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The Soybean Protein Fibre - A Healthy & Comfortable Fibre for the 21st Century

Abstract
This article presents a short characteristic of soybean protein fibres and the perspectives for their development and applications, especially from the point of view of China as their producer.

Key words: *protein fibres, soybean raw material, fibre features, fibre production.*

After nearly a hundred years' development, chemical fibres gradually became mature in the 20th century. Despite the fact that chemical fibres of various features have become one of the major raw materials of the current international textile industry, it has certain serious weaknesses; it relies on gradually depleted oil resources, some products produce pollution during production, and the comfort of chemical fibre products is less than that of natural fibres.

Summarising the research of advanced countries around the world on new fibre materials, the new 21st-century fibre must be born from composite research into new subjects, such as information engineering, material engineering, biological engineering and traditional subjects.

In order to overcome the fatal weaknesses of chemical fibres, efforts will mainly be made in three aspects: first, adopting natural resources from agriculture, animal husbandry and forestry, which are abundant and cheap; second, using production processes which must be clean and friendly to the environment; the third, being more comfortable to the skin of the human body.

China is the first country to achieve the industrial production of the soybean protein fibre in the world. This technical achievement fills the vacancy of original and innovative Chinese technology in the field of chemical synthetic fibre, and also influences the research of development of new fibres in the 21st century.

Soybean fibre is a kind of reproducible plant protein fibre, which uses the residual cake after oil is extracted from the soybean, abstracts high polymer from soybean cake and prepares a protein spinning solution of a certain concentration. 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. Next, the fibre performance is stabilised through hydroformylation, and then it undergoes winding, heat setting and cutting. In this way, soybean fibre of various lengths and specifications for spinning can be manufactured.

As introduced by experts, the soybean protein fibre has small fineness of single fibre, low specific gravity, high tensile elongation, and good acidic and alkali resistance. It is similar to natural fibres such as cotton, wool, hemp, silk, etc. As regards its moisture absorption and discharge performance, permeability performance, heat-retaining performance and spinning performance, people in this industry refer to it as "a healthy and comfortable fibre in the 21st century".

The successful manufacture of the soybean protein fibre is a breakthrough and follows the developmental direction of world-wide fibres. Because its major raw materials are come from natural soybean cake, the quantity of raw material is large and can be readily regenerated. Furthermore, it will not cause waste development.

Because the auxiliary and additional agents and materials used in production of soybean fibre are not poisonous, the semi-finished fibres can be recovered of most additional agents and used again, and the residue remained 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.

As introduced by President Li Guanqi, the inventor of this technology, 100 kg of soybean residue can be extracted from 40 kg of protein. The cost of the extracted protein fibre is only one-third of real silk or one-fifteenth of cashmere. The world-wide output of cashmere is 10,000 tons every year, of which China contributes about 80%, but the goats supplying cashmere eat grass and roots, whose destruction of the grassland vegetation is equivalent to 20 times the amount of sheep. For this reason, many environmental protection specialists at home and abroad are appealing for the production of cashmere to be limited.

This new fibre, which is considerably cheaper than real silk, can partially replace cashmere and real silk, which can raise the usage value of the soybean to a great extent, and can also reduce the ecologi-

cal damage to the grassland environment caused by the production of cashmere.

Since the soybean protein fibre entered material development in August 2000, the quality, grade and subsequent development scale of product have continually improved. At present, some key enterprises are undertaking development and production task in either yarn, shell fabric or garments. Successful manufacture will raise the development tide of the new product in cotton spinning, wool spinning, silk spinning and the corresponding weaving and knitting fields, and will bring new development opportunities to textile enterprises.

The soybean protein fibre has many of the good qualities of natural fibres, and also has some of the mechanical performances of synthetic fibres. Textiles made of this fibre have the following features:

- **Luxurious appearance**

  To the senses of the consumer, the appearance of a garment's shell fabric shows lustre, drapability and a fine degree of weave. The shell fabric made of soybean protein fibre shows the lustre of real silk; its drapability is also very good, giving people the sense of elegance; the textile woven with high-count yarn has fine and clear grain, suitable for high-grade shell fabric for shirts.

- **Good comfort**

  The knitting shell fabric which uses soybean protein fibre has a soft and smooth handle, and the texture is light and thin, with the sense of blending real silk and cashmere. Its moisture absorption performance is equivalent to cotton, and its permeability is greatly better than cotton, ensuring comfort and health while worn.

- **Good chromaticity**

  The natural colour of soybean protein fibre is light yellow, very like the colour of oak silk. It can be dyed with acidic or active dyestuffs. Particularly when dyed with active dyestuff, the colour of product will be fresh and lustrous. With good fastness to light and perspiration, it also has good dyeing brilliance and dyeing fastness in comparison with real silk products.

- **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, and only slightly less than terylene and other commonly used high strength fibres, while the fineness can reach even 0.9 dtex. At present, 6dtex high quality yarn can be woven in cotton spinning equipment with 1.27 dtex cotton type fibre, to develop high-grade, high-count and high-density shell fabric.

  Because the initial modulus of soybean protein fibre 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 worry about the shrinkage of textile, the anti-crease performance is also outstanding, and it is easily and quickly cleaned and dried.

- **Health-care function**

  The soybean 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.

Every year, China produces more than 10 million tons of soybean, and China is also the leading producer of peanut, rape seed and cotton seed. At present, those engaged in scientific research emphasise intensive research into the performance and characteristics of soybean protein fibre. In addition, they have manufactured protein fibres of soybean of various specifications and lengths. They are developing filaments from soybean protein, and are planning to extract protein for spinning from crops such as peanut, rape seed and cotton seed with the same technical method. If such development is successful, it will increase the varieties of protein fibres of crops, form series of new products, and will be beneficial to the industrialisation of agriculture.

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