R&D PROJECTS - 2010-11

1.1 Completed projects

(i) Project title : Development of NYCO fabric for paramilitary and military combat uniforms (Sponsored by Ministry of Textiles, Govt. of India)

Started in : Month : March / Year : 2009

Objectives :

- A critical study on the various combat uniforms being used by military and paramilitary forces in terms of fibre blends, design and colour
- To identify various shortcoming of the present combat uniforms
- To study Nylon 66 fibre properties in terms of its compatibility with cotton fibres in spinning
- Optimisation of blend proportion of Nylon 66 fibre with cotton fibre as per the requirement of the end product
- Optimisation dyeing and printing of Nylon 66 and cotton blended fabric
- To finish developed fabric to impart wrinkle free, flame retardant etc. properties
- To develop combat uniforms

Progress of work : Dyeing, printing, finishing & evaluation of NYCO fabrics have been done.

Research out come : The finished NYCO fabric samples were evaluated for various properties. The test results are given in the Table.

Table : Test Results of Finished Fabric

Sl. No.	Characteristics	Test Result		Test Method
		NYCO	P/C	
1.	End/inch	99	97	IS 1963
2.	Picks/inch	54	54	IS 1963
3.	Mass, gm/m^2	223	210	IS 1964
4.	Breaking strength, Newton - Warp-wise - Weft-wise	 1186 752	 772 687	IS 1969
5.	Elongation at break, % - Warp-wise - Weft-wise	 39 18	 13.22 12.47	IS 1969

6.	Tearing Strength, Newton - Warp-wise - Weft-wise	 4390 4450	 4410 4490	IS 6489
7.	Abrasion Resistance (Martindle) - Up to 50,000 cycles	No thread breakage	No thread breakage	IS 12673
8.	Abrasion Resistance-Taber CS-10, Load 250 g	No hole formation observed upto 1000 cycle	Hole formation observed at 750 cycles	Guideline of ASTM D 3884
9.	Colour Fastness to Washing - Change in colour - Staining on adjacent fabric	 4 4	 4 4	IS 764
10.	Colour Fastness to Perspi-ration - Change in colour - Stainng on adjacent fabric	 4 4	 4 4	IS 971
11.	Colour Fastness to Hot Pressing (200°C, only dry press) - Change in colour - Staining on adjacent fabric	 4 4	 4 4	IS 689
12.	Colour Fastness to Rubbing - Dry - Wet	 4 4	 4 4	IS 766
13.	Colour Fastness to Sea Water - Change in colour - Staining on adjacent fabric	 4 4	 4 4	IS 690
14.	Colour Fastness to Light	5	5	IS 2454
15.	Dimensional Change due to relaxation, both directions, percentage	1	1.3	IS 4419
16.	Heat Shrinkage both directions, percentage	1.8	2.0	Appendix 'C; of IS 11248
17.	pH Value	6.8	7.2	IS 1390 (Cold method)
18.	Pilling (after 5 hours of test)	4.5	4.5	IS 10971
19.	Wrinkle Recovery (after 24 hours)	4.5	4.5	AATCC 128
20.	Air Permeability, cc/sec/cm^2	4	3.5	IS 11056
21.	Water Vapour Permeability (water method), g/m^2/day	1725	1500	ASTM E-96
22.	Flame retardency - After glow, seconds - Hole formation - Melt dripping	 Nil No No	 Nil Yes Yes	ISO 15025, Method-A

From the table it is clear that :

- the wear life of NYCO fabric is better than the P/C fabric as indicated by abrasion property (Taber). In the case of NYCO fabric there is no hole formation up to 1000 cycles while in the case of P/C fabric, hole formation is observed at 750 cycles.
- the comfort property of the NYCO fabric is found to be better than P/C fabric as the water vapour permeability and air permeability of the NYCO fabric are higher when compared with the P/C fabric properties.
- the combat uniforms which are having heat or flame resistance properties are essential in the present day context. The presence of synthetic material such as polyester if exposed to heat or flame melts and sticks to skin causing severe burns. It is clear from the Table that FR property of NYCO fabric is better than P/C fabric as there is no hole formation and no melting and dripping was observed in the NYCO fabric.

(ii) Project title **:** Development of Functional Fabric using Bamboo Fiber to provide Bacterial and Ultraviolet Protection to the Skin. (Sponsored by Ministry of Textiles, Govt. of India)

Started in **:** Month : April / Year : 2009

Objectives **:**

- To produce knitted fabrics from 100% bamboo yarn, bamboo /cotton blended yarns and 100% cotton yarn.
- To analyze the comfort properties, anti bacterial and ultraviolet protection properties of the 100% bamboo, bamboo/cotton blended and 100% cotton fabrics to be used for inner garments/sports-wear.

Progress of work **:**

- To evaluate the comfort properties, antibacterial & UV protection properties of knitted fabrics for innerwear / T-shirts, single jerseys knitted fabrics were produced with bamboo, cotton, and their blends and were bleached and dyed using reactive dyes.
- The fabrics were evaluated for air permeability, abrasion resistance, bursting strength, water absorption, water vapor permeability, pilling, colour fastness to washing, rubbing & light. Results are shown in Table-1.
- The manufacturing cost of different single jersey knitted fabrics was also estimated.
- The knitted fabrics were converted into inner garments and T-shirts.
- The project report has been submitted to the funding agency.

Research out come : The air permeability of bamboo fabrics was found to be higher by about 20-25% than cotton fabric. The bamboo/

cotton blended fabrics also exhibited higher air permeability values as compared to cotton fabrics.

The abrasion resistance of bamboo fabric was slightly lower than cotton fabric. The bamboo fabrics showed poor pilling resistance than the cotton fabrics.

The bursting strength of bamboo fabrics was found to be lower by about 30-40% than cotton fabric. The bamboo/ cotton blended fabrics also exhibited lower bursting strength values as compared to cotton fabrics.

Bamboo fabrics moisture absorption rate were twice than cotton fabrics and therefore they could wick away the sweat from the body faster than cotton fabrics.

Bamboo fibers and fabrics absorb dyes faster and more thoroughly than cotton fabric. Dyeing behavior of fabric indicates that the bamboo and its blended knitted fabrics have better dye pick-up in comparison to the cotton knitted fabric as indicated by K/S value. Color fastness to washing, rubbing and light properties of the all fabric found to be similar.

Table-1 : Quality Parameters of Knitted Fabric

Parameters	Test Resultsof Knitted Fabric of 30^s				Test Results of Knitted Fabric of 40^s			
	100% Bamboo	70/30 Bamboo/ Cotton	50/50 Bambo-o/Cotton	100% Cotton	100% Bamboo	70/30 Bamboo/ Cotton	50/50 Bamboo/ cotton	100% Cotton
Air Permeability (cc/sec/cm^2)	201.23	157.59	151.99	147.74	254.5	238.6	234.5	206.7
Water Vapor Permeability (g/m^2/day)	1840.23	1779.34	1713.47	1701.60	1764.63	1673.65	1621.56	1614.59
Abrasion Resistance (Cycles)	28.17	29.13	30.13	34.26	12.54	14.51	14.81	16.89
Bursting Strength (kg/cm^2)	4.52	4.94	5.04	6.71	2.68	2.83	3.00	4.58
Pilling Grade	2.5	3.0	3.5	3.5	2.5	3.0	3.5	3.5
Moisture Absorption Rate (% per Sec)	41.89	32.05	29.25	24.34	40.54	34.35	29.22	22.22

Table-2 : Antibacterial Activity of Bamboo Fiber

Test Method : AATCC 100-2004 (quantitative)	Bacterial Reduction Percentage	
	Staphylococcus aureus (ATCC 6538)	Klebsiella pneumoniae (ATCC (4352)
Bamboo fiber	No reduction	No reduction

Table-3 : Antibacterial Activity of Bamboo Fabric

Test metod : JLS-1902-2002 (Quantitative)	Staphylococcus aureus (ATCC 6538P)	Klebsiella pneumoniae (ATCC 4352)
Growth value F	1.7	1.29
Bacteriostatic value S	1.75	0.64
Bactericidal value L	-0.03	-0.56

Note : Bacteriostatic value (Capable of preventing of growth of bacteria)
Bactericidal value (Capable of killing of bacteria outright)

Interpretation as per test method,
S value should be 2.0 or over and
L value should be 0 or above
Considering JISL 1902 requirement, sample does not show bacteriostatic and bactericidal activity.

The bamboo knitted fabrics have no inherent antibacterial and UV protection properties. It could be attributed that bamboo pulp fiber loses its antibacterial and functional effects during the chemical manufacturing process. Results are shown in Table-2 & 3.

The assessments of various fabric properties endorse manufacturers' claims about the comfort properties of bamboo fabrics. The study further reveals that the manufactures' claims about the inherent antibacterial property in bamboo fiber may be true for original natural bamboo fiber (mechanically processed) but not for bamboo pulp fiber which is chemically processed.

There is a value addition in bamboo and its blended fabrics due to the better comfort properties. Therefore, in spite of 5-10% higher cost than the good quality cotton inner garments, people may prefer to buy inner garments made out of bamboo and its blended fabrics as they are more comfortable.

(iii) Project title : Optimization of process parameters to produce extra soft knitted fabrics for innerwear/kids-wear by using high performance MODAL fibre (Sponsored by Ministry of Textiles, Govt. of India)

Started in : Month : April / Year : 2009

Objectives :

- To prepare the knitted fabrics with different blend ratio of modal and cotton fibres.
- To study the characteristics of various yarns and knitted fabrics.
- To evaluate and optimize the blend ratios of modal and cotton fibres.
- To study the economics of fabrics produced.

Progress of work :

- Project completed and final report submitted

Research out come : Optimization of MODAL & Cotton Blend Ratio :

The properties of modal, cotton and their blended fabrics are given in the following Table. Based on these properties the optimum blend ratio of both innerwear and kids wear are decided.

The properties which determine the quality/performance of innerwear are comfort and durability. Comfort depends upon the permeation of air, moisture and water vapour as they decide how fast the sweat from the human skin is absorbed. The comfort property is also decided by the degree of soft/smooth feel the fabric offers to the skin. Thus to have maximum comfort, the air permeability, moisture and water vapour permeability should be maximum and similarly the smoothness and total hand value should be maximum.

Sample Code	**Modal 100% TS 110**	**Mo/Cot 65/35 TS 111**	**Mo/Cot 50/50 TS 112**	**Mo/Cot 35/65 TS 113**	**Cotton 100% TS 114**
Fabric characteristics :					
Air permeability ($cc/sec/cm^2$)	276	237	207	196	176
Moisture management water absorption rate (%/sec)	40	33	32	30	29
Water vapor permeability ($g/m^2/day$)	1660	1584	1580	1549	1474
Thermal insulation value (%)	20	25	28	31	32
Extraction Force (Softness) (N)	1.7	2.0	2.4	2.8	2.9
Smoothness (Rating)	5	3.5	3.5	3	2.5
Total Handle Value (Rating)	2.4	2.2	2.1	2.1	2.0
Abrasion resistance (No. of cycles)	27	31	51	55	59
Bursting strength (kg/cm^2)	3.4	3.9	4.6	4.6	5.3
% increase in cost as compared to cotton fabric	13.9	11.0	8.5	5.9	-

Durability is a factor which is decided by resistance to abrasion. Innerwear, in general are in intimate contact with the skin, hence they are under constant abrasion. Therefore, durability of inner garment is decided by its resistance to abrasion. Higher the abrasion resistance, longer the durability while low abrasion resistance indicates poor durability. Bursting strength is also a factor which decides the durability.

For the purpose of determining the optimum blend ratio, one should also consider the cost factor. The increase in cost should be compensated with the desired comfort and durability.

The Table shows the comfort, durability and cost aspects of modal, cotton and their blends. It can be seen from the table that with increase in cotton component, the comfort properties (air permeability, moisture management, water vapour permeability, thermal insulation, softness and total hand value) decreased. The permeability to water vapour and moisture vapour are found to be nearly same for the two blends of modal/cotton – 65:35 and 50:50. While the durability (measured in terms of abrasion resistance and bursting strength) appears to be higher in 50:50 blend than that of 65:35 blend. Further, the former is cheaper than the latter blend ratio. Therefore it may be concluded that the optimum blend ratio for inner wear may be taken as 50:50 modal : cotton. The durability for kids-wear is not an important factor because the kids wear is generally worn for short period, say less than a year or so. Therefore, to decide the optimum blend ratio for kids-wear only the comfort factor and cost are taken into consideration. From the above table, it can be said that the kids will have the maximum comfort if their garments are made of either a blend of 65:35 modal : cotton or fabric made of 100% modal.

(iv) Project title : Development of Personal Protective Textile Using Novel Fibres (Sponsored by Ministry of Textiles, Govt. of India)

Started in : Month : March / Year : 2009

Objectives :

- To study the properties of Crabyon fibre and X-static fibre in terms of their resistance to microbial and bacteria
- To study the compatibility of these fibres in spinning with other fibres
- Optimisation of blend proportion of crabyon fibre X-static fibre with cotton and other conventional fibres with a view to achieve desired antimicrobial properties
- Optimisation the process parameters at different stages of process from yarn manufacturing to finishing
- Development of various end products for medical applications and to study the comparative performance of developed product with conventional product
- Conducting commercial trials and overall optimization at commercial scale

- Working out the techno economic viability of the developed products

Progress of work :

- Imported **Crabyon fibre** from Swicofil Ag. (Switzerland)
- Procured **Flexsil silver** fibre from Ag Flex Technologies, Karnataka, India
- Optimized process variables for both the fibres
- Production at mill level
- Bulk production of fabrics, finishing and quality evaluation.

Research out come : Antibacterial Products

(v) Project title : Waste Minimisation in Shuttleless Loom (Sponsored by Ministry of Textiles, Govt. of India)

Started in : Month : April / Year : 2009

Objectives : To reduce hard waste level of rapier loom shed.

Progress of work :

- An attachment is developed which can be fitted on rapier loom at picking side. This attachment eliminates formation of picking side false selvedge and thus reduces hard waste generation.
- It has been estimated that depending upon the width of the loom the modified system helps increasing yarn realization upto 1.5%.

Research out come : Loom run successfully without picking side selvedge

(vi) Project title : Development of format of 'Baseline Energy Audit in Textile industry' under Perform Achieve and Trade (PAT) Scheme (Sponsored by Bureau of Energy Efficiency, Ministry of Power, Govt. of India)

Started in : Month : October / Year : 2010

Objectives :

- Complete review of energy consumption data as reported by BEE
- Energy performance assessment of sub-system sub-processes, major equipment & comparison with designed data or performance guaranteed data/report.
- Preparation of a detailed report specifying facts and figures, analysis, if any, technology status and energy consumption trends etc. It should also highlight the possible improvements in energy savings based on the best available technologies.

Progress of work : NITRA has reviewed the energy consumption data of 85 Textiles Mills, assessed the sub-process and major equipment and prepared a detailed baseline energy audit questionnaire.

Research out come : Baseline Energy Audit Questionnaire and baseline audit methodology for textile have been developed.

(vii) Project title : Energy Audit Manual & Energy Conservation Study for

Textile Units (Sponsored by Petroleum Conservation & Research Association, Ministry of Petroleum, Govt. of India & Energy Conservation Committee, Japan)

Started in : Month : April / Year : 2010

Objectives :
- Program guidance and preliminary lectures.
- Detailed Energy Audit of 2 factories.
- Interim analysis and report of energy audit carried out in two model units
- To setup steering committee and task force team as an actual implementing entity
- Identifying the energy conservation areas in textile industry
- Formation of energy audit manual for textile industry
- Capacity building of engineers, establishment of Trainers bank and dispatch service of expert for industries

Progress of work :
- Detailed energy audit has been carried out in two textile industries.
- Different areas of energy conservation have been identified and a detailed energy audit report has been submitted to PCRA.

Research out come : Developed an Energy Audit Manual for Textile Industry.

1.2 On-going projects

(i) Project title : Ultrasonic Cleaning of Garments (Sponsored by Ministry of textiles, Govt. of India)

Started in : Month : March / Year : 2009

Objectives :
- Fabrication of garment cleaning gadget using ultrasonic technique
- Optimization of washing process parameters
- Evolution of washing efficiency using newly developed gadget.
- Evaluation of economic benefits of the new washing technique.

Progress of work : Tasks :
- Completed
  - design and fabrication of ultrasonic system, standardization of working parameters.
  - evaluation and optimization of the conditions
- In-progress
  - scaling up and pilot plant trials and evaluation

Research out come : Result awaited.

(ii) Project title : Development of cut resistant & abrasion resistant protective textile by using composite metallic yarn (Sponsored by Ministry of Textiles, Govt. of India)

Started in : Month : October / Year : 2010

Objectives :
- To produce a composite yarn with combination of metallic and non metallic fibers or yarn.
- To develop the different combinations of composite yarn with metallic (stainless steel) and non metallic fibers or yarn (i.e. nylon, cotton, polyester, e.t.c.)

- Evaluation of physical properties of developed yarn and fabrics.
- To optimize the process parameters at different stages of process from yarn manufacturing t o finishing.
- To develop various products applicable for different end uses.
- To develop various end products for protective garments from knitting and weaving and to study the comparative performance of developed product with conventional product.
- To conduct commercial trials and overall optimization at commercial scale
- To work out the techno economic viability of the developed products.

Progress of work : Completed

- Procurement of steel fibres

In Progress

- Communication for Procurement of gloves making machine
- Optimization of process variables at pilot level

To be competed

- Optimization of process variables at mill level
- Yarn & fabric production, Finishing and quality evaluation

Research out come : Result awaited

(iii) Project title : Developing shield of corn fabrics for enhancing the protection from flame (Sponsored by Ministry of Textiles, Govt. of India)

Started in : Month : October / Year : 2010

Objectives :

- To study the properties of corn fibre in terms of its low flammability, resistance to bacteria and UV protection.
- To study the compatibility of corn fibre in spinning with other fibre.
- To study the blend proportion of corn fibre with cotton and other conventional fibres with a view to achieve desired properties.
- To develop 100% corn and its blended yarns.
- To produce woven/knitted fabrics from 100% corn and its blended yarns.
- Testing the resulting fabrics for their properties.
- To analyze the low flammability of the fabrics to be used to develop fire retardant fabrics.
- Testing anti-bacterial and UV-protection properties of the fabrics to be used for inner garments/sports wear.

Progress of work : Completed

- Procurement of corn fibres

In Progress

- Optimization of process variables at pilot level

To be competed

- Optimization of process variables at mill level
- Yarn & fabric production, Finishing and quality evaluation

Research out come : Result awaited

(iv) Project title : Developing armor using Hi-Modulus Polyethylene (HMPE) fibre (Sponsored by Ministry of Textiles, Govt. of India)

Started in : Month : October / Year : 2010

Objectives :
- To study the properties of HMPE fibre in terms of its strength, density and abrasion resistance.
- To study the compatibility of HMPE fibre in spinning with other fibre.
- To study the blend proportion of HMPE fibre with cotton
- To develop 100% HMPE and its blended yarns.
- To produce woven/knitted fabrics from 100% HMPE and its blended yarns.
- Testing the resulting fabrics for their properties.
- To analyze the strength of the fabrics to be used to develop armor.
- Testing abrasion resistance and other properties of the fabrics to be used for clothing.

Progress of work : Completed
- Communication for Procurement of HMPE fibres

In Progress
- Procurement of HMPE fibres

To be competed
- Optimization of process variables at pilot & mill level
- Yarn & fabric production, Finishing and quality evaluation

Research out come : Result awaited

(v) Project title : Data Verification, Analysis and helping Bureau of Energy Efficiency (BEE) in target setting for textile sector under PAT (Sponsored by Bureau of Energy Efficiency, Ministry of Power, Govt. of India)

Started in : Month : March / Year : 2011

Objectives :
- Verification of data collected from the designated consumers of the textile industry.
- Normalization of data collected from textile industry to same units.
- Gate-to-Gate analysis of energy consumption of different sectors of textile industry.
- Calculation of Specific energy consumption of designated consumers.
- Clustering of the collected data according to the gate-to-gate SEC.
- Setting reference SEC for the different sectors of Textile industry
- Setting up targets for designated consumers according to the Energy Conservation Act, 2001.

Progress of work :
- Verification of data collected from Designated consumers of Textile has been accomplished.
- Normalization factors for the conversion of the Final Products in single unit have been setup.
- Gate to gate specific energy consumption of all the textile designated consumers has been calculated.

Research out come : Result awaited .

2. INDUSTRY SPONSORED PROJECTS

2.1 Completed projects

(i) Project title : Indian Textile Supply Chain Energy-GHG-Water Study 2010, India (Sponsored by cKinetic, New Delhi)

Started in : Month : June / Year : 2010

Objectives :
- Evaluate the existing Energy & water consumption level
- Identify the scope for reducing energy& water consumption level & thereby carbon footprints in the factories.
- Most importantly suggesting various energy conservation measures to individual firm to achieve standard Energy & Water consumption level & thereby reducing Carbon Footprint.
- Map the Textile Supply chain for various Products like Garments, Home Furnishing Items & other textile made-ups.

Progress of work :
- Data from the 35 leading textile industry has been collected.
- A detailed analysis of the energy and water consumption has been carried out.

Research out come : Various energy conservation measures have been identified for individual firm to achieve standard Energy & Water consumption level & thereby reducing Carbon Footprint.

3. IN-HOUSE PROJECTS

3.1 Completed projects

(i) Project title : Development of effluent treatment scheme for removal of reappeared color in treated effluent generated from Nylon Dyeing of a Flocking Plant

Started in : Month : April / Year : 2010

Objectives :
- To find out the reason for reappearance of color in the treated effluent of Nylon dyeing carried in a flocking plant
- To develop a suitable treatment scheme for the removal of color so that it can meet effluent discharge norms.

Progress of work :
- Simulated effluent was prepared by using acid dyes and chemicals used in actual dye bath preparation
- Experiments were conducted by removing major color by physico-chemical treatment method followed by aeration of treated effluent. At this stage light color reappeared
- Tried several methods for removal of reappeared color but could remove by combination of powdered activated carbon and a polyelectrolyte.
- Optimized dose and tested for reappearance of color

Research out come : Re-appearance of the colour could be eliminated by powdered activated carbon.

(ii) Project title : Dyeability of Corn Husk Fibres

Started in : Month : June / Year : 2009

Objectives :
- To dye the corn husk fibers with different classes of dyes (vat, sulphur, reactive and natural).
- To compare the dyeability (K/S) of corn husk fibers with other cellulosic fibers (cotton, milkweed).
- To determine the color fastness properties of dyed fibres

Progress of work :
- Experimental method was followed for this study. Corn husk, milkweed and cotton fibers were used.
- Firstly all the fibers were bleached, to get better results in dyeing.
- Four different classes of dyes i.e. vat, sulphur, reactive and natural were used to dye the 3 different types of fibers i.e. corn, milkweed and cotton and three different shades of each class of dye were used.
- K/S values of all the dyed fibers were assessed using computer colour matching system and it was found that the K/S values of vat dyes for brown, blue and green colour in corn fiber are 16.98, 14.32 and 26.33 respectively, which are much higher in comparison to K/S values of milkweed and cotton fibers.
- Similarly, K/S values of reactive dyes for violet, red and blue colours in corn fiber are 6.02, 3.84 and 12.32 respectively, which are much higher in comparison to K/S values of milkweed and cotton fibers.
- K/S values of sulphur dyes for blue, black and olive green in corn fibers are 15.06, 14.00 and 7.29 respectively, which are much higher in comparison to K/S values of milkweed and cotton fibers.
- K/S values of natural dye, pacific for corn, milkweed, cotton are 4.09, 2.44 and 1.25 respectively which are natural dye, rhime, K/S values are 1.68, 0.79 and 2.36.
- The dyed samples were also checked for various colour fastness properties i.e. fastness to washing, fastness to perspiration and fastness to light and it was found that result were good and there was not much deviation in shades.

Research out come : It could be concluded from the results that corn husk fibers exhibit better dye ability with all classes of dyes i.e. sulphur (blue, black and olive green), corazol reactive (violet, red & blue), vat (brown, blue and green) and natural (pacific and rhime) in comparison to cotton and milkweed fibers. The three shades of vat dyes, i.e. brown, blue and green showed best results on corn husk fibers.

The results of fastness properties were also good for all the classes of dyes.

(iii) Project title : Study on Apparels Manufactured from Delicate Fabrics Attempt of an Intervention
:

Started in : Year : 2008

Objectives :
- To understand the manufacturing techniques and machinery involved in processing of garments made of delicate fabrics

- To identify the problems involved at various levels in garment industry dealing with delicate fabrics
- To analyze the most suitable techniques and equipment used during handling and finishing of seven different types of delicate fabrics
- To prepare a catalogue explaining the best method for dealing and caring of different types of delicate fabrics
- To analyze the acceptability and impact of the prepared catalogue on production and quality of garments with such fabrics

Progress of work :

- Prepared 8 questionnaires in order to gather information from industries
- Sample of 60 leading units on the outskirt of Delhi were identified comprised of 30 Export houses, 10 Buying houses and 20 Boutiques.
- Questionnaire and observation method was used to collect the data.
- The data revealed that there are a lot of problems, industry is facing at each and every step of handling the delicate fabrics such as puckering, seam slippage, color variation and fraying of edges.
- Seven commonly used delicate fabrics were selected for further investigation which includes silk georgette, poly georgette, viscose georgette, voile, silk crepe, organdy and silk chiffon.
- Selected fabrics were evaluated for -
  - Mechanical properties (fabric stiffness, yarn crimp, compression, stress-strain property and tensile property), and
  - Physical properties (Fabric weave, Sett, Ends per inch, Picks per inch, Yarn count, GSM, Fabric thickness, Cloth cover factor and Diameter of yarn.
- To minimize the problem of seam puckering and seam slippage, various combinations of garment construction parameters were tried out
- Constants included -
  - Thread (3 ply spun polyester)
  - Machine setting like Upper thread tension (40-60 CN), Lower thread tension (20 CN), Pressure on pressur foot (4 kg.), Stitch per inch (12 SPI), Speed (4000 SPM), Height of feed dog (0.6mm) and seam allowance (1.3mm).
- Variables considered were -
  - Needle (FG point 7, 9, 11)
  - Types of pressure foot (simple, roller and teflon coated with rings)
  - Types of feed dog (simple and teflon coated)
  - Angle of feed dog (straight and front up)
  - Types of throat plate (12 no. and 14 no.)

Research out come : The above mentioned variables have been optimised to reduce the incidence of seam puckering & seam slippage.

3.2 On-going projects

(i) Project title : A Comparative Study of Various Flammability Tests on Different Fabrics

Started in : Month : June / Year : 2010

Objectives :

- To study the effect of GSM, Fibre type, Fabric geometry (fabric grain - warp & weft and orientation of fabric at different angles (0_o, 30_o, 45_o and 90_o) parameters on the burning behaviour of various fabrics.
- To establish a correlation between burnt rate at horizontal, inclined and vertical orientation of fabrics.
  a) To study the effect of direction of ignition on the flammability behaviour of various fabrics using the LOI apparatus.
  b) To compare Vertical Flammability behaviour of various fabrics in ambient atmospheric conditions with controlled atmospheric conditions.
- Preparation of a booklet on various flammability test standards.

Progress of work : In the present study, the effect of various parameters was observed on the burning behaviour of selected fabrics. The parameters taken were the fabric weight, fiber composition and geometry of the specimen (fabric grain and angle of orientation of specimen). Burnt rate of the fabrics was calculated by using vertical flammability tester, inclined flammability tester and horizontal flammability tester. Then, 30^o and 60^o angles were developed and burnt rate was further calculated at these angles also. To observe the effect of direction of ignition on the burning behavior, selected fabrics were taken and they were tested for LOI. The LOI apparatus was modified to give bottom edge ignition to the fabrics. The fabric were then tested with the modified method and vertical flammability tester. Also a booklet comprising various flammability standards according to end use was also prepared.

Research out come : Result awaited.

(ii) Project title : Optimization of Techniques for Quantification of Cellulosic Fibre Blends

Started in : Month : June / Year : 2010

Objectives :

- To make different blend composition using various cellulosic fibres.
- To determine the moisture regain of various blend ratio using two IS standards.
- To optimize the method of quantification of the blend using solubility test.
- To characterize the molecular structure of cotton and bamboo using FTIR technique.

Progress of work :

- The fibres used in the study were cotton, milkweed, viscose, modal and bamboo (chemically spun). Cotton was the main component of the blend. So the blends of 30/70, 50/50 and 70/30 were made. In totally five types of samples were included in each test with

samples were 100% of cotton and the 100% of the other fibre.

- Assessment of blends was made by 3 methods namely moisture regain, chemical solubility test and Fourier transform infrared spectroscopy.

Research out come : Result awaited.

(iii) Project title : Assessment and Improvement of Wrinkle Recovery of Cotton and Modal

Started in : Month : June / Year : 2010

Objectives :

- Application of commercial available resin finish on cotton, rayon, modal and cotton-modal blend (50 : 50) fabrics.
- To evaluate the performance properties of the finish in terms of fastness to washing.
- Applications of softener (Polythene Emulsion) along with wrinkle resistance finish improving tear strength of the selected fabrics.
- To test and compare physical and mechanical properties of treated and untreated samples.

Progress of work :

- In order to achieve the objectives, the cellulosic resin and softener were applied in different concentrations and tested on cotton, rayon, modal and cotton- modal blend (50:50). All the results were analysed in quantitative date.

Research out come : Result awaited.

(iv) Project title : Comparison of Base Fabric Suitable for Shamiana in Terms of Limited Flame Spread

Started in : Month : June / Year : 2010

Objectives :

- To conduct a survey to find out the most popular fabrics that were used nowadays in shamiana by the test houses in Delhi and NCR regions.
- To evaluate the physical and burning behavour of the popularity used fabrics.
- To apply temporary as well as permanent flame retar-dant finish on the selected fabrics.
- To test the efficacy of the finishes.
- To suggest suitable base fabrics for shamiana in terms of limited flame spread.

Progress of work :

- The study was divided into two major phases. Survey was done at the establishment who provide shamianas/ tents at social gatherings in and around Delhi. Popularly used samples were collected. It was followed by experimental study to apply flame retardant finish on collected samples and to check efficacy of the finish on treated samples.

Research out come : Result awaited.

(v) Project title : Assessment of Fabric Comfort Properties for Selected Lingerie

Started in : Month : June / Year : 2010

Objectives :

- To study the current market scenario and customer buy-ing behaviour towards lingerie.

- To collect lingerie from various price ranges.
- To evaluate properties of collected samples in terms of :
  a) Physico-chemical parameters like fibers composition, construction type, gauge/ thread count, fabric thickness, weight and bursting strength.
  b) Comfort parameters like fabric hand, air permeability, water vapor permeability and wettability.

Progress of work :
- The study was divided into two phases, namely exploratory phase and testing phase. The first phase dealt with gaining information about the current market status of lingerie in terms of fiber composition, fabric construction and price ranges. Customer buying behaviour was also studied to get first hand information from the to know their preferences on selection of lingerie and problems faced by consumers of lingerie if any. Based on the findings of this phase, lingerie products (brassieres and panties) from low, medium and high price ranges were collected.
- In the second phase, tests were carried out on the collected samples to evaluate some physico-chemical parameters like fiber composition, construction type, gauge/thread count, fabric thickness, weight and bursting strength and finally assessment of comfort parameters like fabric hand, air permeability, water vapor permeability, wettability of collected samples carried out.

Research out come : Result awaited.

(vi) Project title : Evaluation of Eco-friendly Substitutes for Carbon Tetrachloride

Started in : Month : June / Year : 2010

Objectives : The main objective of the study was to develop and analyse a substitute which is an eco-friendly alternative to carbon tetrachloride, which could remove the machine oil stain from woven and knitted garments/items manufactured in the garment/home textile industry. The specific objectives were :
- To collect and identify stains on knitted and woven items from manufacturing units and export houses.
- To study the common stain removal practices and the chemicals used to remove stains caused by marking and machine oil based stains followed in the industry.
- To select an eco-friendly alternative to hazardous chemicals used in the industry to remove oil based stains.
- To evaluate the effectiveness of the non-haradous chemicals.

Progress of work :
- The study consisted of two phases. In first phase field survey was done to collect the stained samples and to know the stain removal practices followed in the industry. Sample size for the survey was 4 and the area selected for the study was Delhi and NCR. It was observed that the fabric is liable to get stained at every

operational stage namely layering, marking, cutting, stitching and finishing. It was found that in the industry the number of different solvents and reagents were used to remove the stains from coloured and white garments by the technicians engaged for the jobs.

- Second phase consisted of experimental work, in which five solvents namely Acetone, Isopropyl alcohol, Ethyl acetate, Ethyl methyl ketone and Xylene were selected and used to remove the stains from white and coloured woven and knitted fabric samples stains was removed with sponge method and spotting gun.
- Based on the above performance two solvents (ethyl acetate, ethyl methyl ketone) were used at 100% concentration and other three (acetone, isopropyl alcohol and xylene) were mixed with above two solvents at different concentrations.

Research out come : Result awaited.

(vii) Project title : A Comparative Study on Dyeing and Physiochemical Properties of NYCO and Polycot Combat Uniform Fabrics

Started in : Month : June / Year : 2010

Objectives :

- To review the literature related to the performance of Combat uniform fabric in combat field.
- To assess the present specifications for polycot blended uniform fabric being used by the Military & Paramilitary forces and to identify gaps if any.
- To dye NYCO (50/50) and Polycot (50/50) fabric by exhaust and semi-continuous process.
- To comparatively evaluate the colour-fastness and physicochemical properties of dyed NYCO and Polycot fabrics.
- To apply Flame Retardant finish on NYCO and Polycot fabrics and to evaluate the flammability before and after finish application.

Progress of work :

- Secondary data was gathered based on the existing specifications for polycot (50/50) combat uniform used for Indian military and paramilitary forces. From the data, it was observed that the specification did not take into consideration the comfort, durability and safety aspects. Also, for the smart look of soldier and low maintenance of uniform, wrinkle recovery property was also not included in the existing specification.
- On the basis of literature review, it was found that the developed countries like USA, UK etc. have now shifted to NYCO fabric for combat uniform from polycot fabric as this fabric is having good comfort, durability and safety properties.
- NYCO fabric was sourced from USA and tested for various properties as per Indian standard to arrive at NYCO fabric specifications for combat uniform.
- On the basis of the NYCO fabric specifications, NYCO fabric was developed at NITRA. For the study, this developed fabric was used.
- As, NYCO is a new fabric for Indian market, its dyeing and finishing process is not available. A comparative

dyeing and finishing study was conducted on NYCO and polycot using exhaust and semi-continuous method of processing.

The exhaust method of dying was found to be more suitable in terms of colour strength as compared to semi-continuous method. But for uniform fabric it is prefer to go for semi continuous method of dyeing.

- The colour fastness properties of dyed NYCO (union dyed in acid/vat and acid/reactive dyes) fabric were found to be satisfactory when compare with dyed polycot (union dyed in disperse/vat and disperse/reactive).
- The durability and comfort properties of both the fabrics were evaluated. NYCO was found to be more durable than polycot fabric, which indicates its longer serviceability in the combat field.
- NYCO was found to more water permeable than polycot, which indicates its better comfort property as compared to polycot fabric.
- Safety in terms of Protection from fire as the flammability property was evaluated by conducting surface ignition test on NYCO and polycot fabric before and after application of flame-retardant finish. From the test it was found that NYCO fabric gave better results than polycot as there was no hole formation, also no melting & dripping was observed. In the case of untreated p/c, hole was formed, there was melting & dripping. After application of flame retardant finish, the flammability behaviour of both the fabric (NYCO and Polycot) was considerably enhanced.

Research out come: Result awaited

(viii)Project title : Development of Treatment and Recycling of Effluent from Garment Washing Plant

Started in : Month : March / Year : 2011

Objectives :
- Reduction in water consumption in garment washing through selective segregation and treatment.

Progress of work :
- Familiarized with some type of garment washing process by carrying out study in a garment washing plant while carrying out water audit
- Collected samples from individual washing operations
- Analyzed sample for COD, TSS etc
- Further work is in progress

Research out come : Result awaited

4. PROPOSED PROJECTS

(i) Project title : Development of Membrane Bioreactor for Effluent Treatment of Chemical Processing of Textiles

Name of sponsoring agency : Ministry of Textiles, Govt. of India

Objectives :
- Pollution abatement and water conservation from textile processing industry through treatment, recovery of

water from effluent and recycling in processing through Membrane Bioreactor (MBR).

- Characterization of effluent generated from chemical processing of Cotton and its blends.
- To develop suitable laboratory scale membrane bio-reactor (MBR) for treatment of effluent from chemical processing of textiles, its standardization and performance evaluation.
- To explore possibilities of recovering water from effluent for use in chemical processing of textiles using MBR and a suitable polishing treatment.

(ii) Project title : Development of Multimedia Interface on Fabric Defect Analysis and Control to enhance problem-solving and decision-making skills

Name of sponsoring Agency : Ministry of Textiles, Govt. of India

Objectives :

- To develop multimedia educational system that empowers the students and technocrats about the fabric defects and their remedies which can be easily recognized and shared
- To create an awareness and improve skills to assess the quality level of fabric(woven and knits) and apparel in the decentralized power loom & knitting sector, apparel manufacturing units, process houses, organized textile sector, technocrats, experts and students
- To provide a comprehensive multimedia ready reckoner that presents the nature and type of fabric (woven & knits) defects, their classification (defect-wise, process-wise, blend-wise), causes and remedies
- To help students, textile and apparel manufacturers to understand the reasons for defects and there by enabling them to prevent recurrence of such defects
- To develop multimedia based to make the information so obtained interesting and easy to understand through live defects and their analysis.

(iii) Project title : Development of a Low Cost Tertiary Treatment Scheme for Recycling of Textile Effluent in the Process House

Name of sponsoring agency : Ministry of Textiles, Govt. of India

Objectives :

- Development of a suitable physicochemical treatment process, an adsorbent and/or an ion exchange material for the removal of various impurities present in secondary treated effluent, namely the following impurities-
  - Suspended Iron and Silica
  - Residual color and organic matter
  - Dissolved impurities like hardness and trace metals (iron and manganese).
- Evaluation of the efficiency of the developed treatment scheme by recycling the water in textiles processing and quality evaluation of the processed fabric.

(iv) Project title : Development of an Ion Exchange Material for Removal of Toxic Heavy Metals from Textile Effluent

Name of sponsoring agency : Ministry of Textiles, Govt. of India

Objectives :

- To develop an ion exchange material selective for a range of toxic heavy metals.
- Application of the developed material for removal of toxic heavy metals from textile effluent.
- To search for a suitable effluent for regeneration of the ion exchange material and simultaneous recovery of heavy metals from the exhausted column.
- Reuse of the exhausted ion exchange column

(v) Project title : Development of NYCO Fabric for Paramilitary and Military Combat Uniforms- Phase 2

Name of sponsoring agency : Ministry of Textiles, Govt. of India

Objectives :

- To study Nylon 66 fibre (from European countries) properties in terms of its compatibility with cotton fibres in spinning
- Optimization of dyeing and printing of Nylon 66 and cotton blended fabrics
- To finish developed fabric to impart wrinkle free, flame retardant etc. properties
- Compare the properties of finished fabrics with those of already developed.

(vi) Project title : To explore the possibility of application of Cornhusks in textiles

Name of sponsoring agency : Ministry of Textiles, Govt. of India

Objectives :

- To extract and compare the composition and physico-chemical properties of cornhusk fibres with other cellulosic fibres
- To explore the possibility of development of yarns using any suitable yarn manufacturing technology either using 100 % cornhusk or its blends.
- To optimize the dyeing process of cornhusk fibres using various classes of dyes and evaluating their physical and chemical properties.
- To finish developed material to impart softness and other required properties
- To design and develop a product line using corn husks and their blends

(vii) Project title : Development of special functional fabric for bedding and sports wear for providing extraordinary comfort with excellent micro climate.

Name of sponsoring agency : Ministry of Textiles, Govt. of India

Objectives :
- To study the properties of smartcel clima fiber in terms of its compatibility in spinning with other fibers.
- Optimisation of blend proportion of smartcel clima with polyester fiber with a view to achieve better comfort properties at low cost.
- To optimize the process parameters at different stages of process from yarn manufacturing to finishing.
- To develop various end products for home textiles especially for bedding and sports wear and to study the comparative performance of developed product with conventional product.
- To work out the techno economic viability of the developed products.

(viii) Project title : Development of technology to produce seamless low cost jute carry bags using modified power loom

Name of sponsoring agency : National Jute Board, Kolkata

Objectives : To popularise jute bags for packaging by introducing the technology to produce seamless jute bags.

(ix) Project title : Energy-Water-Carbon accreditation program for Textile Supply Chain – Design Phase

Name of sponsoring agency : Ministry of Textiles, Govt. of India

Objectives :
- Classification and taxonomy development to capture Energy-Water-Carbon
- Review by international Subject Matter Expert
- Defining database design and EWC collection tool
- Conveying a stakeholder launch meeting
- Survey and preparedness assessment to 400-500 units
- EWC Data Collection, testing and measurement for model mills
- Refining database design and data collection methodo- logy for EWC generating baseline norms
- Define draft accreditation norms, reporting and gover- nance structure
- Report writing and norm development, Presenting to MoT to get buy in
- Outreach toward industry stakeholders for defining accreditation label
- Work with TRAs to replicate work of model units
- Accreditation adoption plan development
- Regional rollout plans along with TRAs
- Recommendation on scale-up phase and timeline

(x) Project title : Monitoring & Control of Air-Washer System in Textile Industry

Name of sponsoring Agency : Directorate of Information & Technology

Objectives :
- Development of Temperature and Humidity monitoring system
  - Temperature and Humidity measurement

- Optional display system to show temperature and humidity values
- Maintain logs for humidity and temperature values

• Development of cost effective Air Washer efficiency monitoring system
  - Monitor humidity & Temperature of air washer system
  - Optional display system to show values and inter-face to generate alarm
• Development of control system and system up gradation
  - Close loop system to optimize heat load, air-washer system efficiency and indoor weather condition for different environmental conditions.