Unit level for the year 2009-11 to the members of the association who have rendered their excellence services in different way. The Khushal Das H. Shah Service Memento awarded to H. S. Patel, Trustee – TAI A'bad Unit, Chairman of Housing Committee AMC & director Nainita Cotspin, M/s Bachubhai & Co Outstanding Performance memento awarded to H. C. Shah, Manager- Akshat Textiles, Tikelon Excellence Service of Members memento awarded to

R. J. Shah, Ex. Wvg. Supervisor-Rajnagar Textile Mills(NTC), K. S. Shah Memorial Best Lecture memento awarded to P. N. Solanki, Asst. Director(Met.) MSME Development Institute, Ministry of MEME, Govt. of India.

Shri Asit Vora, Mayor of Ahmedabad Municipal Corporation was the chief guest of the function. All the awards handed over by the hand of Mr. Asit Vora, Mayor AMC.

At the end of the function one get-together function organized for the MSMEs delegation to ITMA-2011 who have received visa to visit the said exhibition during 26th -29th Sept,2011 at Barcelona, Spain. The function was very successful.

TAI - Delhi Unit

The Managing Committee Meeting

The meeting was chaired by Mr. R.K. Vij. He welcomed the members and requested Mr. Sameer Dua to start proceeding based on the agenda. Mr. Sameer Dua placed the agenda of the meeting circulated on 16.08.2011 for deliberation:

The Textile Association (India), Delhi Unit has arranged an Industrial plant visit on 5th August, 2011 at M/s. Indo British Garments Pvt. Ltd. (IBGP) Faridabad, Haryana & M/s. Genext Logistics Pvt. Ltd., (GLP) Mahipalpur, (Delhi) for 15 students who were undergoing training of Textile Committee Certified Quality Professionals course under integrated skilled development scheme of Ministry of Textiles, Govt. of India. The students were provided valuable inputs related to various aspects of exports imports, documentation requirements, type of documents etc at IBGP.

At GLP presentation covered different modes of carriage including specialist equipment such as reefer containers and flat racks and various agencies involved in International Logistics including NVOCCs. INCOTERMS were dwelled upon in detail with responsibilities of buyer and seller in each case. DO's & DON'Ts while handling cargo and minute details such calculation of volume weight were also explained. A broad insight into various export incentive schemes offered by the Govt. such as DEPB, Drawback, Advance Authorization and EPCG etc. was also given to the students.

Business Opportunities in Uzbekistan

Mr. Doniyor Ibragimov, Counseller (Trade & Economy), of Embassy of Republic of Uzbekistan made a presentation on Textile Business Opportunities in Uzbekistan to 13 members of TAI – Delhi on 20th August, 2011 (1800 hrs) at Spice Art Restaurant, Rajendra Place, New Delhi.

It was noted that world textile production will increase to the regions with relatively low production costs to which Uzbekistan offers most favourable conditions to absorb foreign investments from leading textile centers.

TAI - Mumbai Unit

Mr. C. Bose re-elected as President

Mr. C. Bose (Technical Consultant of C. Bose & Co.) was unanimously re-elected as President and Mr. Rajesh Balakrishnan (Managing Director, DyStar India Pvt. Ltd.), was unanimously elected as Vice President of The Textile Association (India), Mumbai Unit, for the term 2011-2013.

Mr. C. Bose
B. Tech (Textiles), M. Tech., F.T.A., F.I.E., Hon. F.T.A.

Mr. C. Bose worked at various senior positions in the prestigious organizations like DCM, J.K. Synthetics, Nirlon and Reliance Industries for about 32 years. He was responsible in developing world's largest texturising facilities. Presently he is the Proprietor of M/s. Bose & Co. which is a Technical Consultant firm. He has to his credits various patents on texturising and also has published number of technical papers.

He has organized five consecutive international seminars on "Texturising" from the year 2001 to 2005 in the upcoming textile region of Silvassa & Daman. He is the member of editorial board of technical journals and is a visiting faculty on many Textile Department / Universities. He is a governing council member of reputed Management colleges.

He has widely travelled all over the world in connection with the business & technology upgradation and is the life member of International Council of Consultants.

He is the President of TAI, Mumbai Unit since 2005 and was instrumental in successfully organizing two All India Textile Conferences in Mumbai. For his outstanding services to the Textile Industry he was conferred with "Honorary Fellow of Textile Association" in the year 2003 by the Textile Association (India).

Mr. Rajesh Balkrishnan
Managing Director, DyStar India Pvt. Ltd.

Mr. Rajesh Balkrishnan did his B.Sc. & B.Sc (Tech) from UDCT and started his career in 1993 with Hindoostan Spinning and Weaving Mills Limited. He joined BASF in 1994 and worked in the business development in the Textile Printing Segment.

Mr. Balkrishnan moved to PT. BASF Indonesia in 2001 as the Head of the Asia Technical Center for Textiles. In 2004 he was appointed as Manager Asia Pacific in BASF South East Asia and was based in Singapore. In 2005 he was elevated to the position of Manager Asia Pacific, Global Strategic Management and was moved to BASF East Asia Regional HQ in Hong Kong and was Responsible for global implementation of Business Unit and global innovation management.

Mr. Balakrishnan was then promoted as a Marketing Director of BASF Bangladesh Limited in 2007 and was responsible for the textile, leather, paper, architectural coating and monomer businesses for BASF in Bangladesh. In January 2009, Mr. Rajesh Balkrishnan joined Dystar India Pvt. Ltd. as a Managing Director. Since 2010, for his outstanding contribution in the field of operations he also holds the position as a President - South Asia.

Textsmile

To the optimist, the glass is half full.
To the pessimist, the glass is half empty.
To the engineer, the glass is twice as big as it needs to be.

The following members were re-elected as Office Bearers for the term 2011-2013.

President	: Shri C. Bose	Hon. Secretary	: Shri A. V. Mantri
Vice President	: ShriRajesh Balakrishnan	Jt. Hon. Secretary	: Shri R. R. Mehta
Chairman	: Shri V. C. Gupte	Jt. Hon. Secretary	: Shri A. K. Narkar
Vice Chairman	: Shri R. G. Malvankar	Hon. Treasurer	: Shri M. B. Nambiar
Vice Chairman	: Shri R. R. Gosai	Hon. Editor (Newsletter)	: Dr. V. D. Gotmare

Shri C. Bose
President

Shri Rajesh Balakrishnan
Vice President

Shri V. C. Gupte
Chairman

Shri R.G. Malvankar
Vice Chairman

Shri R.R. Gosai
Vice Chairman

Shri A.V. Mantri
Hon. Secretary

Shri R.R. Mehta
Hon. Jt. Secretary

Shri A.K. Narkar
Hon. Jt. Secretary

Shri M.B. Nambiar
Hon. Treasurer

Shri V.D. Gotmare
Hon. Editor (Newsletter)

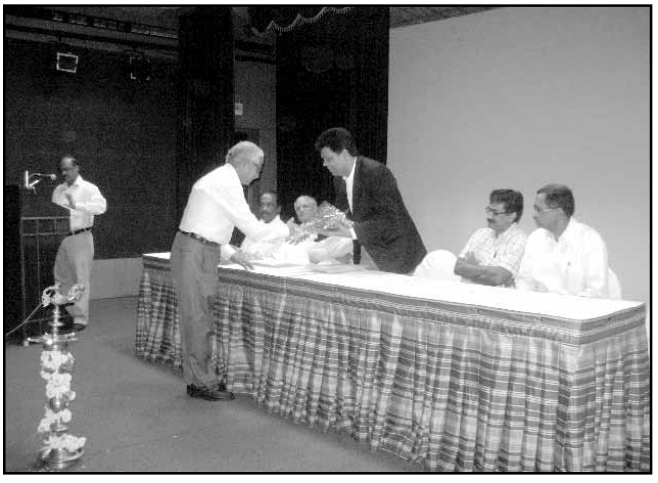
TAI - Karnatka Unit

The Textile Association (India) Karnataka Unit conducted half day seminar on Fire Retardant finishes in association with Bombay Textile Research Association on 21 Oct 2011 at G.M. Rejoyz, Bangalore.

Sri H. S. Bhaskar, Executive Director, Gokak Textiles Ltd and Chairman Governing Council, BTRA presided over the function. He insisted that flame retardant textiles must be made compulsory for all apparels especially for ladies wear used by house wives engaged in cooking. Mr. Vipin Tyagi, Senior Vice President- Global Sourcing, Quality Assurance & Product Development, Reliance Trends Limited was the Chief Guest.

Mr. H.S. Bhaskar lightening the lamp

Mr. T. G. Mrutyunjaya, President of Karnataka Unit and Mr. Dayanand U.R Chairman of the unit were on the dais. Mr. Shillin Sangappa, Hon. Secretary welcomed all on behalf of the Association and Mr. R.N. Bharati rendered vote of thanks.



Mr. Vipul Tyagi delivering his speech

The programme was started with melodious invocation by Mr. Benakappa Hubballi. Dr. A. N. Desai, Director BTRA explained the activities of BTRA. Dr. G. S. Nadgir talked on the importance of Fire retardant textiles in public life. Ms. Pooja Prabhudesai talked on the evaluations made by BTRA on the commercially available flame retardant finishes especially with relation to their eco-friendliness.

Mr. B. Purushothama welcoming Mr. Vipin Tyagi

Ms. Chandrakala of BTRA explained various test methods for assessing the performance of flame retardant finishes. Mr. B.G. Patil of Central Silk Technological Research Institute, Bangalore talked on the works done at CSTRI in making Silk fabrics flame retardant. He explained that silk filaments had natural property of flame retardancy compared to vegetable fibres.

View of Audience

The response for the seminar was very good with over 90 members participating. There was a very interesting question and answer session in which numbers of practical problems in making the fabrics fire retardant were discussed.

Baroda Unit

The Textile Association (India) Baroda Unit has organized a half day Technical Seminar on Advance Materials in Textile on 1st October, 2011 at Auditorium De-

President Prof. Gupta welcome
L to R Dr. Shrieni Mankode (Sec.), Shri. Hemant Dave (Chairman),Dr. S.R. Vengsarker (Seminar Chairman) Shri Nilesh Sonawane (Speakers) & Dr. V.S. Rajan (speakers)

View of Audience

partment of Chemical Engineering, Kalabhavan, Vadodara. The Program was sponsored by members of Textile Association from Industries namely by Rajesh Luhar, Shri Shekher Iyyer, Parag Jha, Sunil Patil ana Shri H. Manseta. The Program was great Sucess and around 80 Delegates from Industries, Institute and Research students have been participated in seminar.

Prof. R.P. Gupta, President, TAI (Baroda Unit), given welcome address. The Technical session Chairman was Dr. S.R. Vengsarker, Adviser, Zenith Fibres Ltd. The Keynote speakers Mr. Nilesh Sonawane VP (Marketing) Advance Textiles and Material, Vadodara spoke on Textile Compositer - materials, Process and Application and highlighted the high performance materials,which can be used in Textiles for composite preforms. Dr. V.S. Rajan, VP Supreme Non-wovens, Vapi will put a light on the topic New Fibres for Industrial Textile and highlighted the change in Structure of old fiber and reformed for hi-end application. Interesting Questions were asked by audience and handled wonderfully by speakers.

Mr. Hemant Deve, Chairman has given highlights on developments and display of machineris at ITMA, Barcelona, Spain. Dr. Hireni Mankodi Hon. Secretary, TAI (Baroda Unit) Has coordinated the seminar very nicely and given Vote of Thanks. Also put an important note that such type of Seminars will organized more frequently on know - how of new advance in textile.

Director NITRA Awarded UP Ratan

Dr. J.V. Rao

Dr. J.V. Rao, Director, NITRA was conferred the honour UP Ratan by All India Conference of Intellectuals (AICOT) on 11th September 2011. At a full house CMS Auditorium in Lucknow, the award along with pagri, shawl and memento was handed over to him. The award is recognition to Prof. Rao's contribution towards spread of technical education in Uttar Pradesh, especially in the areas of textile & clothing industry in multiple capacities such as academician & research scientist, as well as strategy maker, projects head and Director, NITRA.

Kulpati Prof. Monoj Kr. Mishra of Lucknow University, social worker Smt. Rita Mittal, eminent artiste Smt. Anita Narayan, Dr. Sushil Chaudhary of Noida Eye Care Hospital and some other notable personalities also received the award. Lt. Gen. K.M. Seth, Former Hon. Governor, Chattisgarh inaugurated the program. Also present in the occasion are Sh. A. K. Shrivatava, Rtd. Judge, Delhi High Court, Sh. P.N. Sharma, National Gen. Secretary, AICOT and other guests of honor.

Textsmile

Five surgeons were taking a coffee break and were discussing their work. The first said, "I think accountants are the easiest to operate on. You open them up and everything inside is numbered."
The second said, "I think librarians are the easiest to operate on. You open them up and everything inside is in alphabetical order."
The third said, "I like to operate on electricians. You open them up and everything inside is color-coded."
The fourth one said, "I like to operate on lawyers. They're heartless, spineless, gutless, and their heads and their butts are interchangeable."
Fifth surgeon said, "I like Engineers...they always understand when you have a few parts left over at the end..."

A.T.E. Enterprises Private Limited (A.T.E.) to acquire SKF India's Textile Business

A.T.E. Enterprises has concluded an agreement to acquire the textile machinery component business from SKF India Ltd. The textile machinery components manufactured by SKF include key products such as high speed spindles, drafting systems and top rollers for ring frames and speed frames. The transaction is expected to be completed in Q1 2012.

A.T.E., a diversified engineering group, is a leader in textile engineering with state-of-the-art manufacturing joint ventures, as well as representation of 50+ world class principals. A.T.E. has been looking for opportunities to further consolidate its business in this field, whereby it can leverage its experience and expertise built over the last 70+ years.

SKF will, as part of the divestment of its Textile Business, fully transfer the SKF technology used for manufacturing textile machinery components. A.T.E. will serve all existing and future customers with products manufactured based on SKF technology under the A.T.E. brand, which is synonymous with product reliability, performance and service.

As per the terms of the transfer of business, the manufacturing operation will be shifted to A.T.E.'s new state-of-the art set-up at Ahmedabad, for which building construction is in full swing. Key personnel from different SKF functions will also be transferred to A.T.E. A.T.E. has commenced recruitment of remaining personnel, many of whom are under inplant training at SKF India's Pune plant.

SKF and A.T.E. will also build-up and maintain adequate stock of all products before moving the manufacturing operation from Pune to Ahmedabad, to ensure uninterrupted supply of products during the period of transfer.

Explaining the planned acquisition, Anuj Bhagwati, Managing Director of A.T.E. said "Our decision to invest in this business comes after careful due diligence. SKF is a technology leader and A.T.E. has the domain expertise to leverage their textile technology platform. We are excited about this business coming under the A.T.E. umbrella, as it is consistent with A.T.E.'s vision to have only technologically superior products, and as we see great potential for this business both in India and the world".

INDIA ITME 2012 - Most anticipated Textile Machinery Show of 2012

INDIA ITME 2012, the 9th in the series and the most prestigious and anticipated textile machinery show in India and neighboring countries is scheduled from 2nd – 7th December 2012 at Bombay Convention & Exhibition Centre, Goregaon (E), Mumbai, India.

A press conference and networking dinner was held on 26th September 2011 at Gran Salon B, Hilton Barcelona well attended by over 110 guests including press journalists textile associations, research institutes and textile companies from across 16 countries. Mr. Andreas Weber, CText FTI World President of the Textile Institute, UK and IL. Lustrissim Senyor Jordi Marti-Galbi, Councillor of Presidence, Barcelona City Council and H.E. Mr. Luis Valeriano Gonzalez, Hon. Consul General of India graced the evening as guests of honour and many other industry delegations from across globe along with press and media attended the "Rendezvous with INDIA ITME 2012".

It is well known that primary textile machinery market world wide was affected by the global economic crisis and witnessed severe down turn from 2008. However, the growth of the Asian Textile Industry provided the much needed impact to the western textile machinery manufacturers for revival of their business. It is expected that in the long term driven by the demand for non woven textile products especially from Chinese and Indian economies the global market for textile machinery will reach US $ 20.15 billion by the year 2015.

India being the 2nd largest textile market in the world is expected to be a leading textile producing country in the world by 2020. The strength of the Indian textile industry is very apparent from the robust attendance by the Indian delegation in all international textile machinery shows like ITMA Europe, ITMA ASIA + CITME, China, ATMA USA and ITM, Turkey. For most of the European textile machinery manufacturers are from Switzerland, Germany, Belgium, Italy and Spain. India remains the most important market with the export worth millions of dollars.

India has the potential to become manufacturing hub in the textile machinery, with abundance of skilled labour, low cost and natural resources available. The government initiatives like Technology Up-gradation Fund Scheme (TUFS), the Scheme for Integrated Textile Park (SITP) and Integrated Skill Development Scheme for the industry is expected to push the growth of the industry steadily. India's textile & apparel industry (domestic + exports) is expected grow from the current US$ 70 Bn. to US$ 220 Bn. by 2020. (Source: Technopak).

Mr. Bachkaniwala said: "With such need and opportunity based demand, it is only imperative that textile machinery manufactures all across the globe eye Indian market. India ITME 2012 is now a 'must participate, must visit' for Textile Engineering industry all across globe.

Mr. R.S. Bachkaniwala,
Chairman, India ITME Society

INDIA ITME 2012 is an effort to usher in the much needed revolution, growth and global attention to the market, new opportunities in Indian domestic market.

It is expected to be a spectacular event showcasing hi-tech textile machinery, innovative technologies and services for textile industry and is specially designed to be the "gateway event" to the huge market opportunity presented in India as well as the nearby countries like Sri Lanka, Bangladesh, Pakistan Vietnam, Indonesia, etc.

The bookings for this prestigious exhibition have received tremendous response and are ready to close with 100% space sold within next 30 days. The focus is to provide a complete platform and making it a win-win situation for every person associated and interested in the ITME event in terms of acquiring new clients, new markets, new technology, cost competitiveness, sourcing opportunities including academic and research programs. Apart from the business, we also hope to bring to the table new products and innovative ideas

for world class textile products and services through seminars during the event.

Mr. Andreas Weber
CText FTI World President of The Textile Institute

On the occasion Mr. Andreas Weber, CText FTI World President, The Textile Institute, UK, expressed his views that there is a strong chance of Indian multinationals opening subsidiaries in Europe and US for textile machinery and accessory. He also feels that the textile institute world over can through collaboration assist all textile sectors and work together for the overall improvement of textile industry globally.

Il. Lustrissim Senyor Jordi Marti-Galbis,
Councillor in charge of the Mayor's office

Il. Lustrissim Senyor Jordi Marti-Galbis, councillor in charge of the Mayor's Office and district affairs at Barcelona's Local Council, graced the India evening with his august presence, expressing a deep desire to develop a strong business relation with India, especially in the textile machinery sector. In today's world no business activity can succeed in isolation but has to work together towards sustaining the resources and economy.

Mr. Marti-Galbis stressed that India and Catalonia could work closely in many areas. A sector where Indian companies may be interested in finding Catalan partners is the textile industry. Catalonia was, together with Northern Italy, the only territory in Southern Europe to industrialize, and textiles were the tip of the sword in this process. Today, after a painful but successful transformation, having adapted to the new demands of the markets, and following a great effort in terms of research and development, the industry is back on its feet.

The councilor explained that, although the economic landscape in Catalonia is diverse, and a number of new industries are leaving their mark, the textile industry is not only part of the country's past, but of its future. He was particularly proud of the fact that Barcelona was the host city for one of the world's top-ranked textile machinery trade fairs."

Hon. Consul General of India Mr. Luis Valeriano Gonzalez spoke about strengthening bilateral relationship between India and Spain especially in textile engineering sector.

Mr. R.S. Bachkaniwala, Chairman also announced the expanded activity of ITME Society and said that as a responsible organization dedicated towards growth and prosperity of industry and economy the Society is constructing an Industrial Exhibition cum convention & Research Centre in Ahmedabad, Gujarat, India. With all facilities for industrial exhibition and programs for skill development which will target creating employment for youth. This exhibition centre in its completed phase will become one of the largest in India with over 1,00,000 sq. mtr. exhibition area.

Also expanding the exhibition services the Society now will organize exhibition every 2 years instead of 4 years and announces INDIA ITME 2014 to be held in November/December 2014 with focus on technical textile, garment, knitting and chemical Dyestuff, innovative textile technology etc.

Texttreasure

"Good people do not need laws to tell them to act responsibly, while bad people will find a way around the laws."

- Plato

ITMA 2011 affirms position as leading global platform for textile and garment machinery industry

The international textile and garment machinery industry converged for the 16th edition of ITMA, the world's most established textile and garment machinery technology exhibition in Barcelona, Spain from 22 to 29 September 2011.

Trade visitorship of over 100,000 from 138 countries was registered for the eight-day event held at Fira de Barcelona Gran Via fairgrounds. Just over 90 per cent of the visitors came from outside of Spain. The international mix of visitors and buyers was very well received by exhibitors.

Mr. Stephen Combes, President of CEMATEX said, "ITMA 2011 has surpassed our expectations. Considering that the world is still facing economic difficulties, the vast majority of our exhibitors are delighted with the quality and the number of visitors. According to our national associations, their members have reported significant enquiries and many have taken even more orders than they hoped for.

"The textile and garment industry must be commended for its resilience and willingness to invest and to innovate. The sales and serious enquiries generated from qualified international visitors are greatly appreciated by the exhibitors, and our participants have all given a very positive response to the show."

A delighted exhibitor, Mr. Attilio Camozzi, President of Marzoli, commented: "A lot of commercial negotiations have started and orders have been finalised for approximately 30million euros with customers from Argentina, India, Turkey, Turkmenistan and Uzbekistan."

Italy fielded the largest contingent of 9 per cent of visitors, followed closely by host country Spain, then India. Germany and Turkey ranked fourth and fifth respectively in the visitorship tally. Making it to the top 10 list from outside of Europe are Brazil and Iran.

"The majority of the visitors are from the textile making hubs in Asia, and Central and South America. Thanks to our extensive promotions, we have been able to attract leading textile and garment makers from these vibrant areas. Being global companies, they need to invest in innovative, yet cost-effective solutions to stay ahead of the competition," said Ms Sylvia Phua, CEO of MP International, organizer of ITMA 2011 and 2015.

"ITMA 2011 demonstrated the finest of global excellence in textile manufacturing technology. India is emerging as the preferred base for textile manufacturing and Indian buyers were able to evaluate various machines for procurement during ITMA 2011. As a policy planner and in order to usher in India's next leap into finer processing, finishing and a strong textile hub, it was particularly gratifying to be shown the finest technology in the world and a range of options at ITMA 2011," said Ms Rita Menon, Textiles Secretary, Government of India, who led a high level delegation that included the Joint Secretary (Textiles) and the Textile Commissioner.

The Indian delegation was among the over 50 groups from 27 countries welcomed at the exhibition. The United Nations Industrial Development Organization (UNIDO) delegation was headed by the Secretary of Textiles from Bangladesh. The Vietnamese vice Minister of Trade and Industry also led a delegation. Association groups came from all over the world, ranging from Africa, Asia, Europe, Central and South America, and the Middle East.

On the show floor, ITMA 2011 attracted 1,350 exhibitors from 45 countries and economies who demonstrated their latest technological products and innovative solutions. Another major area of focus was sustainability. Many exhibitors displayed their latest green technology and products that are friendly to the environment.

The new fibre and yarn sector was particularly well-received by both exhibitors and visitors. "The opening of a fibre and yarn sector this year was one of the greatest initiatives announced for ITMA's 60th anniversary edition. In our first participation at ITMA, we could meet both current and new customers from around the globe. ITMA was a perfect platform to communicate our marketing innovations and sustainability plan: 'Planet Agenda'," said Ms Denise Sakuma, Global Director of Brand & Communications at INVISTA Apparel Business.

Mr. Michael P. Viniconis, President of Argus Fire Control, whose company has been exhibiting for eight

editions of ITMA enthused, "This has been the best ITMA ever! The exposure we have received has been fantastic and we have seen a large number of visitors from many different countries. We are happy with the business opportunities from this show and are ready to book space for ITMA 2015."

Marking 60 years since its first show in 1951, ITMA 2011 featured exhibits from the entire textile and garment making value-chain spread over 200,000 square metres of gross exhibition space.

Show owner CEMATEX, the European Committee of Textile Machinery Manufacturers, along with organizer MP International, had also introduced several new and innovative offerings tailored to suit the changing needs of the global industry.

Innovation at its best

Miss Maria Avery, Secretary General of CEMATEX said, "The main focus of ITMA has always been about innovation, and it has never been more apparent than at the 2011 edition. We have received many commendations for the conferences we have introduced, along with the new chapters we have added to the exhibition profile. This evolution of ITMA has paved the way for greater success for future editions to promote innovation at its best."

Some 700 industry professionals were present for 'Conferences @ ITMA', a series of collaborative events designed to cater to specific industries and sectors, which included the World Textile Summit, Sustainable Textile Leaders Roundtable, Textile Dyestuff and Chemical Leaders Forum, IFAI Advanced Textiles Europe 2011, and the Young Entrepreneurs of Textile International Meeting.

"The Forum has achieved its objectives. From speakers to attendees, the quality of discussion generated will definitely spark more innovative solutions for a sustainable future," said Mr. Andrew Filarowski, Technical Director of Society of Dyers and Colourists and Moderator for the Textile Dyestuff and Chemical Leaders Forum.

Apart from educational events, research and education was another focus for this 16th edition of ITMA. As part of the move by CEMATEX to focus on the sustainable development of the textile and garment industry, the Research & Education (R&E) Pavilion presented leading edge textile materials and technology research from 47 universities and institutes from 20 countries. Highlights included the European Textile Research and Education Pavilion led by AUTEX, EURATEX and TEXTRANET, and the Speakers' Platform, where participants presented their latest research findings.

Making plans for 2015

With the success of ITMA 2011, preparations are already underway for the next edition of ITMA, which will be held in Milan, Italy.

Said Mr. Sandro Salmoiraghi, President of ACIMIT, the Association of Italian Textile Machinery Manufacturers, "Italy is delighted to be chosen to host the 2015 edition of ITMA. We are already in talks with the Milan city officials and other relevant stakeholders to deliver a worldclass event."

MP International's Ms Phua, said, "We look forward to working with CEMATEX again for the next edition of ITMA. Despite the challenging business environment, we are encouraged by the warm response. We will take in the suggestions of our participants and continue to build a platform that is relevant to the industry."

ITMA 2015 will be held from 12 to 19 November 2015 at the Fiera Milano (Rho) in Milan, Italy.

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"The significant problems we face cannot be solved at the same level of thinking we were at when we created them."

- Albert Einstein

"Life is pleasant. Death is peaceful. It's the transition that's troublesome."

- Isaac Asimov

68th Annual General Meeting

Indian Textile Accessories & Machinery Manufacturers' Association (ITAMMA) has convened its 68th Annual General Meeting on Monday, the 17th October, 2011 at M.C. Ghia Hall, Mumbai. Shri S.V. Arumugam, Chairman, CITI, was the Chief Guest at the AGM and presented ITAMMA's Export Excellence Awards for 2010-11 to award winners, and addressed the members.

Shri J.H. Shah, President, welcomes the members

At the out set Mr. J.H. shah, President, ITAMMA delivered his welcome speech, giving details about the achievements of ITAMMA, its present activities and the future vision of ITAMMA. He briefed as under:

Need for Support Measures

Textile engineering industry has pleaded with the Government many times regarding the excise duty, duty on parts, components, accessories & spares, floor level of customs duty on capital goods, rate of duty on raw materials, parts components & accessories, Ban on import of second-hand textile machines under TUF Scheme. However the results are not encouraging; and so we wish for floating of a special Scheme by the Government of India for the manufacturers of textile machines and accessories which will help in promoting the aspects like 'Energy Conservation' and 'Going Green' through technological developments in machines and accessories.

Exports

In our endeavor to help our members to increase the exports of textile machinery spares and accessories, the Association continued its efforts to create ITAMMA Pavilions in exhibitions in India and abroad, and planned for Bangladesh for 2010-11; as also Catalogue Shows. During the year we have organized Catalogue Shows in Panipat, Kolhapur, Madurai, Salem and Surat; and had been planned for Bhilwara & Dindigul for 2010-11. All these Catalogue Shows were well-attended by the user-industry.

Export Cell Centres created in Ahmedabad and Coimbatore have done exceedingly well in creating better cohesion between member-exporters. We have also created Liaison Offices in Coimbatore and Ahmedabad to plan more and more activities in those regions so that members other than exporters in these regions can also take part in the activities of the Association.

Technology Up-gradation

Fifteen Research & Educational Institutions with whom we had signed MOUs under the Chairman of Sub-Committee for Technology Up-gradation and Cluster Development and our past president, Shri Prashant R. Gandhi are now invited for a contract research and other activities as specified in the MOUs. Research projects will be registered very shortly as a result of this attempt.

In order to bridge the gap between the User and the Manufacturing Industry, Association has decided to launch a Certificate Course titled "Adding to the Skills". Accordingly, efforts have been taken in formation of Expert Panel and further a base is created in organizing the Training Centre.

Cluster Development

The initiatives taken by the Sub-Committee for Technology Up-gradation and Cluster Development has registered the progress of the establishment of the Common Facility Center (CFC) with the help of Entrepreneur Development Institute (EDI) in Gujarat, up to the level of formation of SPVs and DPR. The Lean Manufacturing programmes with the help of MSMEs and the Design Clinic programme with the National Institute of Design (NID) are the other cluster activities initiating at Gujarat.

To make available every activity and services of the Association to each region of the textile clusters of India, initiatives have been taken in the introduction of Webinar & Video Conferences which are further strengthened by the appointment of Regional Chairmen in different re-

gions who have been entrusted with the specific task as per the need of the Industry set up in those areas.

News & Notes

Importance was given to the technical and technological inputs through News & Notes to enrich the knowledge strength and business grooming topics like new technologies/business corners/acquisition & collaboration, etc. for the business growth of members. Knowing the important role of user industry in the business growth of TEI the issue of News & Notes will be now equipped with 50 page informative data and will be circulated free of charge to more than 3000 end users.

To update and upgrade the various technological developments and inform the same to our members, and thereafter to implement them, the Secretariat is also equipped with a well-qualified and experienced Technologist.

Outstation Meetings/Seminars

In its continued efforts in creating closer interaction and sense of participation amongst our outstation members, the Association is organizing its Managing Committee Meetings, coupled with Seminars and Catalogue Shows in Ahmedabad, Coimbatore, Panipat, Kolhapur, Salem, Madurai and Surat.

These efforts have created an excellent interaction between the outstation Members thereby giving us a chance to increase our activities with added vigour. Further, by doing so, we have created a brand image wherein more and more members are taking keen interest in participating in our activities and many new companies are enrolling themselves as members, which has recorded our strength to be about 450+.

During the year association had organized several Seminars, on topics helpful to the Textile Engineering Industry, at Ahmedabad, Coimbatore and Mumbai.

ITMA 2011

In recognition of the contributions being made by ITAMMA for the textile engineering industry, this time, ITAMMA had been allotted a 12 sq. mtr. Complimentary Stall in ITMA 2011 in the Association Village for propagating activities of the ITAMMA and it was our privilege that ITAMMA, for the first time, had been enlisted as one of the supporting organizations of ITMA 2011.

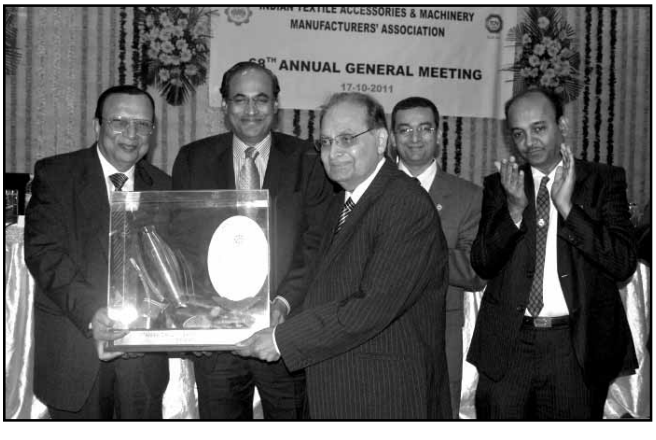
Shri N.D. Mhatre, Dy. Director General (Technical) represented ITAMMA at ITMA 2011 and had interactions with various exhibitors and visitors and explored the opportunities for various activities like MOUs with different Association, business requirements of exhibitors including our members, tie-ups in transfer of technologies, etc. Shri Mhatre will be circulating the detailed report of his visit along with the business statistics to the members & the industry.

Association believes in sustainability which we think is the necessity of tomorrow and based on this mantra of sustainability various programmes are implemented in the administrative and technical set up of the Association including strengthening the financial position of the Association.

ITAMMA Export Excellence Awards

ITAMMA's Export Excellence Awards for 2010-11 was awarded to award winners by hands chief guest Shri S.V. Arumugam, Chairman, CITI.

1. M/s. Precision Rubber Industries Pvt. Ltd., Mumbai, won the Highest Export Excellence Award for Parts & Accessories of Textile Machinery for the year 2010-11. During the relevant period, they have exported Synthetic Rubber Aprons & Cots to the tune of Rs.1630.82 lakhs which formed 29.02% of their total turnover. They have exported their products to Africa, Middle East, South America, South East Asia, U.K. & Europe, U.S. and other countries. Shri G.T. Dembla, Chairman of the Company received the Award.



Shri G.T. Dembla, Chairman, Precision Rubber Industries Pvt. Ltd., Mumbai, receiving Award from the Chief Guest

2. M/s. Vetal Textiles & Electronics Pvt. Ltd., Coimbatore, won the Sector Based Export Excellence Award under Machinery Sector - M.S.M.E. - Spinning for export of Cotton Contamination Cleaning Machines, Dust & Metal Extraction Machines, Dust & Fire Extraction Machines and Spark Detectors & Diverters to the tune of Rs.353.88 lakhs which formed 9.94% of their total turnover. They have exported their machinery to Bangladesh, China, Indonesia, Pakistan, Tanzania, Thailand, Turkey and Vietnam. Shri Kanaga Sabapathy, Engineer of the Company received the Award.

Shri Kanaga Sabapathy, Engineer of Vetal Textiles & Electronics,Pvt. Ltd., Coimbatore receiving the Award

3. M/s. Super Tex Industries, Mumbai won the Sector Based Export Excellence Award under Parts & Accessories Sector - M.S.M.E. - Spinning for export of Synthetic Rubber Cots & Aprons to the tune of Rs.758.74 lakhs which formed 53.48% of their total turnover. They have exported their products to Argentina, Bangladesh, Brazil, China, Egypt, El Salvador, Europe, Indonesia, Iran, Israel, Japan, Malaysia, Mexico, Morocco, New Zealand, Pakistan, Peru, Philippines, Saudi Arabia, South Africa, Sri Lanka, Syria, Taiwan, Thailand, Turkey, U.S.A., Uzbekistan and Vietnam. Shri Jugal Kishore, Managing Director / Managing Partner of the Company received the Award.

Shri Jugal Kishore, Managing Director of Super Tex Industries, Mumbai receiving the award.

Shri Ramesh L. Sidhpura, Managing Director of Maksteel Wire Healds Pvt. Ltd., Vadodara the Award

4. M/s. Maksteel Wire Healds Pvt. Ltd., Vadodara, won the Sector Based Export Excellence Award under Parts & Accessories Sector - M.S.M.E. - Weaving for export of Textile Parts & Accessories to the tune of Rs.347.82 lakhs which formed 31.24% of their total turnover. They have exported their products to Argentina, Bangladesh, Belgium, Brazil, Czech Republic, Ethiopia, France, Indonesia, Iran, Ireland, Italy, Nepal, Russia, Spain, Switzerland, Thailand, Turkey, U.S.A. and United Kingdom. Shri Ramesh Laljibhai Sidhpura, Managing Director of the Company received the Award.

Shri Zainuddin R. Mahuwala, Managing Director of Gurjar Gravures Pvt. Ltd., Ahmedabad receiving Award

5. M/s. Gurjar Gravures Pvt. Ltd., Ahmedabad, won the Sector Based Export Excellence Award under Parts

& Accessories Sector - M.S.M.E. - Processing for export of Perforated Nickel Screens to the tune of Rs.239.16 lakhs which formed 19.53% of their total turnover. They have exported their products to Egypt, Kenya, Sri Lanka, Switzerland, Tanzania and U.A.E. Shri Mr. Zainuddin R. Mahuwala, Managing Director of the Company received the Award.

Mr. S. V. Arumugan, Chairman, (CITI), Chief guest delivered his speech
He said, after independence, in terms of Textile industry there were very small textile institutes supported by the Government; as there was a trend of small industrialists to quit and Corporate wanted to become Vertical and big. However all were not able to achieve a success in becoming Vertical.

Shri S.V. Arumugam, Chairman, CITI (Chief Guest) at the AGM addressing the members.

Also the growth of Technology in textile industry was not to that major extent at that time. But today, in 10th & 11th Five year plan, Government thought that for having been opened out to Globalization, it is necessary to go for huge investments in Textiles; and accordingly had extended TUF subsidy in 12th Five year plan. This has given an opportunity for people especially the women force from rural areas to enter this field which is next to Agriculture. In spinning many developments have taken place, but still why the name of local names of Machinery Manufacturer doesn't come while order for any machines in the field of Spinning/Weaving/Wet-Processing? It calls for serious thinking on this issue.

He appreciated the steps taken by ITAMMA in having MOU's with 15 R&D, and Educational Institutes; where what is the need of the industry is always given by R&D, and Educational Institutes through basic research. However, no efforts are taken in commercializing the outcome/results. The needs for supporting R&D is lacking in textile industry when compared with those of other industries. We are having 4-5 R&D Institutes while the fund allocation by the Government is only Rs 100 crores, which is not enough to pay the salary of the staff. We are aware that today India is no 2 in Cotton production, but still the approval of BT seeds is lacking.

Productivity has got a direct linkage to inflation. Textile machine manufacturers want to ban the import of textile machines; however instead we should take help of collaborations/tie-ups for technology transfers. Today the increase in figures of Export is not encouraging; and if we want to show a great difference in these figures then we should concentrate on innovations. In China the total textile share is 24% as against only 3-4% in India. When I enquired with few of the big industrialists in China, the reasons behind these achievements, the answer was salary level of 1000 dollars/month in China against 150-200 dollars/month in India for a operative. Further, it was told that they buy yarn from us & they do knitting/weaving and processing while the other processes are done in other countries like Gautamala, Srilanka, Combodia, Bangladesh, etc where opportunities of subsidies/taxes/etc. from Government are available.

He concluded his speech stressing on a follow-up on Motivation & consistency is utmost essential while exploiting the Resources available with India. And assured the audience that, by the year 2020 India will be the Nation of Manufacturing & Selling of Textiles in major portions.

Mr. N. D. Mhatre, Dy Director General (Technical) made his power point presentation on "Glimpses of ITMA'2011, Barcelona, Spain"

Shri N.D. Mhatre, Dy. Director General (Tech.) making presentation on 'Glimpses of ITMA 2011'

Mr. N. D. Mhatre said that "ITMA'2011", Barcelona - Spain from 22 -29th Sept. 2011 continued to be the global market place and networking industry platform:
o a world-class, one-stop solutions showcase for the whole textile-making process
o a place for gathering business intelligence and best practices
o a gathering of industry leaders for outstanding business and networking opportunities
It was mentioned that the organizer provided ITAMMA a Booth no. H-4, 2UL3 of 12 sq mtr. in CEMATEX Association village on complementary basis along with various facilities including internet & international calling at 24x7. Some of the initiatives taken by ITAMMA before the exhibition were as follows:

- Talk by Shri J.M. Balaji, Alternate Chairman, Seminars & Public Relations Sub-Committee on "Goal Setting & Establishing World wide Networking through ITMA 2011" (broadcasted through web conferencing)
- Mailers sent to more than 1000 Indian Textile Manufacturing Industry giving details of our member-participants along with a link to their web-site/email
- CD depicting the History and details of members of ITAMMA and having the film of ITAMMA was distributed at ITMA'2011 to all visitors attending ITAMMA booth No. 4UL3
- Flag Type Table Top was distributed to each ITAMMA member exhibitor at ITAMMA
- Exhibitors and Associations participating at ITMA'2011 were informed about our member exhibitors and their stall details & were invited to visit ITAMMA booth for having b2b meetings and to work out possible Tie Ups/ Collaborations.

Mr. Mhatre also mentioned about the facilities made available at ITAMMA booth for the visitors; which included Posters, ITAMMA's film, Distribution of Brochures, CD & Letters, ITAMMA's Publications & organized B2B meetings with other Associations. In the presentation the coverage was given to the statistics of ITMA'2011 at a glance i.e. the information on the number & % of Exhibitors' participation Hall wise & sector wise (spinning, weaving, wet-processing, etc.); as also country wise. Further his presentations were based on 1) ITAMMA's interaction with other Associations [(Associations of textile machinery for exploring opportunities of signing MOU's; and with Associations of Textile manufacturers for exploring opportunities for Delegation visits / Pavilions / Catalogue Shows / Buyer-Seller Meet (USER INDUSTRY)], 2) Categorization of Visitors at ITAMMA booth & 3) Outcome of Dy. Director's visit to other stalls (the details of few technological developments were displayed, while a detail report covering major exhibitors will be submitted in due course)

Also the Visitors attending ITAMMA stall were categorized under , i) those Looking for suppliers of good accessories & machines, ii) those from User Industry (India & other countries), iii) those Looking for Tie-ups/ collaborations, & iv) those who are Service renders; & the detail information regarding their contacts were displayed during the presentations.

At the end of his presentations Mr. Mhatre opined all to support & makes it a grand success, the major international machinery event "INDIA ITME'2012" organized by India ITME Society from 2ND -7TH Dec'2012, which will be in India.

Vote of thanks by Shri Chetan R. Ghia, President-elect.

At the End Shri Chetan R. Ghia, President-elect delivered his vote of thanks.

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"I do not consider it an insult, but rather a compliment to be called an agnostic. I do not pretend to know where many ignorant men are sure -- that is all that agnosticism means."
- Clarence Darrow

FICCI TAG 2011
Focusing on Sustainability - Inaugurated

Mumbai, 13th October 2011 - "Ministry of Textiles has allocated 1972 crores under the Textile Up-gradation Fund Scheme [TUFS] and until 5th October 2011, only 78 crores has been disbursed", said Shri S. Balaraju, Joint Textile Commissioner, Ministry of Textiles, Government of India while inaugurating the FICCI TAG 2011, Conference held in Mumbai.

Shi S. Balaraju, Joint Textile Commissioner lighting the lamp

He also stated that the Ministry of Textiles has drafted the National Fiber Policy and the Common Compliance Code which aims to make India the Global benchmark for social compliance in apparel manufacturing and exports. Shri S. Balaraju released the FICCI Technopak Knowledge Paper which brought out key issues of the Sustainability models.

Shri Premal Udani, Chairman, FICCI Apparel Committee said that "sustainability should not be forced, it arise out of regulation but through voluntary compliance and commitment". He added that as the economic downturn has dented the pockets of end users, it has not dented their aspirations for better planet. He also urged companies to take concrete steps towards achieving this goal not by force but by proactive measures. "AEPC has planned to conduct a Reach Seminar to educate the market" he added.

Shri S. Balaraju, Joint Textile Commissioner releasing book of papers

While making the theme presentation Shri Arindam Saha from Technopak gave snapshots of the key findings of the Knowledge Paper and said "There is a need to take advantage of today's web and social media to promote and create an awareness about sustainability". Earlier Mr. Manoj Patodia, EC Member of FICCI & VC & MD Prime Urban welcomed the gathering.

The eminent speakers for FICCI Tag Conference were

FICCI TAG 2011 Conference was supported by the office of Textile Commissioner Ministry of Textiles Govt. of India, Alok Industries, Pratibha Syntax Ltd, Textile Committee, Polygenta Technologies, Mandhana Industries, SGS, ATE Enterprise, India ITME Society, Hohenstein Institute, ECGC, ASTM, and Shop for Change and DBS Bank among others.

The topics discussed were

- Sustainability: an option or a necessity.
- Profitability and Sustainability : Complementing each other.
- Pillars of Sustainability and Inclusive Growth : Environmental, Social and Economic.
- Sustainability by choice: Outcome and way forward.

Texttreasure

"The instinct of nearly all societies is to lock up anybody who is truly free. First, society begins by trying to beat you up. If this fails, they try to poison you. If this fails too, they finish by loading honors on your head."

- Jean Cocteau

Indian Technical Textiles Industry to grow to a value of 158000 Crore by 2016

The third edition of Techtextil India kicked off successfully on its first day on 10th October 2011 at Bombay Exhibition Cenre, Goregaon, Mumbai. 4 International country pavilions from Germany, France, Belgium and China took part in it. 132 Exhibitors across 14 countries - Belgium, China, France, Germany, Holland, India, Italy, Japan, Korea, Sweden, Turkey, USA, Austria and Indonesia exhibited.

Key representatives from Ministry of Textiles, Indian Technical Textile Association, Bombay Textile Research Association and The Synthetic & Rayon Textiles Export Promotion Council (SRTEPC) supported.

With more than 132 exhibitors, 500 company delegates & 14 different countries attending the opening day of the third edition of Techtextil India 2011, the exhibition & symposium has show a staggering growth trend, year-on-year. The international Trade Fair took place at the Bombay Exhibition Centre, Mumbai.

Hosted by Messe Frankfurt India Trade Fairs India Pvt. Ltd and supported by the Office of The Textile Commissioner, Ministry of Textiles Government of India, Bombay Textile Research Association (BTRA), Indian Technical Textile Association (ITTA) and The Synthetic & Rayon Textiles Export Promotion Council (SRTEPC) turned out to be an excellent edition for exhibitors and buyers from both Indian & International technical textiles and nonwovens sectors.

The inaugural ceremony had the esteemed presence of Shri A. B. Joshi, IAS, Textile Commissioner, Ministry of Textiles, Govt. of India as the Guest of Honour. He released the official catalogue of the 3rd Techtextil India and threw light on fast growing technical textiles sector. He said, "The technical textiles industry has grown to ` 63000 crores in 2011-12 from ` 43000 crores in 2007-08, which is a 11% growth per annum; and it is forecasted to grow to ` 158,000 crores by 2016-17 with a projected growth percentage of 20% growth per annum to be achieved."

He further emphasised on the growing sectors within the Technical Textiles industry in India viz., Medical (Medtech), Geo-Textiles (Geotech), Protective Textiles (Protech) & Agricultural Textiles (Agrotech). The Government of India, in its 12th Five Year plan has allocated funds to the development of Centre's of Excellence (CoE) for the various Technical Textiles Sectors. The upcoming CoE's, that have been established very recently are; for non-wovens & Medical in Ichalkarangi, Kolhapur, Maharashtra; for the Sports sector in Mumbai; for Composites in Ahmedabad, Gujarat & for the Industrial application of textiles in Coimbatore, Tamil Nadu.

Further elucidating his point Mr. Michael Jänecke, Brand Manager-Techtextil, Messe Frankfurt GmbH, in his welcome note, profusely thanked the India Government for their ever growing and extended support towards Techtextil India 2011 and also said that globally, India's presence as a global player in the textiles industry has garnered positive feedback as is fast gaining the respect & influence of many countries, worldwide. Other distinguished guest Mr. S.P. Agarwal, President, Delhi Exporters Association & Board of Directors, SRF Ltd. put forth valuable suggestions for the growth and development of the textile industry in India.

The exhibition floor which has been categorized into the product groups of machinery, raw material, fabric manufacturers and related accessories was open after the lamp lighting and the ribbon cutting by all the eminent Guests after which they made a guided tour to the exhibitor's stalls: SRF, Garware, Lindauer Dornier, Indorama Polyester, Oelikon, Karl Mayer, MEP Olbo, Dilo, Teijin India Pvt Ltd, Waxman Fibres, Birla, ATE, Khosla Profil, Ajanta Universal, Arvind, Tex-View, JMDC, Kusumgar and Raman Science Fibres.

Great excitement perceived on the opening day of the show, stands that were busy till late evening, the discussions at the exhibitors stalls, VIP, media lounge and around, a notable atmosphere of hard work, concentration and intense discussion all already augured good results. High levels of quality and creativity became hallmark of this fair, both exhibitors and visitors enjoyed and appreciated the innovative offers. The expo served as a platform to provide international buyers with business opportunities and to tap the valuable domestic consumer market.

Techtextil India 2011 on its very first day has turned out to be a trend setter for the large and affluent Indian consumer market looking for new and high quality in technical textiles and nonwovens.

Speech of the Textile Commissioner for Techtextile India-Symposium on 10th October 2011 at Mumbai

A technical textile is the emerging area for investment in India. The production of difficrent items of technical textile industry has been slowly but steadily increasing in the country. The accelerated growth of the Indian economy would impact favourably on the growth of the technical textiles. With increase in disposable income, the consumption of technical textiles is expected to increase.

The market size of technical textiles in India is estimated at Rs. 63, 202 crore during the year 2011-12 which has grown from Rs. 41,756 crore in the year 2007-08 with annual growth of 11% year on year basis. Based an the past trend of growth and estimated end user segment growth, the sub-group on technical textiles for 12th five year plan has projected the inarket size to Rs. 1,58,540 crore for the year 2016-17 with a growth rate of 20% year on year basis.

There are many potential areas /markets for technical textiles which can be tapped in India. Few segments are like:

Medical Textile user Industry

Indian Healthcare industry is estimated at US$ 30 billior, contributing around 5% to the country's GDP, and employing around 4 million people. With growing population, it is estimated that Healthcare industry will reach around US$ 100 billion, and contribute 8-10% to the GDP. India has currently received a great deal of attention as an emerging global hub for medical tourism, accounting for around 2% of share in the global health tourism.

Medical textile products which provide comfort, safety and hygiene in patient care are more in demand. Hospitals look for absorbent, impervious material, no fluid strike through, and lintless, products. Non-Wovens are one of the solutions. Demand for hi-tcch products like vascular grafts artificial valves and other medical implants arc met predominantly through imports currently. So there exists a colossal area which could be tapped.

Geotextile textile user Industry

India has the second largest road network in the world.

with a road lcmgth of 3.3 million krn, comprising National Highways/Expressways (70,548 km), State Highways (1,28,000 km), major District Roads and other District Roads (4,70,000 km), and Village Roads (26,50,000 km)

The saving potential of geosynthctics is being globally recognised and being adapted as is indicated by the rapid growth of the global geosynthetics market. Tbough, various applications of geotech products have been explored in developed countries, the main applications in India include soil separation and reinforced earth walls; other applications M'c yet to become popular.

Rapid growth of economy cannot be sustained without a world-class infirastructm. Similarly, quality infimstructure is the backbone of many developed nations. To sustain its rapid growth, India also needs support of world-class road infrastructure. Gcotextiles is one solution for quality Roads and infrastructure.

Protective textile user Industry

Indian Defence Forces with a total strength of around 1.5 million individuals comprising the army, navy and air force, is one of the largest: consumers of protective textiles. In addition, around 1.2 million individuals are present in paramilitary forces and other security forces. The usage of protective textiles in defence comprises Bullet proof jackets, NBC suits, JUgh altitude clothing and Fire retardant apparel. High altitude clothing, bulletproofjackcts and fire retardant fabrics account for 52%,20% and 14% of the technical textile consumption respectively in Protech segment. Imports account for around 600% of the domestic consumption of protective technical textiles. High altitude clothing accounts for around 90% of the total Protech imports. So again lbere exists a huge scope for investment in this field in India.

Agrotextile user Industry

In India, agricultural activities are carried out majorly under natural conditions of temperature and humidity. As a result of absence of control factors, the country faces various challenges including unsatisfactory yield, maned quality of produce, damages to the produce, regional limitation on cultivation, seasonal limitation on cultivation, etc.

Field trials and pilot studies have demonstrated the usage of agrotmailes can increase productivity (50-801/ 16, depending upon the nature of crop). Premium quality of produce (increased income by 50-60%) is possible. All season and any region cultivation of crops is ..... Early and even ripening of produce (more harvest cycles per year). Reduced water Aconsumption (10-15%) with use of agrotextiles. Minimized use of fertilizers and pesticides (25-30%). Preveation of damages owing to birds, insects, hail, sunburns, falling off of ripened fruits (100% protection).So there exists a great opportunity for investors in the field of agrotextiles.

Sensing the opportunities in the field of Itiechnical textiles, Govt. of India has taken Many Steps in a structured manner to encourage investment in this field. The major schemes are:

I. Scheme for Growth and Development of Techniml Textiles (SGDM) The was launched during 2007-08 of XP Five Year.Plan with three components. The scheme has completed its tenure in the year 20 10-11.

- Baseline survey of technical textile industry in India was conducted to make Available the data base of technical textile industry in India. The report has been placed in our website www.technotex.gov.in

- **Creation of Awamness:** more than 60 awareness programmes/ seminars / workshops were organized in association with TRAs / COBs / industry associations like CII, FICCI across tht country.

- **Setting up of four Centres of Excellence (COFs):** Four COEs (BTRA for Geotech, SASMIRA for Agroterch, NITRA for Protech & SITRA for Meditech) have been set up for four thrusl segments of the technical textiles to provide infrastructure support in tenns of testing, training, informatlon eentre ete at one place for the convenience of the manufacture of technical textiles.

II. Technology Mission on Technical Textiles (TMT1) Ministry of Textiles has launched Technology Mission on Technical Textiles (TMTI) with two Mini- missions for a period of five years (from 2010-11 to 2014-15) with a fund outlayo,f Rs. 200 crore during December 2010. The details of the mission are given below:

Mini-Mission- I (Fund Allocation -156 Crore)

Objectives: *Syandardizaijon, creating common testingfacilities with national / international*

accreditation, indigenous development of prototypes and resource center with I T. infrasfteturg.

Interventions

1.1. Setting up offour Centers of Ercellence (COFs) to provide Infraurmcfare supporl at one plarefor the convenience of manufacturers of technical twileg

In addition to four COEs already established in Agrotech, Geotech, Protech and Xleditech under Scheme for Growth and Development of Technical Textiles (SGUM, four McIre COEs am being set up in the area of Nonwovens, Composites, Indutech and Sporteck TO support the n=UfscWrcrs of technical textiles of respective segment and the Government has alreadY identified the four new Centers of Excellence (COa). Thc cenlas are:

Sr.	Name of Agencies	Area of Centre of Excellence
1.	DKTE Society's Textile and Engineering Institute. Ichalkaranji, Maharashtra.	Non-Wovens
2.	PSG College of Technology, Coimbatore, Tamil Nadu	Indutech
3.	Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad, Gujarat.	Composites
4.	Instritute of Chemical Technology (ICT), Mumbai	Sportech

The essential facilities to be created in the center of excellence are as follows:

i) Facilities for testing and evaluation of products of identified segments of technical tcxtilcs with national / internatiowd accreditation and collaboratioa with foreign institutes / laboratories
ii) Resource Centre with I.T. infrastructure
iii) Facilities for indigenous developmeriL orprototypcs.
iv) Facilities for training of core personnel and regular training of personnel from the technical textile industry.
v) Knowledge shajing with stake holders
vi) Incubaiion Centre
vii) Sttdng UP Of Mandatils at par with global level.

1.2 Upgradation of existing four Centres of Ercellence

As stated catlier, 4 COEs have already been established but these centres are not facilities for development of prototypes, incubation centre for products of their segments and provision for recurring expenditure for appointment of experts. Therefore, a fund support will be proided to the existing COEs to upgrade them in line with new COEs.

Mini-Mission-II (Fund Allocation-44 Crore)

Objectives: *Support for domestic & e-c lopment of terhnical textiles*

Interventions

1.3 Supportfor businiess start-ap

Technical textiles is a new area and entrepreneurs especially SME sector find it difficult to start a project on technical textilm.rhe COE and other associations / institutes / independent reputed consultants will. be empanelled by the MOT / Office of the Textile Commissioner who will prepare project reports and do ffie hand holding of the potential entrepreneurs till the completion of the projects. Two consultants bave already been empanelled for Business Start-up under Technology Mission on Technical Textiles (TMTT).

1.4 Providing fund support for organizing workshops

The awareness about the technical textiles is still, low among the stake holdeTs In order to create the awareness about technical textile reputed National and International agencies including the Indian Diaspora settled abroad win be invited to conduct Seminars, Workshops and short term training programmes in which knowhow about latest technology interriational practices market dctails; global scenario etc will be shared. Five programmes have already been organised during this year under this component. Programmes have received huge response from all stake holders.

1.5 Social compliance through standardization, regulatory measures

Some technical textiles require encouragement for use by user industries/Ministries and some require mandatory prescription. Consultants will be engaged to identify the needed regulatoty changes required along with international best practices and also the strategy to facilitate such changes in the rules and regulations. Draft White paper on formulation of regulations in

respect of safcty industrial work-wear (Heat & Flame) has been prepared through NIITRA and is wide circulation for inviting cornments.

1.6 Market development Support for marketing support to bulk and Institutional buyers etc. Under the Scheme Buyers-sellers meet will be organized across the country wherein the indigenous manufacturers can showcase their products and institutional buyers will be invited for enhancing marketing competitiveness of manufacturers.

"TECHNOTEX INDIA 2011: Intemational Exhibition & Confercrice on Technical Textiles" was organized during 25-27 August 2012 at Mumbal under this component. The programme was inaugurated by Textile Minister and was attended by Chief Minster Maharashtra and Textile Minister, Karnataka. The programme was a huge success. 102 companies participated as exhibitors. There was a separate China pavilion in the exhibition and three State Pavilions. Over 280 dclegatcs attended the Conference. 41 speakers addressed the delegates and made presentalions.

1.7 Market development Support for export sale:
There are many reputed technical textile fairs organized abroad. The participation in these fairs will improve the expon potential of the indigenous manufacturers. Some of the technical textile units are also participating in the exhibition of application based fairs. The support includes participation in Technical Textile fairs/ Application based fairs by the Indian technical textile manufacturers to exhibit their products. **Five units have almdy bem 2pproved for support under this component till late.**

1.8. Coutract Research and Development through IITs/ TRAs/Textile Institutes
Technical textiles is high technlogy area where most of the new material high-end converted products are imported, therc is strong need for indigenous development of products for which R&I) is of prime importance. Therefore, contract research will be covered under this head. Individual unit or two or more unit may come together for a Contract research proposal.

III. TUF Scheme :

- All the major technical textile machinery is covered under the Technololy Upgradation Fund Scheme (TUFS) for 5 percent interest reimbursement and specialized / high and machinery has been covered for additional 10 percent capital subsidy.

- From 01.04.2007 to till date 501 no. of technical textile units have been registered with this office for availing 10% Capital Subsidy under TUFS for Technical Textiles with a proposal investment in machineries to the tune of Rs. 2634.65 crores (Approx).

IV. Facilities for training of core personnel and regular training of the technical textile industry.

V. Knowledge sharing with stake holders

VI. Incubation Centre

VII. Setting up of standards at par with global level.

1.9. Upgradation of existing four Centres of Excellence
As staed earlier, 4 COEs have already been established but these centres are not having facilities for development of prototypes, incubation centre for products of their segments and provision for recurring expenditure for appointment of experts. Therefore, a fund support will be provided to the existing COEs to upgrade them in line with new COEs.

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www.textileassocitionindia.org

THE TEXTILE ASSOCIATION (INDIA), MUMBAI UNIT

International Seminar on

Value Addition in Home Textiles & Apparels - the Way Forward

Day & Date : Friday, 20th January 2012 (08.30 a.m. to 06.00 p.m.)
Venue : Hotel InterContinental The Lalit, Sahar Airport Road, Andheri (East), Mumbai - 400 059

The current size of the Indian textile and apparel industry is Rs. 3,29,020 crores including domestic and exports. Of these the apparel industry is worth Rs. 1,54,000 crores and the Home textiles is Rs. 15,570 crores. Both these sectors are estimated to grow at 11% and 9% respectively. The world trade in Home textiles is valued at USD $ 74.75 Billion out of which cotton fibre accounts for 49% followed by the man-made fibres 36%. The Home Textiles trade from China contributes 31% market share which followed by India with 4.4%. In the supply of Cotton madeups India ranks second with 7.25% market share as against China with 28.6%. Thus there is significant scope to increase India's market share in both the categories. These two products are certainly high priced and further value addition can add much higher benefits for the Indian textile industry. Our textile industry is having many opportunities and challenges. The value addition is one of such opportunities and is also a challenge.

TAI Seminar:

The TAI, Mumbai Unit have set high tradition of organizing very successful conferences/seminars and has always been at the forefront in organizing seminars on contemporary subjects. The highlights of this seminar are two Panel discussion sessions comprising of Leaders from the Indian Textile field which will be followed by paper presentations. This will give a rare opportunity to the participants to listen to such high quality experts. We are expecting about 300 participants to attend this seminar.

Topics & Speakers:

The topics for the home textile technical session would cover the special reference to dyeing & printing and the value addition through new machinery, dyes & chemicals and processing. The topics for the technical session on apparel would cover yarn dyeing in apparel and value addition through the machinery and processes. There will be eminent speakers including overseas experts from the machinery manufacturers, dye/chemical manufacturers, processors and the brand owners.

An Appeal:

The international seminar provides an excellent opportunity for companies to gain global visibility and publicity by promoting their products and services to a highly focused audience besides networking with the participants from various parts of the world. Your participation in this seminar by way of sponsorships, advertisements and delegates would provide a common platform to meet the experts from the industry. The main advantage will be an opportunity to exchange views on the latest developments in the textile industry.

We appreciate your support to The Textile Association (India), Mumbai Unit in its activities and it is our pleasure to invite you to be part of this event. Let us join hands to make this seminar a great success.

V. C. Gupte	**Rajesh Balkrishnan**	**A. V. Mantri**
Chairman & Convener	Jt. Convener	Hon. Secretary

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For further details please contact: Hon. Secretary

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"Innovation in Textile Processing"

The Textile Association (India), Mumbai Unit organized a Half Day Seminar on "Innovation in Textile Processing" at Dombivli Gymkhana, P-9, MIDC, Phase-I, Dombivli on October 13, 2011. The Chief Guest was Mr. S. Balaraju, Jt. Textile Commissioner, Ministry of Textiles, Govt. of India.

Mr. Rajesh Balakrishnan, Vice President, TAI, Mumbai Unit welcomed the Chief Guest Mr. S. Balaraju, Jt. Textile Commissioner, Ministry of Textiles, Govt. of India, Guest Mr. Sudhakar Gokhale, speakers and delegates.

Mr. S. Balaraju, Jt. Textile Commissioner releasing the Book of Papers

Mr. Arun K. Narkar, Jt. Hon. Secretary, TAI, Mumbai Unit & Convener of the Seminar 'Innovation in Textile Processing' expressed that inspired by Ministry of Textiles' Cluster Development Program particularly in Powerloom Sector, The Textile Association (India), Mumbai Unit organized cluster wise Technical Up-gradation Program for Textile Processors at Tarapur followed by Vapi, Bhiwandi & now at Dombivli. Keeping in view, up-gradation in field of infrastructure, environment, innovative processes, pollution control, safety etc & after discussion with Sr. Technicians, topics of technical papers relevant to the theme of seminar & respective speakers were selected. Panel Discussion Session on 'Prospects of Cluster Up-gradation' moderated by Dr. G.S. Nadiger, Research Advisor, BTRA with other Panel Members as experts from Textile Processing, MIDC, Waste Management & SIDBI (Small Scale Industries Development Bank of India) was organized.

Mr. Sudhakar Gokhale, Sr. Technician was special invitee in the absence of Guest of Honour, Mr. V. S. Chalke, Managing Director, Oriental Synthetics & Rayon Mills Pvt. Ltd. He has specified in his speech that there is need of innovation in environment protection. According to him, innovation is also essential in field of management in every industry. Cost effectiveness is the need of the hour, but the cost cutting should not be primarily just a cut in labour costs! Contract labour which is now practiced in Textile Processing has some disadvantages like improper training, difficulties in motivating them & production based pay scale which leads to faulty dyeing, steam losses etc. It is the trend of students from technical institutions to prefer white collar, high salaried jobs resulting in non-availability of qualified technicians in Textile Processing. Hence, this is another area where prime innovation is needed.

Mr. S. Balaraju, Jt. Textile Commissioner, Ministry of Textiles, Govt. of India in his inaugural address talked about reluctance of processing sector to come forward with proposals. He has mentioned that up-gradation in processing sector is not keeping pace with other sectors. He also urged the processors to make suitable proposals for the 12th plan.

In all, there were 5 technical papers presented during the seminar.

Mr. Elliyas Mohammed, Sr. Product Manager (Polyester Dyes) and Mr. G. Ranganath, Asst. Gen. Manager, Marketing (South), Tirupur, Colourtex Industries Ltd., presented the paper on "Cotton & Cotton / Polyester Blends - Exhaust Dyeing - Changing Market Trends". Mr. G. Rangnath and Mr. Elliyas Mohammed emphasis on changing application techniques of Reactive dyes with advancement of technology and demands. Right First Time Approach & Short Liquor optimizes dyeing process. Exhaust Process take share of 50% in all application techniques. Coralite, Corazol RFT & Corafix F & XL are newly developed products in their Reactive range to meet challenges of Changing Market Trends. Dyeing of Cotton/ Polyester knits, demands selection of Disperse dyes on the basis of staining on cotton, pH sensitivity & migration properties of Disperse dyes.

Mr. Amit V. Pathak, Senior Executive Technical Service, Rossari Biotech Ltd. presented the paper on "Low

Temperature Bleaching - The New Trend" in absence of Mr. Edward Menezes, Managing Director, Rossari Bio-tech Ltd. Rossari developed suitable metal complex catalyst to incorporate in Hydrogen Peroxide bleaching to reduce bath temperature to 70 to 80 deg. C from conventional 100 to 120 deg C. It helps to adopt eco-friendly processing by reducing carbon dioxide emissions through lesser consumption of fuel required. It imparts smoother surface profile, lesser weight loss & high brilliancy to bleached fabric.

Dr. Ashok Athalye, General Manager - Technical Service, Atul Limited-Colors Division presented the paper on "Challenges and Developments in Reactive dyeing of Cotton". According to Dr. Athalye 62% of Reactive dyes are used for Cotton dyeing in world scenario. Atul has developed Tulactiv C & CC in Reactive dyes range for excellent compatibility, less water & energy consumption, robust & good for RFT. Tularevs XL are for economical deep shades.

Mr. Anand Apte, Managing Director, Waste Encare (India) Pvt. Ltd. presented the paper on "Pollution Control Systems for Textile Processing Industries - Conserving Natural Resources". Mr. Anand Apte has talked about 3R's for Waste Water Management-Reduce, Recycle & Reuse after treatment. He pointed out that for safe disposal, Primary, Secondary & Tertiary treatment of effluent are essential. Disinfection, Reverse Osmosis & Multiple Effect of Evaporation is must for Re-use of water. For Air Management, Industrial Emissions shall be scrabbed. Particular emission system and use of biomass suggested.

Mr. Sateesh Gore, Director, Electron Group presented the paper on "Innovative Printing Inks for Textiles Fabrics". Mr. Sateesh Gore in his presentation emphasis more on innovative styles of printing on cotton & its blended fabric for value addition & to fulfill increased fashion trend. Some novel effects in pigment printing using different binders were discussed. Foam Printing and Digital Printing are in practice among different styles explained.

The main attraction of the Seminar was the 'Panel Discussion' moderated by Dr. G. S. Nadiger, Research Advisor, BTRA with his Panel Members team selected from MIDC, SIDBI, Waste Encare, etc. Dr. Nadiger said that a cluster means an activity having lot of similarity in terms of technical operations and production of end product. In this context, Dombivli could be treated as cluster of textile processing. Although a discussion has been made in addressing issues pertaining to the cluster, it is worthwhile to do a detailed diagnostic study to identify various issues related in the supply chain i.e. Quality related problems, Manpower related issues, Technology related issues, Infrastructure related issues and Marketing issues. While concluding, he suggested making use of training, testing and technical services of BTRA. If industry association collectively approaches BTRA, they may consider a concession for availing these facilities.

Dr. G.S. Nadiger chairing the Panel Discussion session

Smt. Farogh Mukadam, Deputy Collector & Regional Officer, Thane, MIDC covered background about development of MIDC in Maharashtra, Importance given by MIDC on issues related to safety, particularly fire safety. Each industry should comply with the fire safety norms which are available on MIDC and other websites. She also observed that Dombivli cluster is still in Gram panchayat area and Gram panchayats are financially unsound to tackle waste water disposal & CETP's issues. Also, Gram panchayats are not included in Municipal Corporation's developmental work.

Mr. S. V. Soudagar, Consultant expressed his views for technical up-gradation in Panel Discussion. According to him minimizing redyeing, feasible automation and processes to keep low effluent load are important areas to be considered. Analysis of incoming grey fabric as well as dyes chemicals, auxiliaries, tanker water, etc is essential. The standardization at each stage of processing is must. RFT index should be calculated to monitor performance. Dispensing systems, batch wise process controlled automatically are also needed to avoid human errors. Low liquor ratio, RFT approach, caustic recovery, ultra RGB (DyStar) suggested to reduce COD & TDS in effluents. Enzymes for desizing and scouring help to reduce effluent load.

View of the Audience

Mr. Anand Apte, Managing Director, Waste Encare (India) Pvt. Ltd. expressed that ETP's Should be considered as integral part of overall development and not in isolation. Complying with MPCB norms is essential. He mentioned that there is an absolute need for conserving water as it is being very essential natural resource. For this minimization of consumption of water is to be practiced as textile industry uses large amount of water. Due to implementation of waste minimization practices existing waste water treatment facilities can be utilized without any up-gradation although there is an expansion at industry level. No extra capital and operating expenditure is required.

Mr. Anil Kulkarni, Dy. General Manager, Small Industries Development Bank of India (SIDBI), briefed about the benefits & products provided for the small industries by the SIDBI. It's the nodal agency for TUF's and other schemes for MSME's. Cluster based proposals if any, could be considered by SIDBI in terms of technology up-gradation or setting up of new enterprises.

The organizers of the seminar were happy to note that the objectives of the seminar were fully achieved.

Dr. (Mrs.) Sujata S. Pariti, Adjunct Professor, Department of Fibers and Textile Processing Technology, UICT compared the whole seminar commendably.

At the end, Mr. A. V. Mantri, Hon. Secretary, TAI, Mumbai Unit proposed a vote of the thanks.

The Seminar was grand success and was attended by over 150 participants.

Successful market introduction of the new Sultex A9500 Air Jet Weaving Machine

ITEMA Weaving reports significant sales success of the Sultex A9500 Air Jet Weaving Machine, which was introduced only a few months ago. With perfect quality, the Sultex A9500 is already performing at the highest speeds at mills in Italy, Germany, India and China.

"The Sultex A9500 machines allow us a step forward in the woven quality considering an improved fabric appearance and reduced starting marks, what is particularly important on the high competitive European market", explains Mr. Steidel, CEO of Lauffenmuehle GmbH & Co. KG in Germany. Lauffenmuehle purchased the Sultex A9500 in order to increase productivity by using the latest technology in high speed air jet machines. Mr. Steidel adds "ITEMA is a good and reliable partner. The excellent service and the technical support of ITEMA were other major advantages to decide for the Sultex A9500". Lauffenmuehle GmbH & Co. KG is a reputable German vertical integrated supplier of high quality fabrics for work and protective clothing running more than 100 ITEMA weaving machines.

ITEMA has a long tradition in air jet weaving. The company was the first to launch an air jet weaving machine using relay nozzles some 30 years ago. Under the brand name Ruti and later Sultex, our air jet weaving machines became extremely popular with over 100.000 machines sold.

This new Sultex A9500 air jet weaving machine combines the experience gathered in the past with the most revolutionary machine technology.

The ITEMA Weaving R&D Team reduced the total parts of the machine by 30%, resulting in a simplified machine concept requiring less maintenance. The mechanical settings of the machine are minimized; pattern configurations & settings are electronically confirmed.

Using the vast electronic expertise present at ITEMA, a new electronic platform was developed; not only for the A9500 but also for other new weaving machines to be introduced to the market in the near future. This new "common platform" uses a Windows CE driven, full color touch-screen as the user interface. The networking feature allows serial-VDI as well as Ethernet connectivity.

From a textile technology view point, the A9500 offers a unique shed geometry. The slay can be driven by conjugated cams or by a crank mechanism, depending on the requirements of the customer. The Sultex A9500 is the only weaving machine on the market that offers both options for the slay drive.

The A9500 is an extremely versatile machine and can be supplied with a broad range of key configurations to successfully produce the most demanding styles. The new lateral & central independent selvedge devices combined with new pneumatic tuckers for full width reed guarantee perfect quality double panel weaving.

Thanks to the powerful electronic platform, new functionalities are now available for the best control of insertion parameters. It's in the wider width weaving that the Air Management System, including the RTC and the fully digital Air Consumption Metering, ensures optimum air consumption yielding energy savings and full automation of the pneumatic settings.

Finally, our new A9500 provides remote, networking capabilities with connection to Loom Browser. A new product at ITEMA, the Loom Browser allows remote access to the machine PC to monitor performance and even make changes to machine settings.

Contact
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INDIA

International Seminar on "Value Addition in Home Textiles & Apparels - The Way Forward"
Date : Friday, 20th January 2012
Venue : Inter Continental The Lalit Mumbai
Sahar Airport Road, Andheri (E),
Mumbai 400 059, India

Igmatex-Textile Home Furnishing and Garment Machinery Exhibition
Date : 21-22, January 2012
Venue : Panipat
Contact : Mr. Rajesh Sinha / Mr. Manoj Sinha
Igmatex Exhibitions
B-504, Goodwil Gardens, Sector-8, Kharghar,
Navi Mumbai - 410 201
M. : 09324077881, 09312069048
E-mail : info@igmatexfair.com, igmatex@gmail.com
Website : http://www.igmatexfair.com

67th All India Textile Conference
Theme: "Textiles & Clothing - Emerging Global Scenario"
Date : 04 & 05th February 2012
Venue : Habbitat World, India Habitat Centre,
Lodhi Road, New Delhi -
Organizer : The Textile Association (India) -
Delhi Unit
Contact : Mr. Ashok Juneja, Conference Chairman,
Mr. R. Dudeja, Conference Secretary
The Textile Association (India) - Delhi Unit
401, Gagan Deep, 12, Rajendra Place,
New Delhi - 110 008 (India)
Tel. : +91 11 2575 0224, Fax: +91 11 2573 6456
E-mail : taidel@bol.net.in
Website : http://www.tai-delhi.org

INDIA ITME 2012 - 9th India International Textile Machinery Exhibition
(INDIA ITME 2012 is the largest and the most and is the "gateway event" toi India's large domestic market for both Indian and foreign textile machinery manufacturer)
Date : 2-7 December 2012
Venue : Bombay Convention & Exhibition Centre, Mumbai
Contact : India ITME Society Route Map
76 Mittal Tower, 'B' Wing
7th Floor, 210 Nariman Point, Mumbai - 400 021.
Tel. : +91-22-2202 0032/2282 8138/ 2285 1579
Fax : +91-22-2285 1578
E-mail : contactat@india-iteme.com

International Textiles Conference
ATNT 2011 in Coimbatore
Date : December 15-17, 2011
Venue : Coimbatore, India
Contact : Srinivasan Jagannathan, Professor,
Department of Fashion Technology,
Kumaraguru College of Technology, Coimbatore, India
Tel.: +91 422 2669488
E-mail : atnt2011kct@gmail.com

ABROAD

5th Aachen-Dresden International Textile Conference,
Date **:** 24 - 25 Nov 2011,
Venue **:** Eurogress Aachen, Germany.
Contact : Dr. Brigitte Kuppers,
DWI an der RWTH Aachen eV,
Tel. +49 241/80-233-36
E-mail : Kueppers@dwi.rwth-aachen.de
Website : www.aachen-dresden-itc.de

ITME Asia & CITME 2012
(*Asia's most prestigious textiles machinery industry event)*
Date **:** 12-16 June 2012
Venue **:** Shanghai New International Expo Centre (SNIEC), Shanghai, China
Contact **:**
CEMATEX (European Committee of Textiles Machinery Manufacturers)
PO Box 248, Newcastle upon Tyne
NE7 7WY UK - United Kingdom
Tel.: + 44 7967 477305
E-mail : info@cematex.com

Every effort is made to ensure that the information given is correct. You are however, advised to re-check the dates with the organizers, for any change in schedule, venue etc., before finalizing your travel plans.

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