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STUDY OF THE USE OF SPECIALITY POLYESTER FIBRES FOR VALUE-ADDITION IN GARMENTS & MADE-UPS

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report " **STUDY OF THE USE OF SPECIALITY POLYESTER FIBRES FOR VALUE-ADDITION IN GARMENTS & MADE-UPS** " is the bonafide work of **ARCHANA MOHAN, PASUPATHY S GIREESH KUMAR, SIVASANKAR RATHINA GIRIDHAR** who carried out the project work under my supervision.

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ABSTRACT

Man-made fibres are fast replacing natural fibres in the apparel industry. This can be attributed to the dwindling availability of natural fibres such as cotton. Besides low availability, cotton is also proving to be increasingly expensive. This has caused apparel and home-textiles manufacturers to consider other fibers for the manufacture of textile products.

Polyester has emerged as a clear favourite in the apparel industry. It has a number of advantages over the natural fibres such as increased strength, less expensive and more easily available. These advantages are offset by a number of disadvantages which are slowly being overcome.

A number of the inherent disadvantages of polyester have been overcome by the use of speciality polyester. Speciality Polyester fibers are essentially modified polyester fibres that have atleast one property that fully covers one of polyester's disadvantages. With the advent of Speciality Polyester, there is an increased scope for greater use of polyester fibers in the apparel and the home-textile industry. Besides this, polyester also forms a major chunk of the total quantity of man-made fibres produced in the world. Thus polyester production and garments made out of polyester fibre is poised for a huge growth both in terms of volume and value. The study of the effectiveness of speciality polyester in covering some of the inherent disadvantages of conventional polyester will be useful to the textile industry.

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1.1 GENERAL

Polyester fibre – staple fibres and filament yarns – together is the largest textile fibre produced worldwide (24.48 million tons) in 2004.. It alone accounts for 36.30% of all textile fibres produced and constitutes 64.45% of all manmade fibres made. Also, polyester has grown at an impressive rate of 6 % per year world wide (15 % in Asia) against 3 % for all fibres put together. Thus polyester is the most popular textile fibre today and will remain so for years to come.

1.2 REASONS FOR POPULARITY OF POLYESTER FIBRES

There are several reasons for the popularity of polyester fibres. Some of the major ones are:

(i) It has a high tensile strength and an excellent abrasion resistance compared to that of natural fibres and some manmades. This combination makes for a high wear life – upto 3 times of fabrics made from natural fibres. Polyester fabrics last much longer than cotton fabrics.

(ii) Polyester fabrics maintain their smooth appearance / creases well throughout the working day thus maintaining the smart and confidant appearance of the wearer.Polyester fabrics do not get crumpled even if the person wearing sleeps in them.

(iii) Dyes and prints on polyester fabrics are fast to repeated washings / dry cleanings and do not fade over years of use.

(iv) Polyester fabrics do not shrink or lose their shape on long usage.

(v) Polyester offers a wide range of speciality fibres – and the list is growing.

1.3 DISADVANTAGES OF POLYESTER FIBRES

Polyester has its share of disadvantages too. The major drawbacks are:
(i) It generates static charge – particularly in dry weather. This charge attracts dirt and dust, which fortunately are not held tenaciously.
(ii) If proper precautions have not been taken, polyester fabrics could generate pills in places where repeated rubbings take place.
(iii) Polyester's very low moisture absorbency can lead to considerable discomfort to the wearer particularly in hot, humid atmosphere and if the wearer is doing a vigorous physical activity, the RH at skin level then could go well above 80 – 85%. A wearer is comfortable only if RH at skin level is held below 50 % .
(iv) White polyester tends to turn 'yellow' after long exposure to bright sun light.

1.4 POLYESTER

The work of W H Carothers, on linear fibre forming polymers put this initial foots on polyesters by polycondensation method. The polyester were aliphatic polyesters, made from dibasic acids like adipic acids and glycols. The melting point of the polyester was below 100 deg. C having molecular weights in the range of 2500 – 5000. It is only a short step onward from him to J R Whinfield and J T Dickson , who prepared the first high molecular weight, high melting polyester in 1940. This polymer is poly-ethylene terephthalate or poly oxy-ethylene oxy terephthaloyl or simply PET. Polyester fibre is defined as a manufactured fibre in which the fiber forming substance is any long chain synthetic polymer composed of atleast 85% weight of an ester of di-hydric alcohol and terephthalic acid. So this may include pure polyester or polyester- ether fiber. Generally polyester fibres are produced from spinnerets. Polyester polymer is produced commercially in a two step polymerization process i.e monomer formation by ester interchange of di-methyl terephthalate with glycol or esterification of terephthalic acid with glycol followed by polycondensation by removing excess glycol.

Monomer formation [Step 1] by the catalysed ester interchange reaction between molten di-methyl terephthalate and glycol takes place at about 200 deg.C . The product is a mixture of monomer, very low molecular weight polymer and as a methanol by-product, which distils at 150 deg. C. Ester Interchange catalysts are divalent salts of manganese , cobalt, magnesium, zinc or calcium. An alternative monomer formation system involves terephthalicphthalate and a catalysed direct esterification rather than an ester interchange. The monomer which is the same from both methods except from some end-groups, usually is polymerized in the presence of antimony catalyst. Chain extension is promoted by removal of excess glycol from the various viscous melt at about 280 deg.C , with carefully controlled agitation and progressive reduction of pressure toa about 200 Pa. heating is continued at 280 deg.C until the desired degree of condensation is obtained.

1.5 STRUCTURE OF POLYESTER

The length of the repeated unit in poly ethylene terephthalate is 10.75 A. a value only slightly less the expected for a fully extended chain with one chemical unit to the geometric repeating unit, and successive ester group in the trans configuration to each (10.9 A). The chains are therefore nearly planar. The unit cell is tri-clinic, the atomic positions in the crystal indicate that no special forces of attraction exist between the molecules. The spacings between atoms of neighbouring molecules if of order expect if Van der Waals forces operate.

Drawn polyester fibers may be considered to be composed of crystalline and non crystalline regions. The theoretical density of pure crystalline material can be determined mathematically from the dimensions of the unit cell. Percentage crystallinity and molecular orientation relate to tensile strength and shrinkage, however the various methods of measurement are problematic.

Polyester fibers have many favourable properties, such as high strength and resilience, resistance to man chemicals and resistance to abrasion, stretching, shrinking and wrinkling. It has certain disadvantages, such as tendency to pill, static charges, and high luster, as well as being unbreathable, difficult to dye and resistant to oily stain removal, due to its hydrophobic nature and inactive surface, improving the undesirable properties of polyester fibers is done under harsh conditions, since the fibers are resistant to most chemicals. In order to modify the surface of the polyester enzymes are used. The enzyme, polyesterase, is a serine esterase that acts by cleaving the polymer chain through hydrolysis of ester bonds of the polyester fibers.

1.6 CHEMICAL PROPERTIES :

1.6.1 EFFECT OF ALKALIES :

Polyester fibers have good resistance to weak alkalies at high temperatures. It exhibits only moderate resistance to strong alkalies at room temperature and degraded at elevated temperature.

1.6.2 EFFECT OF ACIDS :

Weak acids, even at the boiling point, have no effect on the polyester fibers are exposed for several days. Polyester fibers have good resistance to strong acids at room temperature. Prolonged exposure to boiling hydrochloric acid destroys the fibers, and 96% sulphuric acid and causes disintegration of tne fibers.

1.6.3 EFFECT OF SOLVENTS :

Polyester fibers are generally resistant to organic solvents. Chemical used in cleaning and stain removal do not damage it, but hot m-cresol destroys the fibers, and certain mixtures of phenol with trichloromethane dissolve polyester fibers. Oxidising agents and bleachers do not damage polyester fibers.

1.7 MISCELLANEOUS PROPERTIES :

Polyester fibers exhibit good resistance to sunlight , and it also resists abrasion very well. Soaps, synthetic detergents, and other laundry aids do not damage it. One of the most serious faults with polyester is its oleophilic quality. It absorbs oily materials easily and holds the oil tenaciously.

1.8 PHYSICAL PROPERTIES :

1.8.1 MOISTURE REGAIN :

The moisture regain of polyester is low, ranges between 0.2 to 0.8 % . Although polyesters are non absorbent, they do not have wicking ability. In wicking, moisture can be carried on the surface of the fiber without absorption.

1.8.2 SPECIFIC GRAVITY :

The specific gravity 1.38 or 1.22 depending on the type of polyester fibers is moderate. Polyester fibers have a density greater that polyamide fibers and lower that rayon. Fabrics mede form polyester fibers are medium in weight.

1.8.3 HEAT EFFECT :

The melting point of polyester is close to polyamide, ranging from 250 to 300 deg.C polyester fibers shrink from flame and melt, leaving a had black residue. The fabric burns with strong, pungent odour. Heat setting of polyester fibers, not only stabilizes size and shape, but also enhances wrinkle resistance of the fibers.

1.9 MECHANICAL PROPERTIES :

A wide of polyester fibers properties is possible of depending on the method of manufacture. Generally, as the degree of stretch is increased, which yields higher crystallinity and greater molecular orientation, so are the properties e.g, tensile strength and initial Young's modulus. At the same time, elongation normally decreases. An increase in molecular weight further increase tensile strength, modulus and extensibility.

Shrinkage of the fibers also varies with the mode of treatment. If relaxation of stress and strain in the oriented fiber occurs, shrinkage decreases but the initial modulus may be also reduced. Yarns maintained at a fixed length and constant tension during heat setting are less affected with respect to changes in modulus, and reduced shrinkage values are still obtained.

Poly (ethylene-terephthalate) shows non linear and time-dependent elastic behaviour, Creep occurs under the load with subsequent delay in recovery on removal of the load, but compared to that of other melt-spun fibers, creep is small.

2. LITERATURE REVIEW

2.1 SPECIALITY POLYESTER

Speciality polyester fibres are essentially modified polyester fibres and have at least one property which fully covers one of polyester's disadvantage e.g. Antistatic or conducting fibres do not generate static charge, anti pill fibres produce pill free fabrics, moisture management fibres carry perspiration out very fast thereby maintains RH at skin level at a comfortable level and Optically Bright or White fibres ensure very slow yellowing of the white fabrics. Apart from these, there are several other specialities like flame retardant, anti bacterial, UV Block etc, which give some very special property to the fabrics made – and what is important is that all the fabrics from speciality polyester fibre do have all the good properties of the standard polyester fabrics.

2.2 METHODS USED TO MANUFACTURE SPECIALITY POLYESTER FIBRES

Several methods are used to make speciality fibres. These are:

(i) Adding a specific chemical / compound during polymerization. Thus the special property conferred is permanent, fast to any number of washes / dry cleanings, as the specific chemical becomes an integral part of the fibre. Examples are: Flame retardant fibre wherein a derivative of phosphoric acid is added and anti bacterial / anti fungal fibres where another additive is added.

(ii) Alterations to polymer quality – like lowering of Intrisic Viscocity (IV) for making antipill fibres.

(iii) Making changes in the manufacturing process – examples are micro denier fibres and sewing thread fibres.

(iv) Modifying the cross section of the fibre – examples are single and multiple hollow, trilobal, triangular, pentalobal, octalobal, flat, kidney shaped and dog bone shaped fibres. There are also serreated fibres and in plus sign shape.

(v) Addition of a suitable colorant like carbon black and pigments. To give dope dyed fibres in black and over 60 shades covering the full range of a rainbow. Black, of course, is the most popular fibre in this range.

2.3 MANUFACTURERS OF SPECIALITY POLYESTER FIBRES

Only a few polyester fibre manufacturers offer a range of specialities. Some of these are: Toray, Teijin and Unitika from Japan, Saehan in Korea, Nan Ya Plastics of Taiwan, Penfibre from Malaysia, Thai Teijin in Thailand, Sasa of Turkey, Hoechst in Germany and Wellman from USA. Information on quantities of Speciality Fibres made is not easily available.

In India, black, sewing thread fibre, triangular, cationic dyeable, easy dyeable and micro 0.8 Den are being made.

2. 4 SPECIALITY POLYESTER FIBRES

Most of these specialities are available in both staple and filament form. There are some which are available only in staple form and few are produced only in filament form. This information is given in the text below.

2.5 LIST OF SPECIALITY POLYESTER FIBRES

Here is a list of speciality fibres prepared on the basis of the author's information. The list gives the name of the speciality, available deniers / cut lengths / , special properties and end uses.

2.5.1 MOISTURE MANAGEMENT FIBRE:

It is available in 1.4 and 2.0 Den in all the usual cut lengths. It has a serrated cross section to enable wicking action to transport sweat quickly to the outside and helps in evaporating it faster. A strip of fabric made out of this fibre and dipped in coloured water illustrates its strength. Water climbs the fastest and highest in this strip against strips from 100% cotton and normal polyester and when the strips are removed from water, shaken and held under a fan, this is the strip that dries first.

As mentioned earlier, comfort to a wearer is a function of RH at skin level, and for a wearer to feel 'good', RH at skin level should be below 50 %. By quickly carrying the sweat formed at skin level to outside for evaporation, this fibre ensures comfort under hot humid conditions.

Moisture management is one of the key performance criteria in today's apparel industry. It is defined as the ability of a garment to transport moisture away from the skin to the garment's outer surface. This action prevents perspiration from remaining next to the skin. In hot conditions, trapped moisture may heat up and lead to fatigue or diminished performance. In cold conditions, trapped moisture will drop in temperature and cause chilling and hypothermia. Excess moisture may also cause the garment to become heavy, as well as cause damage to the skin from chafing.

Any garment, which is worn next to the skin or worn during exercise, benefits from moisture management properties. The range of applications for such fabrics continues to expand as new fabric technology is released in the market.

Moisture is transported in textiles through capillary actin or wicking. In textiles, the spaces between the fibres effectively form tubes, which act as capillaries, and transport the liquid away from the surface. As a rule, the narrower the spaces between the fibres in a fabric, the more effectively they will draw up moisture. For this reason, fabrics with many narrow capillaries, such as microfibres, are ideal for moisture transport.

Another factor, which affects moisture management, is absorbency. However, while greater absorbency increases the ability for moisture to be drawn into the fabric, the tendency of absorbent fibres to retain such moisture affects comfort levels, as the garment becomes saturated. It has been shown that fabrics which wick moisture rapidly through the fabric while absorbing little water help to regulate body temperature, improve muscle performance and delay exhaustion.

End Uses :

Sports wear and track suits. In cities like Mumbai, Kolkata and Chennai, which are hot and humid for a major portion of the year, shirts / T-shirts / blouses / sarees / salwar kamiz out of this fibre should prove comfortable to people. We really need to try out this idea.

2.5.2 FLAME RETARDANT FIBRE:

Is available in 1.2, 1.4, 2.0 and 3.0 deniers in all usual cut lengths for woven / knitwear and in 6, 7, 10, 12 and 15 deniers in 64 mm cut length for non wovens. Here a derivative of phosphoric acid is added during polymerization, so flame retardant property is permanent. The fabric out of this fibre does not burn, nor is any smoke produced. Flames get extinguished when they reach this fabric. In one incident of a theatre burning – Uphaar Theatre in Delhi – 62 persons died, but only 20 or so were dead due to burning, rest were suffocated and trampled to death. When fire was noticed, there was considerable smoke and people could not see the exits. There was a mad stampede. If the chairs, carpets and curtains in that theatre were to be made out of the flame retardant fibre, there would have been no casualties. Further at higher temperature reached in a major fire, this fibre being a polyester, will melt @ 240 Deg C , and then could burn and produce smoke – this smoke is not toxic, so it is a safe fibre to use. This fibre satisfies standards for flammability / limiting oxygen index / non-toxicity if it burns in different countries.

The burning of a polymer in air involves four main stages which are illustrated in Fig. 1.

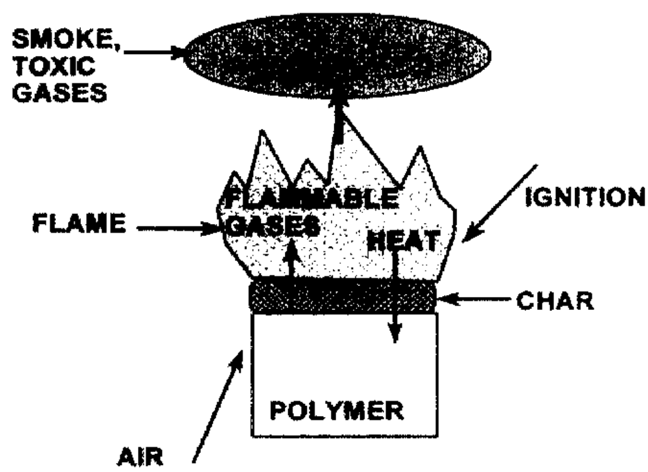


Fig. 1 Schematic of polymer combustion

1. Ignition, when some source, usually thermal or electrical, starts the polymer degrading,

2. Pyrolysis, during which the polymer degrades under effect of heat to give products including char, that is solid carbonaceous material and also smoke, which is particulate material in gas phase, together with gases, both toxic (e.g. CO) and flammable (e.g. benzene),

3. Flame, that is the region where gases ignite and produce heat and more thermally degraded products,

4. Heat, produced by exothermic reactions. The feedback of heat increases the rates of reaction, causes further degradation and polymer melting. It may also alter the mechanisms of burning reactions.

The task of the fire-retardant polymer scientist must be to interfere with or break the burning process at one or more points and to reduce the hazards. One way would be to stop the burning at source, by producing a polymer which is far less flammable. Such polymers are available, for example poly(tetrafluoroethylene) or polyimides, but tend to be too expensive for general use. Frequently they are also more difficult to process or mould than the conventional plastics used in large bulk.

Flame Retardant Additives

In order to change the flammability of a particular polymer without significantly altering
the properties which make it useful in its applications, it is necessary to modify the chemistry
involved in the burning cycle of that polymer. A method frequently used is to add a substance to the polymer, either by changing the monomer used, called a reactive fire retardant or by including an independent chemical called an additive fire retardant. The mode of action of these fire retardants frequently requires considerable study, but in very general terms, it may be:

Modification of polymer to render it less liable to ignition or degradation;
Production of gaseous species which interfere with the radical flame reaction;
Endothermic decomposition to reduce feedback effect of heat on polymer;
Changing the solid-state decomposition mechanism of the polymer so that less flammable materials are produced and preferably less smoke and more char. Production of a barrier to the feedback of heat, either char, fluid droplets or

glassy layer. Intumescent coating systems act in this way. The additives may also have deleterious effects, such as altering the mechanical properties of the polymer system for the worse, changing the colour, making it more difficult to process or actually producing more smoke plus corrosive or toxic products.

Consideration of the major fire retardant chemicals with respect to the place their elements occupy in the periodic Table, as shown in Table 2, is a useful exercise, since it suggests possible alternatives or mechanistic similarities. The properties of a wide range of fire retardant chemicals have been reviewed by Cullis and Hirschler and by Bair .

Table 2 Major fire retardant additives according to their periodic table groups

Group	Element	Compounds
II	Mg Zn	magnesium hydroxide (MH) zinc compounds (borate, phosphate, stannates)
III	B Al	borax, zinc borate aluminium hydroxide (ATH)
IV	Ti Sn	titanium compounds tin(IV) oxide, zinc stannates
V	N P Sb	ammonium salts, nitrogen-containing polymers phosphorous, phosphate esters including halogenated esters antimony(III) oxide
VI	Mo	molybdenum(VI) oxide, ammomium molybdates
VII	Cl Br	chlorinated polymers, chlorinated monomers, polychlorinated compounds, chloroparaffins brominated monomers, polybrominated compounds
VIII	Fe	ferrocene, iron(III) oxide

Aluminium hydroxide (.Alumina Tri-Hydrate, ATH.) and magnesium hydroxide are materials which decompose endothermically and are incorporated in large quantities, up to 60% w/w in polymers such as polyethylene and polypropylene, as well as in polyesters, polyurethanes and epoxies. The ignitable gases are also diluted by the water vapour evolved.

Antimony oxides together with zinc salts, molybdenum trioxide and others have good effects as fire retardants and give higher oxygen index values when incorporated in quite low concentrations usually with halogens also present. Borax, phosphates and others can work by endothermic decomposition to produce barrier materials. However, phosphates also tend to plasticise many polymers.

Chlorinated additives, whether they be incorporated in the polymer structure, where a good example is polyvinyl chloride (PVC), or added during processing, work by producing radicals which interfere with the flame process, especially when used in conjunction with metal compounds such as Sb2O3. Other compounds, like ferrocene derivatives are thought to act by providing an alternative pyrolysis route and to produce CO and CO2 instead of smoke by a chemical incandescence mechanism.

It is found that, if two fire retardants are employed together, there may be an effect which is more than the sum of the two separately. This is referred to as a synergistic effect.

The reverse, an antagonistic effect would be of little use. The reason for synergy could involve a reaction between the fire retardants, or between the products of their interaction or thermal decomposition.

Test conditions vary from country to country; also depends upon the end use. Fabrics meant for aviation use have the strictest conditions. Europe, USA, Canada, Australia, New Zealand and Japan – these countries have laws which state that all textile materials used in public places – restaurants, theatres, halls, buses, trains, passenger ships, aircrafts must be made out of flame retardant fibres only. (Flame retardant finishes are also available. These are fast to only 4 to 5 washes and nil to dry cleanings as the flame retardant finishes are soluble in dry cleaning medias.). Several countries including India still have yet to pass such a law.

End Uses:

Furnishings, curtains carpets, interior fabrics used in halls, theatres, lounges, cars, buses, trains, air crafts etc. Also for work wears in industries where high temperatures are common and there is danger of fire. Also recommended for night dresses / bed sheets (for those who smoke in bed) and children's night wear. The coarser denier range 6 to 15 is for non – woven – carpets, mats, partition felts etc.

2.5.3 MICRO 0.8 DEN AND SUPER MICRO (0.5 DEN)

The world's finest polyester fibre.Available cut lengths are 32 and 38 mm. There are 2 special properties:

(a) Ability to spin finer counts– up to 160s with 0.5 D in 100% form and

(b) An extremely soft silky feel which is permanent due to the inherent fineness of the fibre, but it is necessary to have a polyester rich blend and fabric should have high reed / pick.

End uses: A brand new range of fine and superfine fabrics in either 100% polyester or polyester / combed cotton blends using 2 / 80s, 2/100s, 2/120s yarns has to be developed to make:

Fine shirting – 2/120s X 2/120s in 100 % polyester and p/c

Fine bed sheets – 2/100s X 2/100s in p/c

Fine salwar kamiz – 2/80s X 2/80s in 100% polyester or p/c

Fine blouse pieces – 2/110s X 2/110s in p/c

Fine saris – 2/110s X 2/110s in p/c or carbonised variety

Fine tops – 2/100s X 2/100s in 100% polyester.

Fine cambrics / mulls for kurtas – single 100s or single 120s in p/c

Fine knit wear – 2/80s p/c or 100% polyester.

This is just a proposed list. It can well be expanded. Indian spinners are amongst the very few in the world to spin fine yarns upto 140s in pure cotton. We have, therefore, the culture to spin fine. Author feels we should take advantage of this unique strength of ours to offer fine and superfine fabrics / garments / made ups to the world market. This could be a niche market waiting to be developed. Since there will not be any worldwide competition, Indian manufacturers can easily obtain their prices and earn reasonable profits. Small quantities of 0.5 Den X 32 / 38 mm fibres have been imported by a few adventurous spinning mills in India, and surely in the next few months several fabrics will be developed and final garments and made ups manufactured. Only then the potential of the super micro denier fibre of 0.5 Den will be known.

2.5.4 ANTIBACTERIAL / ANTIFUNGAL FIBRES:

These are available in solid form in 1.2, 1.4 and 2.0 Den in 38 / 44 / 51 mm cut lengths for apparel / sheeting end use and in 6.0 Den X 64 mm for non wovens. It is also available in hollow form in 7.5 Den X 65 mm cutlengths. An organic compound that gives the antibacterial / antifungal properties is added during polymerization, so these properties are permanent – fast to any number of washes and dry cleanings.

End Uses :

(a) In hospitals / operation theatres – for gowns for surgeons and nurses, sheets to cover a newly operated patient who still may be bleeding; as bedsheet and pillow cover with pillow stuffed with hollow antibacterial / anti fungal fibre. Blankets used by patients could be made of a non woven structure using hollow antibacterial / anti fungal fibre covered by a fabric out of solid antibacterial / antifungal fibre, we go all the way. Other uses in hospitals are: masks, bandages, underwears, socks etc. Another use could be uniforms for workers in pharmaceutical and food industries. One more use will be in hotels particularly in blankets as well. Indian Railways give free beddings and blankets to all travelers in airconditioned bogies, while we would expect the bed sheets etc to be sufficiently sterile as they are freshly laundered; the blanket is always a suspect. The fibre structure inside a blanket would offer enough space for bacterias like those of TB to multiply, so one always worries who used the blanket the previous night. Also, blankets are not washed frequently, so it makes sense to have a blanket made out of hollow anti bacterial / anti fungal fibres. One more plus point of the fibre is that it removes bad odours of certain bacterias.

2.5.5 UV BLOCK FIBRE:

This is a sheath and core fibre. The sheath is normal polyester polymer and the core contains very fine ceramic powder. This fibre is available in 1.7D and 2.2 D in 38 / 51 / 69 mm cut lengths. The fibre reflects both, UV A and B rays and infrared rays so the wearer is fully protected from the ill effects of UV rays on skin- wrinkles and pre – mature aging (Australia has the world's fiercest Sun and prolonged exposure to Sunlight has even caused skin cancer there.). The ceramic powder also makes the fibre totally opaque and increases the density of the fibre; thereby improves its drape and fall.

End Uses :

Dress Materials – particularly for persons with delicate skin and in countries where sun is fierce- Middle East, deserts and, umbrellas, curtains to reflect UV and curtains for dark rooms / theatres etc. This is another niche market waiting to be explored.

Also the use of fabrics made out of this fibre will not need a wearer to use costly sunscreen lotions. Further as this fibre blocks IR rays, a wearer will feel 'cool' in hot sun.

2.5.6 HIGH DRAPE FIBRES:

This fibre is similar to UV Block Fibre except that it is a normal fibre where ceramic powder is added during polymerization. So the friction with this fibre will be high and may pose minor problems in actual spinning. Also friction at ring / traveller could release ceramic powder, so spinners may see ring rail etc. full of white powder.

This is cheaper than the UV block fibre. Is available in 1.2/ 1.4 D in 38 mm cut lengths. While the manufacturers do not claim blocking of UV etc. the ceramic powder inside the fibre will contribute. The main advantage of this fibre is basically higher fibre density, which in turn will improve drape and fall.

It should therefore allow mills to make lighter suiting and lighter curtains to give good drapes. If a mill makes a lighter suiting – say 125 grams / sq m out of normal fibre then it will not behave as a suiting but more as a pajama, but if the same fabric is made with this High Drape Fibre, it should be okay.

This fibre opens a field for real lightweight suiting, which will have good drape and fall.

2.5.7 NYLON LIKE POLYESTER FIBRE:

Nylon fibre has better elastic properties than polyester.So if we have a polyester with nylon like properties, it could be used in fabrics wherein the elastic properties play a part-- in knitwear / tight fitting dresses etc. so this is a fibre, which will give some stretch (Not as good as what spandex fibre gives) at a reasonable price. Surprisingly the dyeability of this fibre is almost three times that of standard polyester, so another advantage for knitwear – Disperse dyeing at 1/3rd of cost. Fibre is available in 1.7, 2.0 and 3.0 D in 38 / 44 / 51 mm cut lengths.

End Uses :

Knit wear / as weft in tight fitting dress including jeans.

2.5.8 HOLLOW APPAREL FIBRE:

Is available only in 2.8 D in 38 and 76 mm cut lengths. This hollow fibre has entrapped air that gives excellent thermal insulation. Recommended for thermal underwear and outer wear for use in winters which are severe.

2.5.9 DOPE DYED FIBRE:

Are available in black and another 60 plus shades of rainbow.Black dope dyed fibre is made by using carbon black and master batch chips containing inorganic pigments which will be stable at 290 deg. – 300 deg, the temperature used during spinning of polyester fibre.

Black dope dyed fibre is used mainly in apparel – preferred for ladies garments. The use of fibre of 60 plus shades is not so much for apparel but for car interiors – seat covers, carpets, curtains. The reason being cars get parked in hot sun for hours, so light fastness values of all dyed goods used inside a car ought to be 7. It is not possible to get this fastness value with disperse dyeing where with certain skills, a dyer could achieve a light fastness value of 5. Therefore top car makers in Japan insist on using dope dyed fibre fabrics. These fibres are usually available in limited deniers like 2.0 D for car interiors and 8.0 D for carpets. The shades here are custom made to match the car exterior shade. Black dope dyed fibre is available in all deniers and in all cutlenghts.

2.5.10 CATIONIC DYEABLE / EASY DYEABLE FIBRE:

Is available in 1.2, 1.4, 2.0 and 3.0 Den in all cut lengths. The polymer of this fibre has affinity for cationic dyes which gives very vivid and bright shades or prints on polyester. That brightness cannot be obtained with disperse dyes. The fibre is, therefore, recommended for ladies' dress material, children's dresses, draperies and knit wear. By using standard polyester yarns along with yarns from this cationic dyeable fibre, it is possible to get a two tone effect after dyeing.

This fibre also can be dyed with disperse dyes at 98 deg. C. in open becks without the need of a HTHP Dyeing Machine. Thus this fibre is ideal for making 'polyvastra' fabrics – hand spun hand woven polyester khadi fabrics. So far this polyvastra fabric was being sent to large process houses for processing. With this fibre being used, polyvastra could be dyed in a village. Heat setting may be avoided as villagers use fairly loose fitting garments where a little higher shrinkage will not matter.

2.5.11 ANTI PILL FIBRES:

Pilling has been a problem with polyester fabrics particularly with spinners preferring high tenacity fibres in 1.2 / 1.4 D X 44 or 51 mm cut lengths to spin 30 s / 40 s / 50 s yarns at high spindle speeds pf 20,000 rpm plus. The yarns so produced are hairy. It is these protruding fibres which form pills after rubbing. Pills do get formed with cotton or viscose fibres, but the pills fall off during use as the fibre breaks because of lower strength. The tenacity of polyester being high – in the range of 6.4 grams / denier, the pills formed do not fall off and so give a bad appearance to the garment.

Therefore today anti pill fibres with a tenacity of 3.5 gpd are available for 100 % polyester and polyester / viscose fabrics spun on cotton system and super anti pill fibre with even lower tenacity of 2.8 gpd are recommended for polyester / wool blends to be spun or worsted spinning system.

These fibres are produced by reducing the intrinsic viscosity of the polymer from the normal 0.63 to as low as 0.53 for anti pill and 0.48 for super anti pill fibres. One advantage of particularly super anti pill fibre is its natural fibre feel. It is very 'wool' like which could be its bigger advantage.These fibres are recommended for premium quality suiting in polyester / viscose and polyester / wool for sophisticated markets in US, Europe and Japan.

2.5.12 SEWING THREAD FIBRE:

This fibre is also called Super High Tenacity Fibre. It is normally made only in 1.2 D in 44 mm cut length and in bright lustre. (May be because cotton sewing threads are mercerized and so are brighter). Its tenacity at break is around 7.5 gpd, elongation at break is around 16% and its T 10 is around 6.0 gpd. Its dry heat shrinkage at 180 deg. C. is around 3.5% (against 5 to 8 with normal apparel fibres). This fibre has to have the high tenacity since it is used solely for stitching polyester fabrics. A general rule is the sewing thread has to be stronger than the fabric it is stitching; otherwise sewing threads could break during the use of the stitched garment and may cause embarrassment to the wearer.

Its low hot air shrinkage ensures puckering free stitching.The end use is 100% polyester sewing threads. Rkm of the single yarn should be around 40 – 41. The fibre becomes almost 100% crystalline in the effort to get 7.5 gpd; and a true sewing thread fibre does not easily dissolve in the solvent for polyester at room temperature.

Also, because of high crystallinity, the dyeability of this fibre is lower by 15-20% compared to that of normal 1.2 Den fibre.

As this fibre is heat set at very high temperatures – 225 deg. C, or so and for a longer duration, its crimping is poor – crimps / inch are lower than the normal value of 12 – 14 per 25 cm and both crimp stability and crimp take up are also inferior. This fibre cannot, therefore, be processed at high speeds in preparatory.

2.5.13 HIGH SHRINK FIBRE:

This fibre shrinks upto 59% in boiling water in 30 seconds in one step. One condition is - this fibre – even in bale form – is stored below 27 deg. C. before use i.e. during transportation, at the ports and in mill godown. At higher room temperature the fibre will start shrinking. This fibre is available in 1.4, 2.0 and 3.0 D in all usual cut lengths. It is recommended to use in apparel to get crinkle effect, for non-woven felts and for making artificial leather. One possible use is to replace high bulk acrylic yarn by doubling 100 % high shrink fibre with normal fibre yarn with a light twist; knit a garment and then process it to allow the high shrinkfibre yarn to shrink.

2.5.14 LOW SHRINK FIBRE:

This fibre shrinks only less than 1 % in hot air at 180 deg C in 20 minutes. Fibre is available in 1.5, 2.0 and 3.0 D in all usual cut lengths.

End Uses :

Filter fabric for hot air / hot liquids in process industries. One idea is to use this 100% low shrinkage fibre yarn for weaving fabrics of finished width equal to the reed space of the loom.

2.5.15 FULL BRIGHT AND FULL DULL FIBRE:

Titanium di oxide is added during polymerization to make the fibre appear dull. By varying the amount of this delustrant, different lustres could be produced such as %TiO2 Lustre 0.05 Full Bright, 0.10 Bright , 0.30 Semi Dull , 0.50 Dull ,0.70 Full Dull. It is recommended to spin these fibres in 100% polyester. Then use yarns of different lustres in warp way and weft way or both ways to get shadow stripes or checks.

2.5.16 FIBRES OF DIFFERENT CROSS SECTIONS:

By changing the shape of holes in the spinnerets, it is possible to have fibres with different shapes. Some of the more known fibre shapes are:

(i) Flat – Available in 3.3 Den. gives a unique feel and handle to the fabric. Recommended for furnishings.

(ii) Trilobal – A true Trilobal fibre does not give glitter but a soft feel.

(iii) Triangular – what is called trilobal in India is essentially a triangular fibre with a slight curve in all the 3 sides. This fibre is made with full bright polymer i.e. with a TiO2 level of 0.05%. the shape makes light falling on the triangular fibre to reflect repeatedly from inside and so gives a glittering appearance. This fibre is made in coarser deniers of 2.5 and 3.0 D in 51 mm. (Coarser denier fibre gives better glitter). This fibre is used in 15 – 25% blend with regular fibres in fibre dyed suiting. Occasionally some mills have spun 100% triangular yarns for weaving some special fabrics.

(iv) Dog bone / kidney shaped – Used in coarser denier for furnishing end use.

2.5.17 HYGIENE FIBRES:

This is a two polymer fibre with-- polyester / polypropylene. This fibre is highly water absorbent, is non-toxic and has a feel of natural cotton. Is available in

2.0 and 6.0 Den. Recommended end uses are disposable diapers, feminine napkins and under pads.

2.5.18 LOW MELT FIBRE / BINDER FIBRE:

This fibre is used for bonding polyester webs in non wovens. Earlier chemical binders were used to bind the webs. But then because of pollution problems, most non-woven producers have shifted to these low melt binder fibres. These are essentially sheath and core fibres. Sheath is a modified polyester polymer that softens at 110 deg C while the core is standard polyester.

This fibre is available in 2, 3, 4 and 6 deniers in 64 mm cut lengths. Normally about 15% binder fibre is used. One fibre producer's binder fibre has 50% cross section with low melt polymer. So lower quantities of binder fibres are needed.

2.5.19 HOLLOW AND HOLLOW CONJUGATE FIBRES:

Simple hollow fibres- with single hole or multiple holes-are used for stuffing- in siliconised finish for pillows and in nonsiliconised version for quilts and furniture. These fibres are usually made out of recycled polymer. The hollow conjugate fibre is a core and sheath fibre with polymers of different viscosities. A spiral crimp develops due to differential shrinkage properties of the 2 polymers. This fibre is available in 3, 4.5, 7 and 15 deniers in 64 mm cut lengths. It is also given an anti bacterial finish.

End Uses – soft toys, pillows, furniture and non woven padding, bedding etc.

2.5.20 SHORT CUT PSF:

This is standard polyester fibre of denier from 0.5 to 7.0 denier cut to a short length of 3, 5, 6 and, 12 mms. It is treated with a different spin finish that enables this short fibre to disperse easily in aqueous solutions. This fibre is used for reinforcing paper, plastics, rubber and concrete and can be employed as filter media in automobile air filters, vacuum cleaner bays, battery separators, in R/O separate medias and in synthetic and specific papers. Additions of 2% of this fibre increase tear strength of paper by 20 – 25%. India is short of good pulp for making quality papers and so a considerable quantity of paper is made by blending recycled used paper. Every time paper is recycled, the mean fibre length of the cellulose fibre in paper shortens and affects tensile and tear strengths. This is where short cut polyester can help in reinforcing recycled blended paper.

2.5.21 PERFUMED HOLLOW FIBRE:

Some fibre producers offer hollow fibres with perfumes put inside the hollow. Ranges of perfumes vary from floral to those of mountain air. Both pillows and quilts are available with perfumed hollow fibres. Producers claim sound- peaceful- stress free sleep is obtained using pillows and quilts containing perfumed fibres, but then perfumes being volatile, the fragrance is lost in a few months.

2.5.22 WATER SENSITIVE FIBRES:

These are fibres which contain sensitive pigments, when dry, the pigment has one colour, when wetted with water, and the colour alters. Recommended end use is swimsuits. So when a swimmer having said red swim suit jumps into swimming pool, the swim suit changes its colour say to green. On drying the original colour reappears.

2.5.23 ANTI STATIC OR CONDUCTING FIBRES:

By adding fine stainless steel powder polyester fibre is made fully conductive. Fibre is recommended for use as carpets in computer rooms to allow static charges –

if any- to leak away.

2.5.24 OPTICALLY BRIGHT OR OPTICALLY WHITE FIBRES:

These fibres are usually made with bright polymer and by adding at least 180 ppm of optically brightner usually in bluish or violet tinge. The final fabric has an excellent milky white appearance and retains its whiteness for a much longer period. Ideal for office wear and uniforms.

3. AIM :

There is a wide scope for value-addition of garments and made-ups by using speciality polyester fibers. Presently cotton is the most widely used fiber in the apparel and home-textiles industry. But the dwindling availability of cotton and its increasingly high cost have proven to be a disadvantage in the continued use of cotton.

Conventional polyester has a number of disadvantages such as low moisture absorption, high pilling tendency and accumulation of static charge. These disadvantages have limited the use of polyester in the textile industry. But these disadvantages are slowly being overcome by using speciality polyester. Therefore this investigation has been undertaken to study the feasibility for value-addition by the usage of these fibers in apparels and made-ups.

4. METHODOLOGY

We've taken two types of speciality polyester fibers – Flame-retardant polyester fiber and Moisture-management polyester fibers.

4.1 SPECIFICATION FOR MOISTURE-MANAGEMENT FABRIC :

A yarn of count 24s was spun from the moisture management polyester fiber. A rib knit fabric was knitted from the yarn.

Fiber Denier – 1.4

Cut Length - 44 mm

Yarn Count – 24s

Rib Knit Fabric

4.2 SPECIFICATION FOR FLAME-RETARDANT FABRIC :

A yarn of count 20s was spun from the flame-retardant fiber. The yarn was then woven into a fabric of plain weave with both the 20s count yarn used for both the warp and the weft.

Fiber Denier – 1.4

Cut Length – 44mm

Warp Count – 20s

Weft Count – 20s

Ends per inch – 60

Picks per inch – 64

Weave – Plain

Warp Crimp % - 12%

Weft Crimp % - 10%

4.3 CONVENTIONAL POLYESTER FABRICS :

A rib knit fabric of the same construction as the moisture management fabric was knitted using conventional polyester yarn of 24s count.

A plain weave fabric of the same construction as the flame-retardant fabric was woven using conventional polyester yarn of 20s count.

4.4 TESTING

Tests Carried out on the Moisture Management Fabric and Conventional Polyester Knitted Fabric :

1. Wicking Test
2. Water Drop Test
3. Air Permeability Test
4. Pilling Test
5. Bursting Strength Test
6.

Tests Carried out on the Flame Retardant Fabric and Conventional Polyester Woven Fabric :

1. Flammability Test
    i. Char Length
    ii. After glow time
2. Abrasion Test
3. Pilling Test
4. Tensile Strength Test

4.5 TESTS CARRIED OUT FOR MOISTURE MANAGEMENT FABRIC :

4.5.1 WICKING TEST :

TESTING PROCEDURE

1. Conduct the test in a standard atmosphere.
2. Cut strips of fabric of 30mm width and 200mm length.
3. Clamp one end of the fabric vertically.
4. Immerse the dangling end to about 3mm in water.
5. Note the height to which the water rises after 2 hours and then after 24 hours.
6. Take 5 readings.

4.5.2 WATER DROP TEST :

Testing Method : AATCC : 79:2000

Testing Procedure :

1. Conduct the test in a standard atmosphere.
2. Water Drop Absorption is the amount of water absorbed by the fabric.
3. Mount the cloth in the embroidery hoop so that the surface is free of wrinkles, but without distorting the structure of the material.
4. Place the hoop about 1.0 $\pm$0.1 cm below the tip of the burette and allow one drop of distilled or deionized water at 21 +/- 3 deg.C to fall on the cloth.

5. Using a stopwatch, measure the time required, upto 60 sec maximum, for the surface of the liquid to lose its specular reflectance.This point is determined by the hoop between the observer and the source of light such as window or laboratory spot light at such an angle that the specular reflectance of light from the surface of the flattened drop can be plainly seen. As the drop is gradually absorbed, the area of this tiny mirror diminishes and finally vanishes entirely, leaving only a dull water spot. At this instant the watch is stopped and the elapsed time is recorded. When the wetting exceeds 60sec, 60+ sec should be recorded.
6. Water Drop Test is measured in seconds.
7. Take 10 readings.

4.5.3 AIR PERMEABILITY

Testing Method : ASTM D 737-96

Testing Procedure:

1. Make all the tests in the standard atmosphere.
2. Air permeability is nothing but the amount of air that can penetrate into the fabric.
3. The sample is placed in the sample holder and the template of 4 sq.cm.
4. The valve is adjusted to zero.
5. The rate of flow of the air in the fabric is adjusted by the valve A,B,C.
6. The flow rate of air is noted.
7. Air permeability is measured in cubic cm/square cm/seconds.
8. Take 10 readings.

4.5.4 PILLING TEST:

Testing Method: ISO-12945

Testing Procedure:

1. Make all the tests in the standard atmosphere for testing textiles.
2. Pilling Resistance is the amount of protruding fibers created by the fabric when it is rubbed against the rough surface.
3. A piece of fabric measurement 5 inches * 5 inches is sewn so as to be a firm fit with when placed round a rubber tube 6 inches long, 1.25 inches outside diameter, and 1/8 inches in thick.
4. The cut ends of the fabric are covered by cellophane tape and four tubes are placed in a box (9 inches * 9 inches * 9 inches) lined with cork 1/8 inches thick which is then rotated at 60 rev/minute for 5 hour.
5. Pilling Resistance is measured in grade.

4.5.5 BURSTING STRENGTH TEST :

Testing Method: ASTM D3786

Testing Procedure:

1. Insert the specimen under the tripod, drawing the specimen taut across the plate, and clamp specimen in place bybringing the clamping lever as far to the right as possible

2. Inflate the diaphragm by moving the operating handle to the left.

3. While the diaphragm is inflating, take hold of the latch that is located below, or to the right, of the operating handle.
4. At the instant of rupture of the specimen, swing the latch as far as it will go to bring the operating handle to an idling (neutral) position .
5. Record the total pressure required to rupture the specimen.
6. Immediately after rupture, and in rapid succession, release the clamping lever over the specimen.
7.Immediately relieve the strain on the diaphragm by dropping the latch back to its normal position, throw the operating handle to the right, and record the pressure required to inflate the diaphragm (tare pressure).

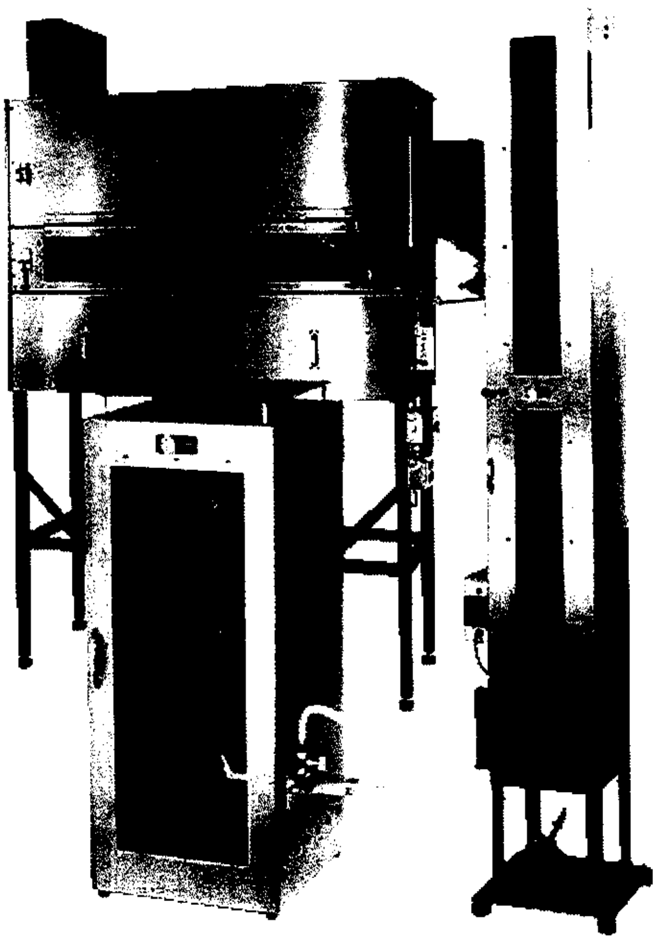
4.6 TESTS CARRIED OUT ON FLAME-RETARDANT FABRIC :

4.6.1 FLAMMABILITY TEST :

Testing Procedure :

1. Make all tests in the standard atmosphere.
2. Cut the fabric specimens to the required dimensions.
3. Suspend the fabric specimen over the flame source by clamping it to the metal clamp.
4. Ignite the flame source.
5. Allow the flame to burn for 19 seconds.
6. Measure the char length.
7. If the fabric catches fire, note down the time taken for flame propagation.
8. Take 5 readings.

7. If the fabric catches fire, note down the time taken for flame propagation.
8. Take 5 readings.



Flammability Tester

4.6.2 ABRASION TEST :

2. Abrasion is a test to stimulate and measure the performance of textile fabrics.
3. A sample size of 1.5" inches is cut using template, weighed and mounted on a mushroom shaped holder.
4. The abradant material may be in the form of emery paper, sand paper, canvas etc, cut the abradant to the size of 5" * 5" using the template provided.
5. Place the abradant on the abrading table.
6. Now mount the mushroom holder in its position.
7. Set the counter with required number of cycles.
8. Start the machine and after the required number of cycles is completed the machine will stop.
9. Abrasion Resistance is measured in percentage.
10. Remove the sample from the holder and weigh it.

4.6.3 TENSILE STRENGTH

Testing Method: D-2261-96

Testing Procedure :

1. Make all the tests in standard atmosphere.
2. A sample size of 12" * 4" is cut in both warp way and weft way.
3. Yarns are unraveled at 1inch on both sides.
4. Now the sample is mounted between the two jaws of the tensile strength tester.
5. The load is applied at a Constant Rate of Elongation.
6. The fabric tensile strength is determined at the point where the fabric is torn.
7. The load is applied in pounds.
8. Take 10 readings.

7. The load is applied in pounds.
8. Take 10 readings.

5. RESULTS AND DISCUSSIONS

5.1 TESTS CARRIED OUT ON MOISTURE MANAGEMENT FABRIC

5.1.1 WICKING TEST :

Moisture Management Fabric:

Wickability after 2 hours = 130 mm

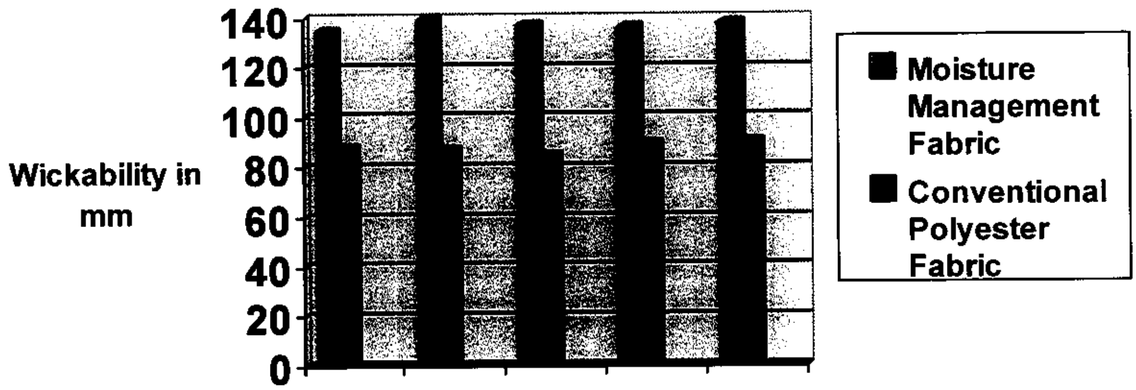
Wickability after 24 hours = 137 mm

Conventional Polyester Fabric:

Wickability after 2 hours = 80 mm

Wickability after 24 hours = 88 mm

Wicking Test Results



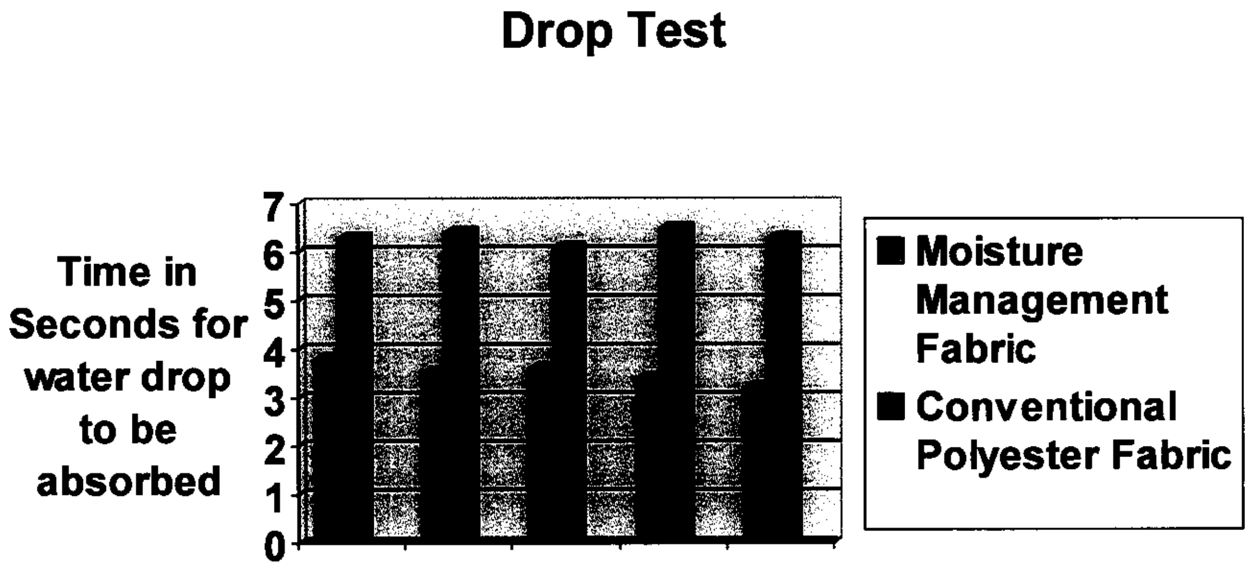
The wickability tests show that the moisture management polyester fabric has a better wickability than a conventional polyester fabric. This implies that the moisture management fabric transfers water to a greater extent than the conventional polyester fabric. The serrated cross section enables wicking action to transport sweat quickly to the outside and helps in evaporating it faster. This in turn will lead to greater comfort and wear properties which can be used to advantage in sportswear, t-shirts etc.

5.1.2 WATER DROP TEST :

(Time taken for the water drop to be wholly absorbed by the fabric and lose its specular reflectance)

Moisture Management Fabric – 3.5 seconds

Conventional Polyester Fabric – 6.3 seconds



The time taken for a drop of water to be completely absorbed was noted for both the moisture management and the conventional polyester fabric. The results show that the moisture management fabric absorbs water at a faster rate than the conventional polyester fabric. This property enables a better and a faster wicking action. Sweat and perspiration from the body will be absorbed and will evaporate quickly. This will lead to better comfort and wear properties for the wearer.

5.1.3 AIR PERMEABILITY TEST :

Air Permeability in $cm^3/cm^2/sec$ for moisture management fabric - 54.4

Air Permeability in $cm^3/cm^2/sec$ for conventional polyester fabric – 48.9

The test results show that the moisture management fabric has greater air permeability than a conventional polyester fabric of the same construction. This again improves the wear and comfort properties of the fabric.

PILLING TEST :

Moisture Management Fabric : Grade 3
Conventional Polyester Fabric : Grade 3

Grade 1 : No Pilling
Grade 2 : Slight but tolerable pilling
Grade 3 : Moderate Pilling of borderline acceptability
Grade 4 : Unacceptable Pilling
Grade 5 : Extremely High Pilling

Both the fabrics show pilling to a similar extent . On comparison with the photographic standards the grade accorded to both fabric was grade 3.This shows that there is no difference between the moisture management fabric and the conventional polyester fabric as far as the pilling is concerned.

5.1.5 BURSTING STRENGTH TEST :

Bursting Strength of Moisture Management Fabric – 165lbs/sq.inch
Bursting Strength of Conventional Polyester Fabric – 170 lbs/sq.inch

Grade 5 : Extremely High Pilling

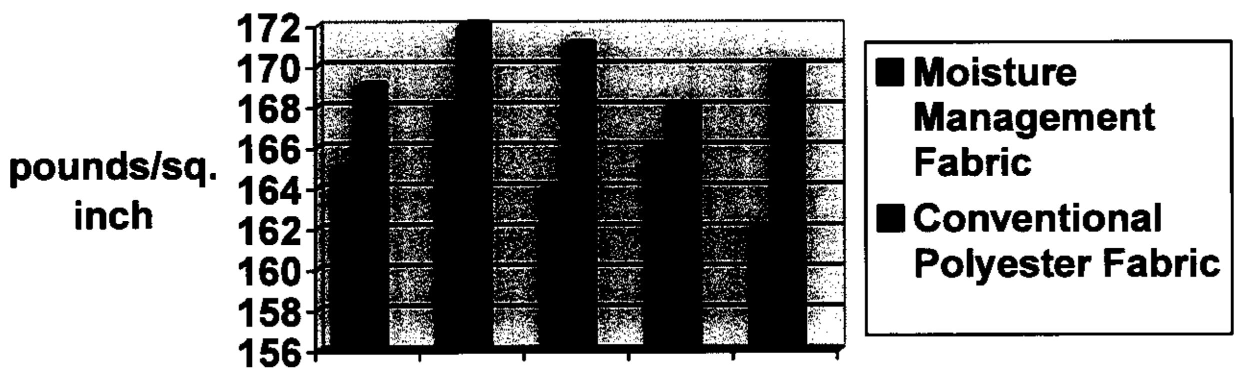
Both the fabrics show pilling to a similar extent . On comparison with the photographic standards the grade accorded to both fabric was grade 3.This shows that there is no difference between the moisture management fabric and the conventional polyester fabric as far as the pilling is concerned.

5.1.5 BURSTING STRENGTH TEST :

Bursting Strength of Moisture Management Fabric – 165lbs/sq.inch

Bursting Strength of Conventional Polyester Fabric – 170 lbs/sq.inch

Bursting Strength Test



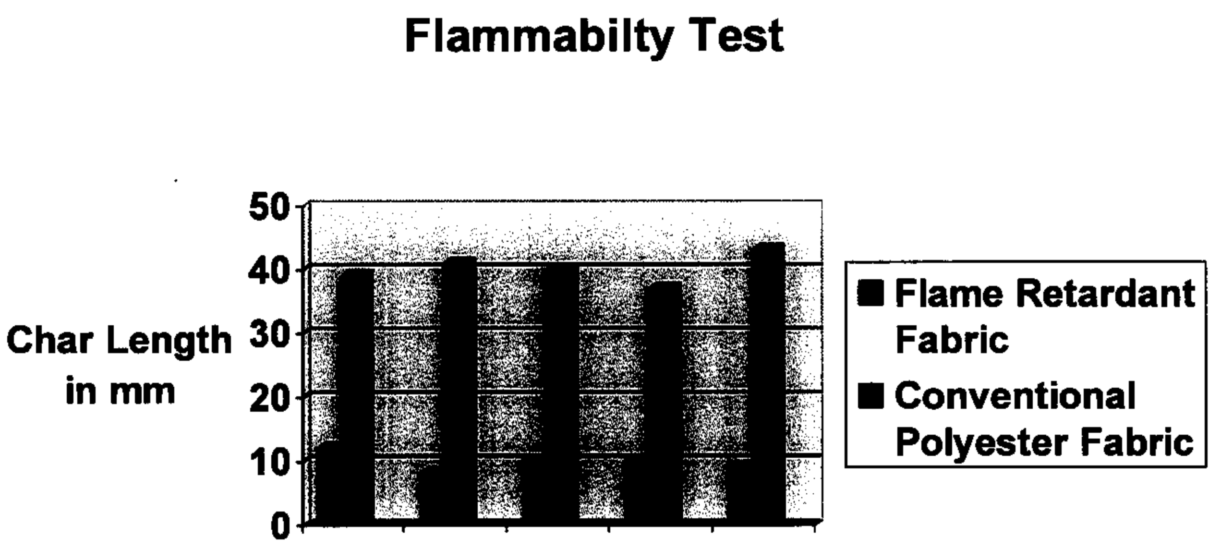
The bursting strength of both the moisture management fabric and the conventional polyester fabric are similar. Thus imparting the moisture management property to the polyester fibres does not compromise on the fabric bursting strength.

5.2 TESTS CARRIED OUT ON THE FLAME RETARDANT FABRIC

5.2.1 FLAMMABILITY TEST :

Char Length for the Flame Retardant Fabric – 10mm

Char Length for the Conventional Polyester Fabric – 40mm



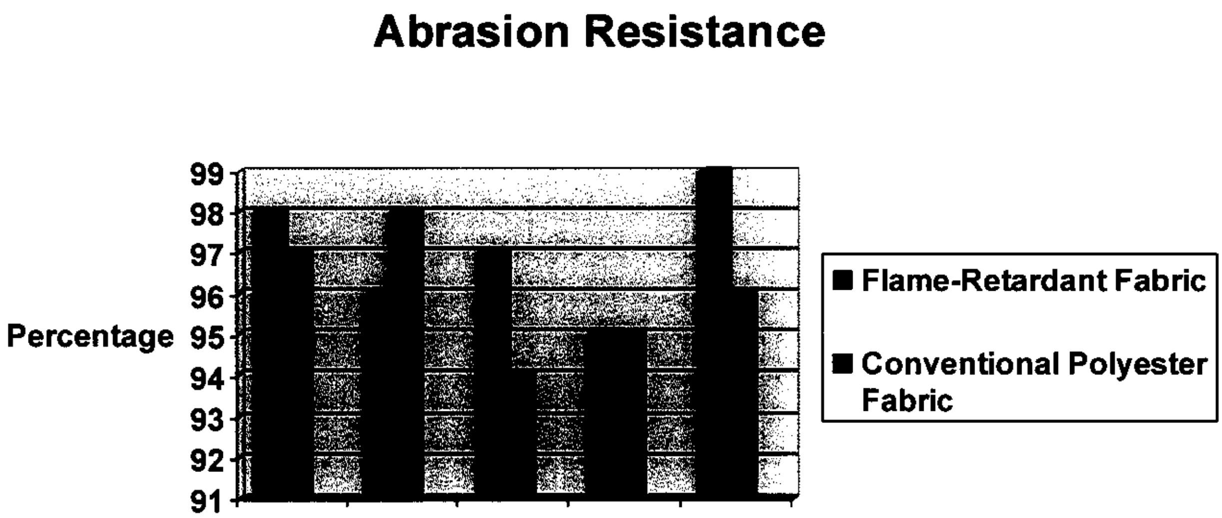
The results for flammability show that the flame-retardant fabric has a considerably improved resistance to flame. The flame retardant fabric hardly caught fire whereas the conventional polyester fabric showed some melting and dripping of a black residue.

The improved resistance to fire can be used to advantage in manufacturing home furnishings such as curtains, sleeping bags etc.

5.2.2 ABRASION RESISTANCE :

Flame-Retardant Fabric – 97 %

Conventional Polyester Fabric – 96%



Abrasion resistance is calculated by subjecting the fabric to a no. of cycles of abrasion and then calculating the percentage of weight loss. Lower weight loss implies a lower abrasion resistance.

Both the flame-retardant and the conventional polyester fabrics showed an equal level of abrasion resistance. The inherent resistance to abrasion can be used to advantage in home furnishings where the fabric is expected to subjected to a considerable amount of abrasion.

5.2.3 TENSILE STRENGTH

Flame-Retardant Fabric :

Tensile Strength (warp direction) – 110 pounds

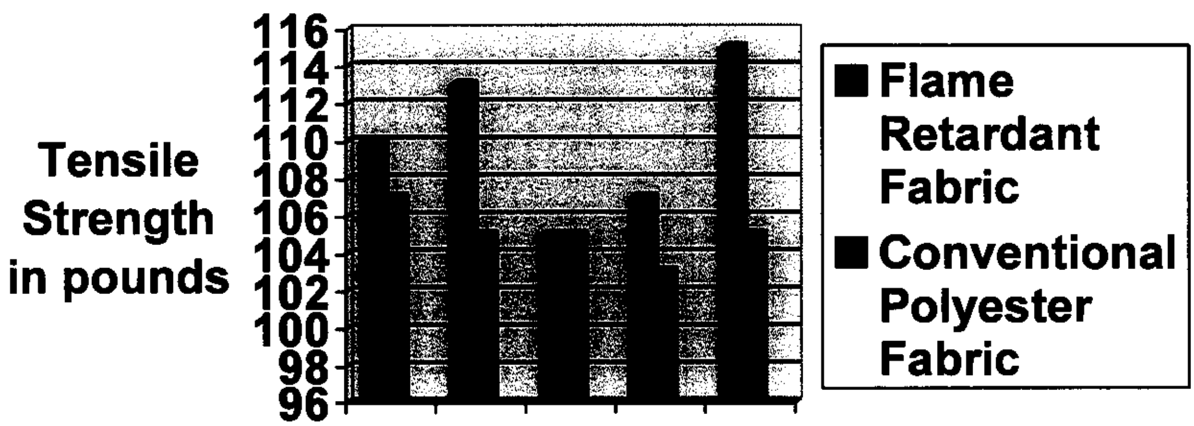
(weft direction) – 75 pounds

Conventional Polyester Fabric :

Tensile Strength (warp direction) – 105 pounds

(weft direction) – 72 pounds

Tensile Strength (warp)



The tensile strength in both warp and weft direction for the flame-retardant and conventional polyester fabric did not show much difference in value. From this we can infer that imparting a flame-resistant property on the polyester fiber does not compromise on the tensile strength of the polyester fabric.

Thus the flame retardant polyester fabric can be used in home furnishings where the fabric is expected to be subjected to considerable amount of abrasion and friction.

6. MARKET SURVEY

Given the recent trends in increasing cost of cotton and the dwindling availability, textile manufacturers worldwide are looking for an alternative fiber that can substitute cotton. Polyester, being the largest manufactured fiber in the world, looks set to take over as the most widely used fiber in the textile industry.

The increasing competition both in the garment and the home-textile industry, manufacturers are looking for viable ways to add value to their products. The emergence of speciality polyester has proved to be a boon for these manufacturers. In speciality polyester, we can incorporate a special property which is not inherently present in polyester but can be incorporated during the polymerization process.

The market for moisture management fabrics is set to grow as apparel manufacturers shift their attention to the high-performance end of the sector and consumers place increasing importance on the performance of garments. Moisture management is one of the key performance criteria in today's apparel industry. Manufacturers who respond quickest to the market demand are set to benefit.

Similarly, flame-retardant polyester has a huge scope for use in the home-textile industry. Polyester, being very durable and abrasion resistant, is an ideal fiber for use in home furnishings. If fire-retardant polyester were to be used, there is tremendous scope for value-addition of home-textile products.

7. CONCLUSION

Polyester fibres have become popular since they have certain desirable characteristics like high strength, wash and wear property, good dimensional stability, elegant appearance and suitability for blending with cellulosic and protein fibres. However, certain drawbacks like low moisture regain, tendency to accumulate static charges, pilling tendency and flammability have limited its use in the textile industry. The use of speciality polyester can help in overcoming the disadvantages that are generally associated with polyester fibers. The project work undertaken has shown that the two types of fibers- moisture management and flame retardant polyester fiber- did show considerable improvement in property when compared with conventional polyester fibers. This can be made use of to add value to garments and made-ups.

Moisture management fabrics are poised for a huge growth in terms of volume of manufacturing. The moisture management fiber can be used in sportswear as it will help in transferring the sweat out of the layers of clothing. Apart from sportswear, moisture management fibers can also be used to add value to conventional garments as it will largely improve the comfort and wear properties of the garment. As manufacturers of sports and active outdoor wear strive to improve the functionality of their collections, the future will see further developments in the field of moisture management fabrics.

Flame-Retardant fabrics can be used in home furnishings. Polyester, with its excellent abrasion resistance and high tensile strength, is the ideal fiber for use in the home textile industry. By incorporating flame retarding properties to the fiber, home textile manufacturers can hope to beat competition by introducing a new range of products. The flame resistant property will also help in securing a higher price for their products. Thus, home textile manufacturers can add value to their products.

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