Need Arises Again for Eco-friendly Mid-twentieth Century Fibres

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Abstract

The article deals about those forgotten mid - twentieth century fibres, which were a craze in around the period 1930- 1960 marketed as innovative fibres from war point of view. But in peacetime, interest in these poorly performing fibres faded as they were overtaken by better quality synthetic fibres such as Nylon. Using scarce food for these poorly developed fibres seemed inappropriate. Today, research is motivated by both commercial and environmental concerns and these fibres are staging a comeback in textile fibre market.

Keywords: Forgotten fibres, Eco - friendly fibres, Soya bean fibre, Bamboo fibre, Protein fibres, Regenerated fibres, Cellulosic fibres.

1. Introduction

The mid-twentieth century saw a revolution in fibre making. Many innovative fibres came into light but again faded from memories of people due to the changing cultural, ecological and economical priorities of the time. Chemical or synthetic fibres have become a major raw material of the textile industry in the world. But, chemical fibres in the 20th century have three limitations - 1) They rely on crude oil resource which is being depleted; 2) many of chemical fibres pollute the environment during their production and 3) the texture of synthetic fibres does not have the same texture of that of natural fibres. To avoid the limitations of chemical synthetic fibres widely used today in textile industry, the new fibre should have the following characteristics of - 1) It should be developed from low cost natural resources (i.e. agriculture, husbandry and forest sectors) instead of relying on crude oil; 2) its production process should be clean and environment friendly; 3) it should be comfortable to the skin of human beings.

All these problems were solved, to some extent, by the forgotten fibres and thus if revived back into business could help develop them into good eco- friendly fibres. The aim of presenting this paper lies in trying to bring these fibres to forefront. Fibres we are going to focus mainly in this paper are soyabean and bamboo fibres.

2. Soyabean Protein Fibre

Soyabean Protein fibre (SPF) is a kind of regenerative plant fibre. Soyabean oil is extracted from soyabean. The residue or the oil-free cake or dreg, which is left behind after the oil extraction process, is a waste. Soyabean Fibre is prepared from this waste. The protein content of the fibre is up to 45%.

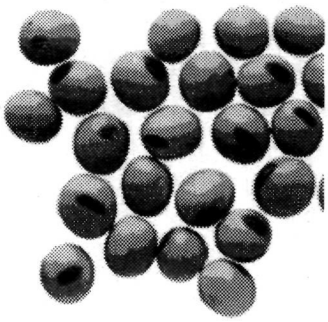

Fig. 1 Soyabean Protein Fibre (Ref. 12)

2.1 Preparation

Initially the fibre was manufactured by crushing beans under pressure and extracting oil. The protein in turn was extracted by passing the meal through a saline solution; it was then combined with various chemicals to form a liquid about as thick as molasses to be used as a spinning solution. This was forced through a spinneret and the filaments were then hardened in an acid bath. Cross section of fibre is like dumbbell. The fibre is white to light tan colour and has the appearance and texture similar to wool and silk.

Nowadays soyabean fibre is prepared using the residual cake after oil is extracted from the soyabean, by the continuous solvent extraction method. Then high polymer is abstracted from soyabean cake and a protein spinning solution of a certain concentration is prepared. After obtaining the spinning solution, a filament bundle of a single fibre 0.9-3.0 dtex is spun with the use of the wet-method spinning process. Then, the fibre performance is stabilized through hydroformylation, and then it undergoes winding, heat setting and cutting. In this way, soyabean fibre of various lengths and specifications for spinning can be manufactured. [Ref. 7]

2.2 Superiorities of Soyabean Fabrics

Because the auxiliary and additional agents and materials used in production of modified soyabean fibre are not poisonous, the semi-finished fibres can be recovered of most additional agents and used again, and the residue remaining after purification of protein can be used as foodstuff. Therefore, its production course will not cause pollution to the environment, and complies completely with environmental protection requirements.

Fig. 2 Modified Soybean Fibre (Ref. 13)

Textiles made of this fibre have the following features:

i. **Luxurious appearance** - The shell fabric made of SPF shows lustre of real silk and good drapability giving people the sense of elegance.

ii. **Good comfort** - SPF has relatively good wet permeability, excellent moisture vapour transmission property, dry touch, soft and smooth handle and light and thin texture.

iii. **Good chromaticity** - The natural colour of SPF is light yellow. It can be dyed with acidic or reactive dyestuffs. With reactive dyestuffs, the colour of product is fresh and lustrous. It has good dyeing brilliance, dyeing fastness and good fastness to light and perspiration.

iv. **Good mechanical & physical performances** - The breaking strength of single filament of this fibre is over 3.0 cN/dtex, higher than the strength of wool, cotton and silk; while the fineness can reach even 0.9 dtex. Because the initial modulus of SPF is quite high, the boiling water shrinkage is low, and so the size stability of shell fabric is good. In common cleaning, there is no shrinkage of textile, the anti-crease performance is also outstanding, and it is easily and quickly cleaned and dried.

v. **Health-care function** - The soyabean protein fibre, with its good affinity to human skin, contains several amino-acids and has good health effects. In the fibre-spinning process of the soybean protein fibre, the addition of Chinese herbal medicine with the effects of sterilisation and anti-inflammation will combine with the side chain of the protein in the manner of a chemical bond. The medical effect is outstanding and permanent, avoiding the disadvantage that the medical effect is less long-lasting when functional products of cotton goods are developed with the after-finishing method.

vi. **Fine denier, low density good tenacity & elongation** - The fabric made of SPF has cashmere-like hand touch, silk-like lustre, cotton-like moisture conduction and wool-like warm retentiveness. The exclusive and excellent properties of SPF not only are emerged perfectly in its own application but also make it the ideal material for blending which improves the properties of other fabrics such as Soyabean/Wool (50/50), Soyabean/Cotton (50/50), Soyabean/Polyester (50/50), Soyabean/Silk (50/50) and Soyabean/Cashmere (80/20).

Due to its excellent performances in moisture-conduction, air-permeability and skin comfort ability, plus the functions like anti-bacteria, anti-ultraviolet radiation and forming far-infrared ray & negative ion, its performance/price ratio has certain competition advantage.

3. Bamboo Fibre

Bamboo fibre is a regenerated cellulosic fibre produced from 100% bamboo pulp fibre. It is characterized by its good hygroscopicity, excellent permeability, soft feel, easiness to straighten and dye and splendid colour effect of pigmentation. It can be easily applied in the manufacturing of underclothes, close-fitting T-shirts, stockings etc. Meanwhile cloth made by the mixed texture of bamboo fibre and cotton or other raw materials also boasts the same superior property.

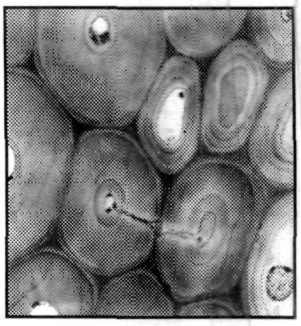

Fig. 3 Bamboo Fibre (Ref. 13)

3.1 Production

Bamboo Fibre is a kind of regenerated cellulose fibre, which is produced from raw materials of bamboo pulp. Natural bamboo fibre is extracted directly from bamboo culms, and completely different from bamboo viscose, which is produced by chemical processing. Firstly bamboo pulp is refined from bamboo through a process of hydrolysis-alkylation and multi-phase bleaching. Then bamboo pulp is processed into bamboo fibre which in some respect similar to viscose rayon processing of converting wood pulp into viscose fibre.

3.2 Properties

The fibre does not contain any chemical additives and is a genuinely environment-friendly product. Its unique properties are:

i. Anti Ultraviolet Nature: UV radiation can not pass through fabric made out of 100% bamboo fibre.

ii. Good moisture absorption and ventilation.

iii. Strong durability, stability, tenacity and elasticity.

iv. Similar thinness and whiteness degree as that of classic viscose.

v. High abrasion resistance.

vi. Green and biodegradable

vii. Natural Anti-bacteria: Bamboo owns a unique anti-bacteria and bacteriostatic bio-agent named *Bamboo Kun*. This substance is combined with bamboo cellulose during the bamboo fibre production. Bamboo fibre has particular and natural functions of anti-bacteria, bacteriostatic and deodorization.

viii. Skin Comfortability: The cross-section of the bamboo fibre is filled with various micro-gaps and micro-holes, so it has much better moisture absorption and ventilation. With this unparalleled micro-structure, bamboo fibre apparel can absorb and evaporate human sweat in a split second. It has round and

smooth surface due to which there is no stimulation against human skin. Just like breathing, such garments make people feel extremely cool and comfortable and also are never sticking to skin in hot summer [Ref. 4].

3.3 Applications of Bamboo Fibre

Bamboo intimate apparels include sweaters, bath-suits, mats, blankets, towels etc. since they have comfortable hand, special lustre, bright colours and good water absorbance. Because of the natural antibiosis function of the bamboo fibre, the finished products need not to be added with any artificial synthesized antimicrobial agent, which are well popular in **home textiles** such as bamboo towels and bath robes. Due to fibre's natural effects of sterilization and bacteriostasis, there are incomparably wide applications in **sanitary materials** such as sanitary towel, gauze mask, absorbent pads, and food packing. In the **medical scope**, it can be processed into the products of bamboo fibre gauze, operating coat, and nurse dress, etc. [ref 6]. Thus, bamboo fibre comes from nature and completely returns to nature in the end.

4. Conclusion

The research and development of synthetic fibre material is heavily dependent on petroleum which will reach its limit sooner or later. In this age of globalisation and environment consciousness, it is important to promote people for saving energy and resources and its recycling. One approach is to develop new environment-friendly fibre material such as wood-based biomass, starch, biodegradable polyester etc. And another approach is to utilize the naturally existing unconventional and non familiar fibres. It has to be really well communicated. Since the main industries in India are agriculture and textiles, lives of millions rely on them. If these industries get going big time then India will soon become a developed country. For all these to happen, both these industries have to work hand in hand, should form series of new products which will be ultimately beneficial to the mankind.

5. References

Book References

1. Mishra S.P., *A Textbook of Fibre Science and Technology*, (New Age International Limited, 2000).

Journal References

2. J.C. Sakthivel and R. Vasanthakumar, Unconventional Natural Fibres, *Synthetic Fibres*, (April/June 2006) **17-20.**
3. G Kamatchi Gayathri and S Krishna Bala, Non-traditional natural textile fibres: Production and applications, *Asian Textile Journal*, (Nov 2006) **63-66.**
4. Li Yi-you, The Soybean Protein Fibre - A Healthy & Comfortable Fibre for the 21st Century, *FIBRES & TEXTILES in Eastern Europe*, **12** (No. 2 (46)) (April/June 2004) **8-9.**
5. Anita Rani, Manisha Gahlot Isha Mittal, New Generation Protein Fibres: Soy Protein Fibre & Spider Silk, *Man-Made Textiles in India*, **4** (3) March 2007.
6. Saravanan. K & Prakash. C, Bamboo fibres & their applications in textiles, *The Indian Textile Journal*, (April 2007).
7. *Industrial and Engineering Chemistry*, (Dec 1940) pp1549.

Internet References

8. www.wsa.soton.ac.uk/conservation-and-museums/Research-Projects. (Accessed in Jan 2007)
9. www.fabrics.net/joan103.asp (Accessed in Dec 2006)
10. www.steve.gb.com/images/science (Accessed in Dec 2006)
11. www.bambrotex.com (Accessed in Jan 2007)
12. www.deltaandpine.com (Accessed Feb 2007)
13. www.fabrics.netjoan103.asp (Accessed Dec 2006)

Physical Property		SPF	Cotton	Viscose	Silk	Bamboo	Wool
Breaking strength (CN/dtex)	Dry	3.8-4.0	1.9-3.1	1.5-2.0	2.6-3.5	2.33	0.9-1.6
	Wet	2.5-3.0	2.2-3.1	0.7-1.1	1.9-2.5	1.37	0.7-1.3
Moisture regain (%)		8.6	9.0	13.0	11.0	13.03	14-16
Density (g/cm3)		1.29	1.50-1.54	1.46-1.52	1.34-1.38	1.14	1.33
Heat endurance		Yellowing and tackifing at about 120° C(Bad)	Becomes brown after long time processing at 150°C (Excellent)	Strength decreases after long time processing at 150° C (Good)	Keep stable. When temperature <=148° C (Good)	Yellowing Occurs at high temp. (Good)	(Good)
Alkali resistance		At general level	Excellent	Excellent	Good	Very Good	Bad
Acid resistance		Excellent	Bad	Bad	Excellent	Bad	Excellent
Ultraviolet resistance		Good	At the general level	Bad	Bad	Excellent	Bad

Table 1: Comparison of Properties [Ref. 3]