

Application and Development Prospect of Jade Fiber in Summer Knitted Garment

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Abstract: With the increasing maturity of people's consumption concept and consumption psychology, more attention is paid to the environmental protection value and health care characteristics of clothing. Combined with the rising temperature caused by global warming, cool fiber is widely used in summer knitted clothing. Among them, jade fiber includes many excellent properties, which have high research value. The preparation method and functional characteristics of jade fiber were discussed by data collation and comparative analysis. The purpose of the study is to analyze the existing cases of the fiber in the market and put forward reasonable solutions for the problems of high cost, low fiber strength and beautiful finished fabric of jade fiber at present, so as to provide innovative direction for the application and development of jade fiber in summer knitted clothing.

Keywords: Jade fiber; environmental value; health; functional characteristics; fiber strength

With the development of fiber manufacturing and textile technology, all kinds of new fiber materials emerge endlessly. In addition, due to the influence of earth resources and ecological environment problems, consumers' demand for sports fabrics is no longer limited to comfortable ventilation, but also need to have more diversified functions. Functional high-tech textiles have become one of the mainstream of market development^[1]. Jade fiber has its own health care performance, and it has excellent performance in cooling, antibacterial, ultraviolet resistance and even health care. It is a very ideal summer sports clothing material. It is worth noting that since the advent of jade fiber in 2006, the research in China and abroad has basically focused on the preparation method of the fiber and its own properties, and explored the use of the fiber in knitted bras, household textiles and knitted socks, rarely using the fiber in summer sportswear. The existing sportswear products on the market are mainly based on moisture absorption and quick drying or antibacterial and anti-ultraviolet functions. The common method to endow fabrics with antibacterial or anti-ultraviolet properties in literature is to add relevant additives or use fabric finishing to achieve ideal results. There are some disadvantages to this method, which cannot guarantee environmental protection and health of clothing. This paper proposes to combine the new type of jade fiber with cooling, antibacterial and ultraviolet resistance with other fibers to reduce its cost and enhance its aesthetics, so as to promote the application of jade fiber in summer knitted apparel in the market, which is of certain research significance.

1. Preparation and Advantages of Jade Fiber

1.1 Preparation method of jade fiber

The preparation of jade fiber is mainly to use extraction and nanotechnology to make trace elements and jade together into nanometer particles, and then form fiber by melt spinning. The processing and production of jade fiber is complicated. The main process is as follows: firstly, the jade and minerals are made into nanometer particles, and then the silicon surfactant is added for finishing. On this basis, the fused polyester is mixed with each other at high temperature and fed into the screw extruder. Then the spinning is carried out, and finally formed through blowing, cooling, oiling and winding processes. The production process of jade fiber makes each jade fiber have a unique honeycomb structure that runs through from inside to outside^[2], and its morphological structure is shown in picture 1. Based on this porous and hollow structure, the surface area of jade fiber increases, which is not only beneficial to heat dissipation, but also can enhance the moisture absorption and permeability of the fiber itself.

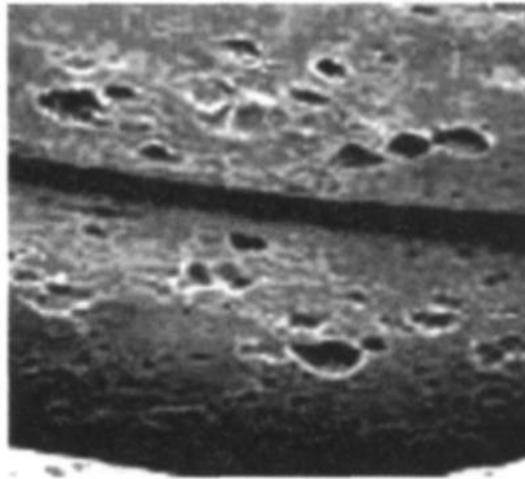


Figure 1: Morphology of jade fiber (picture from network)

1.2 Advantages of Wearability of Jade Fiber

The advantages of jade fiber are the fundamental reason why it can become an ideal material for making summer knitted garments. Many wearability advantages of jade fiber are derived from processing and production, in addition, the raw material itself is also a major factor.

1.2.1 Health care characteristics

Jade has been hailed as a good health product since ancient times. According to the famous ancient medical article ' Compendium of Materia medical ' in China, jade has the following functions : ' removing heat, relieving pain, moistening heart and lung function, helping voice and throat, nourishing hair, nourishing five viscera, calming soul, dredging blood vessels, and clearing ear '^[3]. Studies have shown that natural jade is rich in a variety of minerals and trace elements. These trace elements can be absorbed by the human body, and human cells will resonate with the fluctuation of jade in mutual contact, so that human tissues are more active. The jade fiber contains nanoscale jade particles, so it can also have corresponding special functions. Clothing made of jade fiber for a long time can promote systemic blood circulation and metabolism, balanced veins and blood, and play a role in calming the mind.

1.2.2 Antibacterial properties

Textile surface is relatively loose, easy to infect human metabolism secretion of sweat and grease, so as to give microorganisms a suitable growth environment. In summer, the weather is hot and humid. Microorganisms in the breeding process will lead to clothing odor, and even skin infection causes human diseases, endangering human health. At the same time, the proliferation of colonies will also affect the color and comfort of textiles. Therefore, considering human health problems, and in order to protect textiles from pollution, its antibacterial function is particularly important. However, since the current antibacterial treatment methods are mainly based on the addition of antimicrobial agents, this method is not only unstable in antibacterial effect but also prone to certain harm to human body. Jade can release a large number of negative ions at high temperature, and the activity of bacterial cell membrane or cell protoplast active enzyme will be damaged by the oxidation and reduction of negative ions^[4]. Thus, the antibacterial function of jade fiber is relatively natural, in line with people ' s pursuit of safety for clothing materials.

1.2.3 Cooling characteristics

For summer, the moisture absorption and breathability of clothing is valued by consumers. The production of jade fiber is based on the addition of the third monomer sulfonic acid group on the basis of polyester fiber. The porous and hollow structure of jade fiber increases and increases its surface area. The fiber surface can absorb more water molecules, which can be directly transferred from the micropore on the fiber surface to the hollow part, and then spread to the outer space. By comparison, the thermal resistance of jade fiber is smaller than that of superfine polypropylene fiber, polyester / cotton fiber, Modal fiber and polyester fiber, which is conducive to human heat dissipation^[5]. It can be seen that the clothing made of jade fiber not only has the effect of moisture absorption and air permeability, but also can contact with the external air flow to achieve obvious cooling effect. Some studies have shown that

when the external temperature is above 32 °C, compared with ordinary polyester fabric, jade fiber fabric can be cooled by 1.2 – 2.0 °C^[6]. It is high quality material for making summer clothes, T-shirts and sportswear.

1.2.4 Energy Saving and Environmental Protection Characteristics

Ordinary fiber fabrics have high requirements in dyeing, and it usually requires the setting of high temperature and high pressure to better guarantee the dyeing effect. Jade fiber is less limited in this respect, its dyeing work can be completely completed at normal temperature and pressure. This is due to the production method of fiber. First of all, the third monomer sulfonic acid group is added to the processing. In addition, cationic dyes are mostly used for dyeing, resulting in the close combination of anionic groups and cationic dyes, and ultimately reducing the difficulty of fabric dyeing. At the same time, its honeycomb microporous structure also provides convenience for dyeing, so that it can be dyed at room temperature. Compared with ordinary fibers, the adsorption performance of jade fiber on dyes is more excellent, which is also conducive to reducing the production of waste liquid, minimizing the adverse impact on the environment, and increasing the utilization rate of dyes, which meets the current requirements for energy conservation and environmental protection of clothing. At the same time, the acceptance of jade fiber to dyes is also conducive to the pursuit of color richness in summer knitted apparel.

1.2.5 Ultraviolet resistance

Skin is the first barrier for the human body to isolate the outside world. General skin aging is divided into natural aging and photoaging, and ultraviolet (UV) radiation is a major cause of skin photoaging. Although proper exposure to sunlight can promote the absorption of vitamin D, long-term exposure to ultraviolet radiation can cause a series of skin lesions such as rough skin, pigmentation, capillary dilation, wrinkle deepening and thickening, and even increase the incidence of skin cancer^[7]. At present, with the aggravation of ecological problems and the increase of UV intensity, consumers pay more and more attention to the UV resistance of summer clothing. Domestic studies have found that the fiber diameter is inversely proportional to the reflection effect^[8]. Ultrafine polyester fiber has strong ultraviolet resistance, and jade fiber is originally derived from polyester fiber. Therefore, the sunscreen properties of jade fiber with higher fineness are better than those of other fibers.

2. Application of jade fiber in summer knitted apparel

As jade fiber belongs to a new type of fabric made in China, according to the survey, jade fiber is widely used in home textiles and industrial textiles. It is used less in the current clothing market, and its application in knitted garments focuses on close-fitting underwear, sports T-shirts and so on. The main selling point is summer cool feeling, comfort and its antibacterial sunscreen performance.

2.1 Application of jade fiber in underwear



Figure 2: Front zipper underwear (picture from network)

Consumer demand for summer underwear mainly around the cool light, moisture permeability, environmental protection and antibacterial keywords. Compared with cotton, hemp and ordinary polyester fiber, jade fiber in related aspects of the characteristics are relatively good, the market jade fiber underwear technology and sports. As shown in Figure 2, a front zipper underwear made by SKY HAND Company has a cooling effect, and has a certain blocking ultraviolet light and anti-aging effect. The main

colors are black and white. The underwear has good wrapability and comfortable material. The jade factor is used in the weaving of the fiber, which can enhance the cooling and permeability of the underwear. The front zipper design makes it easier to wear and tear, and the interior also has a removable underwear pad, which is convenient for users to clean and replace. The back adopts the stitching design of the same color as mesh yarn, which is lighter and cooler.

At the same time, the company also designed some extension styles, as shown in Fig. 3. The series has been expanded in color, but the style is relatively simple and ordinary. The mesh design is added to the shoulder belt and the decompression structure is adopted, which can further make the underwear reach the senseless bearing. The partial hollowing-out design was added to the details of the back to add a little sexy.



Figure 3: Brief sports underwear (picture from the network)

2.2 Application of jade fiber in sports knitted T-shirt



Figure 4: Men ' s New Essential City Leisure Sleeve (pictures from the Internet)

Compared with woven T-shirts, consumers currently prefer knitted T-shirts. The reason is that : firstly, it is more skinny and classic. Secondly, knitted clothing has a loose structure, elastic and good permeability, which is relatively suitable for sportswear. The jade fiber has cooling function and good moisture absorption and fast drying performance, which makes it an excellent material for summer knitted T-shirts. The sports T-shirt made of this material can use the honeycomb microporous structure of the fiber itself to quickly discharge the sweat and body heat of the user, so that it feels cool and comfortable. There are related products in the domestic market. As shown in Figure 4, the sports T-shirt is a new man ' s ESSENTIAL urban leisure sleeve developed by Mizuno Company. It integrates micro-nano powder grinded by jade powder into the yarn to weave a scientific and technological fabric with jade cooling, impermeability and quick drying. The T-shirt uses a low-key neutral color system. The clothing style is simple and atmospheric, and the collar is comfortable and flexible. It can be easily worn and removed, and it provides convenience for sports. The chest prints are gradually printed to increase their fashion.

3. Application Dilemma and Development Prospect of Jade Fiber in Current Garment Market

3.1 Application Dilemma of Jade Fiber in Knitwear Market

Through the comparison and research between many literatures, it is found that the thermal resistance of jade fiber is the smallest compared with ordinary polyester, Modal, polyester cotton, cotton + superfine polypropylene fiber. The clothing made of jade fiber has obvious heat dissipation and good effect of sweating, moisture absorption and fast drying^[9]. At the same time, antibacterial, ultraviolet resistance and health care performance are its advantages, but the use of jade fiber in the field of knitted apparel in the current market is very few and consumers pay less attention to it. There are mainly the following reasons. First of all, from the perspective of knitting production, due to the high cost of extraction and production of jade fiber itself, fabric manufacturers will give priority to the replacement of relatively low-priced viscose fiber (ice fiber) and bamboo fiber from the perspective of clothing profit and pricing. Secondly, the strength of jade fiber is not high, and knitting has certain requirements for the physical and mechanical properties of fiber or yarn. At the same time, the main tone of the existing products is pure color technology, the appearance is monotonous, and the aesthetic sense needs to be strengthened. Finally, due to the less use of manufacturers, consumers know little about the jade fiber itself, unable to highlight its advantages.

3.2 Development Prospect of Jade Fiber in Knitwear Market

Jade fiber is a rare summer knitted garment material, which can meet the multi-faceted needs of consumers. It is an ideal fabric for summer underwear, T-shirts and other clothing, and has broad development prospects^[10]. In the future, people will do exploration and research on the use of jade fiber in solving existing problems. The author predicts the development direction of the above problems:

3.2.1 Jade fiber blended with various fibers

Fiber blending is a common means in the current clothing market. Fiber blending can improve the function and characteristics of single fiber, and reduce the cost of fabric. Jade fiber contains jade and mineral nanoparticles, and the problem of high production cost needs further development of technology. However, at present, it can be solved to a certain extent by fiber blending. The jade fiber can be blended with natural fibers such as cotton, hemp, silk, wool and other chemical fibers, which reduces the proportion of jade fiber in the fabric. At the same time, the strength problem of jade fiber itself can also be improved by selecting high strength Tencel fiber to improve the strength of jade fabric, in a variety of ways to cooperate with jade fiber to adapt to knitting and consumer demand for superior comfort of summer knitted clothing.

3.2.2 Improving the Beauty of Jade Fiber Knitted Garment

The new knitted fiber is used to reflect the comfort, safety, hygiene and aesthetics of wearing^[11]. The development of jade fiber clothing in the future not only needs to be explored in the performance of the material itself, but also needs to be improved in fashion and aesthetics. At present, the style of knitted apparel related to jade fiber in the market is relatively simple, and the color is mostly pure color. The overall product effect is ordinary, and the attraction to consumers is not high. It cannot compete with the newly knitted apparel with rich colors in the market. The better dyeability of jade fiber can be used to develop a variety of color systems. In the design of summer knitted sportswear, some patterns and patterns of scientific and technological elements can be appropriately added. For ordinary knitted clothing, more decorations representing Chinese characteristics can be added to enhance the overall visual impact of clothing.

3.2.3 Enhancing Propaganda of Advantage Performance of Jade Fiber

Jade fiber has a variety of functions, which are the advantages of the fiber itself. In the future, if jade fiber needs to be widely used in summer knitted apparel, it will inevitably be recognized by consumers. In today's Internet age, various We-Media platforms have developed and a variety of marketing models coexist. For example, in recent years, the KOL model is quite popular. KOL is the key opinion leader. Generally speaking, leaders themselves often have rich sources of information, knowledge, opinions or experience, and have strong social skills and interpersonal communication skills, so they are highly sought after and trusted by consumers^[12]. The promotion of products by key people can enhance consumers' understanding of product functions, appearance, usage and other aspects. The related advantages of jade fiber clothing can be popularized by using a variety of new forms to promote consumers' understanding of fiber advantages and enhance the competitiveness of clothing products.

4. Summary

In the development of the textile industry, multi-functional textile products have gradually become popular and loved by consumers^[13]. The multiple advantages of jade fiber represent the satisfaction of the new fiber to the current demand difference of consumers. At present, there are few application cases of jade fiber in the clothing market. It should be further studied and explored to promote the popularization and use of fiber. From the fiber itself, it is necessary to pay attention to the problem of high preparation costs. While exploring and improving the technical level, it can also be blended with other fibers to reduce the cost and make up for the lack of strength. In terms of the summer knitted garment made of the fiber on the market, as a product that needs to compete with other similar garments, it needs to be further strengthened in terms of aesthetics, focusing on innovation in style, color and decorative patterns to enhance product competitiveness ; from the promotion level, it is necessary to combine with the current popular forms to increase the publicity of jade fiber characteristics and increase consumers ' understanding of the function of the fiber.

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