Technical Fibres : Trends And Innovations

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Introduction

So far, two types of fibres have been available to human society; natural fibres which existed for four thousand years or more and synthetic fibres which first appeared some fifty years ago. Macroscopically, the era of natural fibres, which existed upto 1950s can be identified as the first generation; the synthetic fibres such as nylon, polyester, polyacrylonitrile which appeared in the 1950s were the second generation. Though the synthetic fibres were a Chemist's copy of the natural fibres; in order to replace them, today they are not mere alternatives to natural fibres but are new materials of high functionality and high performance which play a key role in the field of advanced technology. These are the fibres which can now be classified as third generation fibres.

This article features in brief some of the recent fibres developed for use not only for the textile industry but for all industries in general.

Modified Cellulosic Fibres

An environmentally friendly fibre, *Lyocell*, was recently launched by Courtaulds at Techtextile, Frankfurt. Sold until now as Tencel in the high fashion market, it is claimed to be the strongest man-made-cellulosic fibre which outperforms many polyesters. It is obtained in the fibre form through the process of solvent spinning the cellulose in methylmorpholine - N- oxide (NMMO). It has a high wet modulus and it fibrillates to add strength, integrity, opacity and absorbency to yarns. The vast areas of applications include protective clothing, coated fabrics, sewing threads, swabs, filters and special papers.

Aramid Fibres

The commercial aramid fibre available today is represented by *Kevlar* of Du Pont (USA) and *Twaron* of Azko (Holland). Kevlar is spun from sulphuric acid solution and when the liquid crystals are extruded through the nozzle, Kevlar chains orient in the direction of the fibre axis and form fibre in the coagulating bath. The fibre produced by this comparatively new technology of 'liquid-crystal spinning' exhibits extremely high tenacity/high modulus as well as high heat-resistance. Twaron is produced similarly. The fibres find use in automotives, machine building, optical fibre cables, etc. Amongst the other aramid fibres worth mentioning are the Hoechst *Trevira* and Teijin's *Technora GTN* which are high tenacity microfilament yarns for flexible containers, protective wear, airships and hot air balloons, tents, etc.

Polyethylene Naphthalate Fibres (*PEN*)

PEN is described as a homopolymer of dimethyl- 2,6- naphthalene dicarboxylate with ethylene glycol. PEN resins with high molecular weight have been produced in mid 1970s. They have great structural stability at the molecular level relative to PET. In fibre, it translates to high modulus, tenacity and resistance to stretching and breaking. It also has great resistance to thermal and chemical attack. The first use of PEN in the tyre industry is in the Carcass or foundation structure.

Silk like fibre

The production of artificial silk has been attempted ever since early times. However, Toray Co., Japan have recently developed a silky polyester fibre *Sillook Royal S*, which has a three-pedal shaped cross-section that has microslits which absorb the reflected light and provide the vivid deep colour and elegant anisotropic luster simultaneously. Sillook Royal is silk-like not only from its hand touch, but also from a visual and auditory standpoint.

Magic Fibre for AIDS Diagnosis and Treatment

Asahi Chemical Industry Co., Japan, have developed a porous hollow fibre membrane, the *Bemberg Microporous Membrane (BMM)* to filter out and isolate AIDS virus (Acquired Immuno Deficiency Syndrome) and hepatitis type B in blood. The company has established the technology to produce cellulose membranes having homogeneously distributed pores of predetermined diameter (usually 300 - 400 μm in outer diameter). Since a single layer of membrane is not sufficient to isolate these viruses completely, BMM has a multilayer structure of 100-150 layers. The multi layer hollow fibre membrane is produced by wet spinning from cuprammonium solution of cotton linter mixed with an inorganic solvent. Each layer of BMM has over a billion pores which enables complete filtration and isolation of the viruses.

Fibres in Sports

Sports records have improved over the years (barring India!) and so has the quality of sportswear. Modern athletes require that the sportswear should be functional and fashionable. To be comfortable, sportswear needs to be able to absorb moisture and sweat. Teijin Ltd., Japan have developed a porous fibre *Wellkey* which has a hollow centre, with a large number of micropores at the surface. Sweat is immediately absorbed through pores and it diffuses into the hollow centre, so keeping the fibre surface dry. It does not cause chilly sensation on sweating, nor does it stick to the skin and restrict body movement.

Silicon Nitride Fibres

A potentially important discovery has been made in Japan relating to the production of silicon nitride fibre and whiskers. It involves a vapour-solid process where high purity silicon nitride is heated under a high pressure of nitrogen. The silicon nitride dissociates and recombines in fibre or whisker form.

Some Speciality Fibres

AfterGlow Accent Yarns Inc., USA have developed a new phosphorescent yarn. It follows the principle of spin colouring of fibres where finely divided phosphorus is mixed with the polymer extrudate, thereby incorporating the phosphorescent pigment into the structure of fibre with a high degree of fastness. Also gaining importance are the *Visil* fibres i.e., the silica containing, flame retardant, viscose fibres used in protective clothing specially as a seat cover in trains. Yet another type of fibres, based on melamine resin are the *Basofil fibres* which are particularly resistant to elevated temperatures over long periods. They are also resistant to chemicals and radiations and the uses include protective clothing in the steel and welding industries, firemens' suits, aircrafts and cars.

Thus it can be concluded that the recent advancements taking place in the field of fibres are beneficial not only to the apparel industry but to all other technical industries alike.

References

1. Lennox-Kerr, *Technical Textiles Int.*, 1994, 3(10), 18.
2. Anon, *Chemical Fibres Int.*, 1995, 45(1), 27.
3. Imuro H. and Yoshida N., *Chemiefasern Textilindustrie*, 1987, 37/89 T4.
4. Amocco Chem. Co. & Shell Chem. Co., *Chemiefasern Textilindustrie*, 1994, 44/96, E54.
5. Hongu T. and Phillips G., *New Fibres*, Ellis Horwood Pub., New York, 1990, 51.
6. Manabe S., Tsurumi T., Ishikawa G., Satomi M., Yammashiki T., Hamamoto Y., Yamaguchi K., Kobayashi S. and Yamamoto N., *Membrane*, 1989, 14, 77.
7. Kawai C. and Yamakawa A., *Advanced Composites Bulletin*, 1995 April, 3.
8. AfterGlow Accent Yarns Inc., *High Performance Textiles*, 1995 Feb, 4.
9. Davies S., *Textile Horizons*, 1995, 15(4), 42.
10. BASF Corp., *Textil Praxis Int.*, 1994, 49(7/8), 518.