Polyester Staple Fiber Futures

I. Overview of Polyester Staple Fiber

(I) Definition

Polyester or polyester fiber, as a downstream product of PTA, is the most produced and most widely used chemical fiber, accounting for more than 80% of China's chemical fiber output. Due to its high strength, abrasion resistance, light resistance, and stiffness, and other characteristics, polyester is extensively used to produce apparel fabrics, beddings, decorative fabrics, special fabrics for national defense and military industries, and other textiles, and filter materials, insulation materials, conveyor belts, and other fiber products for industrial use.

By length, polyesters can be divided into polyester staple fibers and polyester filaments. Polyester staple fibers ("staple fibers") are short fibers produced through spinning, drawing, and cutting polyesters in a molten state which are created via polymerization of purified terephthalic acid ("PTA") and mono ethylene glycol ("MEG"). Staple fibers resemble cotton in appearance, have a length of tens of millimeters, and can be used to produce fabrics through the spinning or non-woven process. Polyester filaments may reach thousands of meters in length and can be directly used for weaving without spinning. Staple fibers were introduced to China in the 1970s. Since then, China's staple fiber market has witnessed rapid growth due to the wide application and low price of staple fibers. To date, staple fibers have become essential raw materials for textile, apparel, home textile, and other industries.

Generally, the fineness of staple fiber is measured according to the constant length system. Under the constant length system, the weight of a certain length of fiber or yarn is measured by tex or denier.

Tex is the number of grams of mass per kilometer of yarn or fiber at the conventional moisture regain. The commonly used unit is deci-tex (or "dtex"), with 1dtex equal to 0.1tex.

Denier (or "D") is the number of grams of mass per 9,000 meters of yarn or fiber at the conventional moisture regain.

Figure 1 Physical Staple Fibers

(II) Classification

Staple fibers can be classified into different categories by different criteria, as shown in the following table:

Table 1 Categories of Staple Fibers

Classification Criteria	Staple Fibers
Raw materials	Virgin and recycled staple fibers
Production process	Melt-directly-spun and intermittently-spun staple fibers
Cross section	Ordinary solid and special-shaped staple fibers
Luster	Bright and semi-dull staple fibers
Fineness	Cotton-like, medium-length, and wool-like staple fibers
Application	Staple fibers for yarn-making, filling, and non-weaving

Source: Zhengzhou Commodity Exchange

The benchmark deliverables of polyester staple fiber futures are 1.56dtex×38mm, semi-dull natural color staple fibers with circular cross section, which meets the quality indicators of the cotton-like staple fibers of premium grade as set out in the *National Standard of the People's Republic of China for Staple Fibers* (GB/T 14464-2017), is used for virgin spinning, and has an oil content equal to or higher than 0.10% but equal to or lower than 0.20% and a moisture regain equal to or higher than 0.30% but equal to or lower than 0.60%.

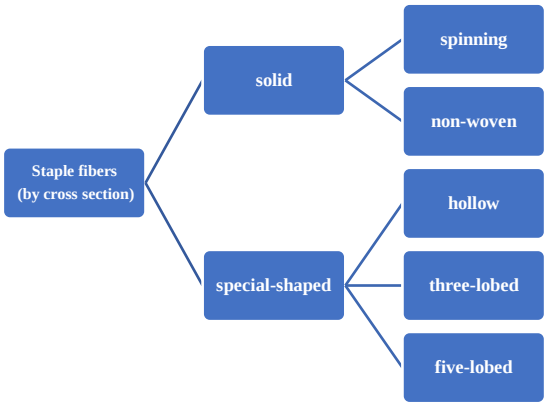
1. By raw materials

By raw materials, staple fibers are divided into virgin and recycled ones. Virgin staple fibers are produced using PTA and MEG as raw materials, and are commonly known as “large chemical fibers”. Recycled staple fibers are mainly produced using recycled PET bottles and others as raw materials through the drying, melting, spinning, and cutting process, and are commonly known as “small chemical fibers”.

2. By cross section

By cross section, staple fibers are divided into ordinary solid and special-shaped ones.

Figure 2 Staple Fibers by Cross Section



As the current leading staple fiber product, ordinary solid staple fibers with circular cross section are mainly used in the spinning and non-woven markets.

Special-shaped staple fibers include hollow, three-lobed, and five-lobed ones, of which, hollow stable fibers are the leading product, and the other special-shaped fibers are produced in a very limited quantity. Hollow staple fibers have a hollow cross section. By the dimension of hollow cross section, hollow staple fibers can be divided into two-dimensional and three-dimensional ones. Hollow staple fibers are primarily used for filling home textile beddings, cotton garments, plush toys, and furniture.

3. By luster

Staple fibers can be divided into bright and semi-dull ones depending on whether their surface is lustrous.

Chemical fibers usually have a strong luster, while many textiles are not required to have a strong gloss and thus need to be de-lustered. To this end, an appropriate amount of a delustering agent (which is highly dispersive powder) is added to the spinning solution to destroy the fiber surface so that the fiber surface will irregularly reflect light to achieve the de-lustering purpose. Currently, titanium dioxide is often used as a delustering agent for staple fibers. For bright staple fibers, no titanium dioxide is added during the spinning process, and for semi-dull staple fibers, approximately 0.3% titanium dioxide is added during this process.

4. By fineness

By fineness, ordinary solid staple fibers are divided into cotton-like, medium-length, and wool-like ones.

Cotton-like staple fibers (0.8dtex~<2.2dtex) are primarily used for spinning and constitute the dominating staple fiber market segment. The cotton-like staple fibers mainly include 1.56dtex and 1.33dtex ones. The 1.56dtex staple fibers, most of which are semi-dull, are used mainly for spinning and partially for producing non-woven fabrics such as spun-lace non-woven fabrics. While the 1.56dtex semi-dull staple fibers for the above two purposes are produced

through the same process and equipment, the differences between their production processes lie in: First, oil agents; specifically, hydrophilic oil agents are required for staple fibers used for the spun-lacing process; Second, requirements for strength and fracture elongation during the production process; while staple fibers for spun-lacing are mainly used to produce skin-friendly products, such as wipes and face mask paper, which require low strength and high fracture elongation, staple fibers for spinning requires high strength and low fracture elongation. In terms of production process, both staple fibers need to undergo the melting, spinning, winding, doffing, bunching, drawing, crimping, cutting, and packing process. In terms of production equipment, the same production line can be switched over to produce both staple fibers after the two indicators, i.e., strength and fracture elongation, are under control.

The 1.33dtex staple fibers can be divided into semi-dull and bright ones. Semi-dull staple fibers are mainly used for spinning, while bright staple fibers have high strength and are mainly used to make polyester sewing threads.

Medium-length staple fibers (2.2dtex ~ <3.3dtex) are mainly used for producing nonwoven fabrics.

Wool-like staple fibers (3.3dtex ~ 6.0dtex) are mainly used in the wool textile market.

(III) Major uses

Staple fibers are mainly used for yarn spinning, filling, and non-weaving.

The most important use of staple fibers is for yarn spinning, including cotton spinning and wool spinning. A large quantity of staple fibers is consumed for cotton spinning, which mainly includes pure spinning and blending. Purely spun yarns are divided into pure polyester yarns and pure polyester sewing threads. Yarns made wholly from staple fibers are called pure polyester yarns, and threads made wholly from staple fibers called pure polyester sewing threads. Blending includes polyester-cotton blending, polyester-viscose blending, and polyester-wool blending. Polyester-cotton blending refers to the blending of cotton and staple fibers at different proportions. Polyester-viscose blending refers to the blending of polyester and viscose fibers. Polyester-wool blending is the blending of polyester and wool. Blending has a bigger market share than pure spinning.

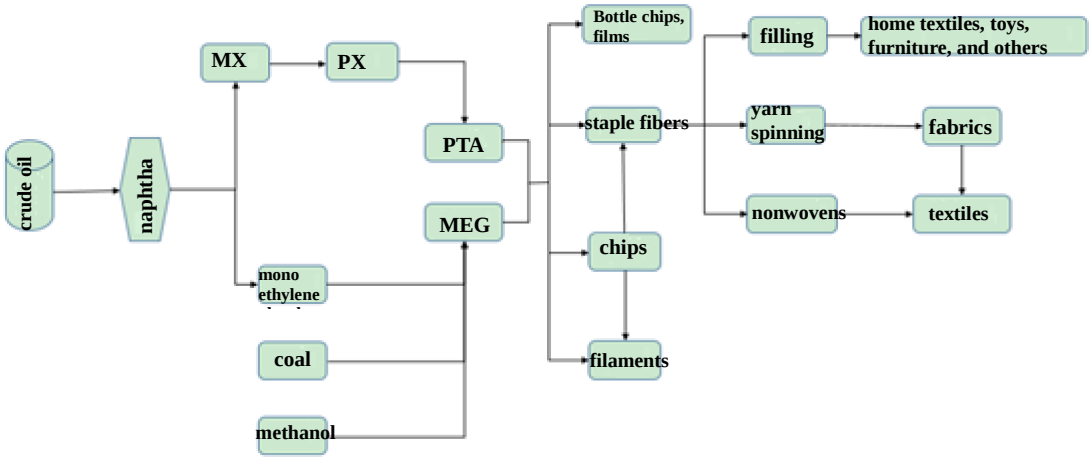
In the case of filling, staple fibers are mainly used as fillers to improve homes and keep clothes warm. In most cases, hollow staple fibers are used for such purposes.

The nonwoven market has been growing rapidly in recent years, with a large amount of spun-lace non-woven fabrics being consumed mainly to produce wipes, medical curtains, surgical garments, cotton pads, and mask-covering materials. Unlike the regular post-spinning weaving process, the nonwoven process is a process whereby fabrics are produced by arranging staple fibers in a targeted or random manner to form a fiber web structure and then reinforcing the structure with mechanical, heat-bonding, chemical, and other techniques.

(IV) Production process and related industries

As an intermediate product, staple fibers serve as a link between the upstream olefins and aromatics industries and the downstream garment and textile industries.

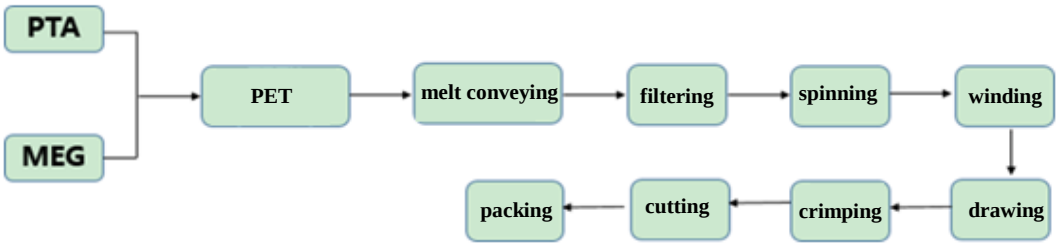
Figure 3 Structure of Staple Fiber-Related Industries



The staple fiber production process includes melt direct spinning and intermittent spinning.

Under the melt direct spinning process, PTA and mono ethylene glycol are used as raw materials to produce polyester melts, which are then directly spun and cut to produce staple fibers without using the polyester chip production process. This production process consists of two parts: polycondensation and melt spinning. China's conventional staple fibers are produced basically through the melt direct spinning technology as this production process is integrated and boasts a large single-line capacity and a slightly lower unit processing cost than the intermittent spinning process.

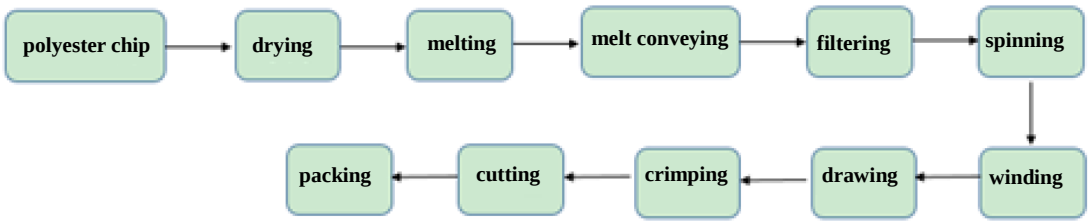
Figure 4 Melt Direct Spinning Process



Intermittent spinning includes chip spinning and recycled bottle chip spinning, both of which use virgin polyester chips and recycled PET bottles as raw materials to produce virgin and recycled staple fibers through the drying, melting, spinning, and cutting process. Compared to the direct melting spinning process, the chip spinning process has the additional process of chip fabrication and remelting and thus does not have a cost advantage. As a result, most of the products produced through the chip spinning process are differentiated ones with high added value, such as cationic, triangular, flame retardant, UV resistant, and other types of

staple fibers, the market demand for which is relatively small.

Figure 5 Intermittent Spinning Process



Given the current production of staple fibers in China, most of the projects which mass produce a single product or conventional products use the melt direct spinning process to achieve a better economy of scale, thereby reducing investment and costs and enhancing market competitiveness. It is suitable for projects which produce a small quantity of various products for the high-end market to use the intermittent spinning process, which is highly flexible in production and can quickly adjust the types of products to adapt to market changes.

(V) Quality standard

At present, China's national standard for staple fibers is *the National Standard of the People's Republic of China for Staple Fibers* (GB/T 14464-2017). The national standard specifies 13 quality indicators for staple fiber products, including fracture strength, fracture elongation, and linear density deviation rate, and classifies staple fiber products into three grades: premium grade, A grade, and qualified. The national standard does not set out explicit requirements on the oil content and moisture regain of staple fibers. The two indicators are considered important in the industry as they also affect the spinnability of staple fibers.

Thanks to the mature staple fiber production technology, domestic staple fiber producers can ensure 99% of their staple fiber products are of premium grade when their facilities maintain stable operation.

Table 2 Main Quality Indicators for Virgin Staple Fibers (GB/T 14464-2017)

Item		Cotton-Like Staple Fibers		
		Premium Grade	A Grade	Qualified
Fracture strength /(cN/dtex)	≥	5.50	5.30	5.00
Fracture elongation/%		M_1[a]±4.0	M_1±5.0	M_1±8.0
Linear density deviation rate/%		±3.0	±4.0	±8.0
Length deviation rate/%		±3.0	±6.0	±10.0
Extra-long fiber rate/%	≤	0.5	1.0	3.0
Multiple-length fiber content/(mg/100g)	≤	2.0	3.0	15.0
Flaw content/(mg/100g)	≤	2.0	6.0	30.0
Crimp frequency/(pcs /25mm)		M_2[b]±2.5	M_2±3.5	
crimp rate/%		M_3[c]±2.5	M_3±3.5	
Dry heat shrinkage at 180℃/%		M_4[d]±2.0	M_4±3.0	M_4±3.0
Specific resistance /Ω·cm	≤	M_5[e]×10^8	M_5×10^9	
10% constant elongation strength/(cN/dtex)	≥	3.00	2.60	2.30
Variable coefficient for fracture strength%	≤	10.0	15.0	

Source: National Standard of the People's Republic of China for Staple Fibers (GB/T 14464-2017)

Notes: M_1[a] means the central value of fracture elongation, which is selected within the range of 18.0% - 35.0% for cotton-like staple fibers, 25.0% ~ 40.0% for medium-length staple fibers, and 35.0%- 50.0% for wool-like staple fibers, and, after being determined, will not be changed without permission.

M_2[b] means the central value of crimp frequency, which is selected by the supply and demand sides within the range of 8.0pcs /25mm-14.0pcs /25mm, and after being determined, will not be changed without permission.

M_3[c]means the central value of crimp rate, which is selected by the supply and demand sides within the range of 10.0%-16.0%, and after being determined, will not be changed without permission.

M_4[d] means the central value of dry heat shrinkage at 180℃, which is selected within the range ≤7.0% for cotton-like staple fibers, and ≤10.0% for medium-length staple fibers, and after being determined, will not be changed without permission.

$1.0 \leq M_5$[e] < 10.0.

In addition to the above indicators, there are differences in the spinnability of staple fibers

during the spinning process. Spinnability is a general term in the industry for the stability of the fiber spinning process. There is no testable specific indicator to measure differences in spinnability. After long-term practices and research, enterprises in the industry deem that the spinnability of staple fibers is a combined result of multiple production factors, which is related to not only various physical indicators specified in the national standard, but also the machinery and equipment, workers' skills, working environment, and other aspects of their spinning plants. Therefore, staple fibers which have the same testing results according to the national standard may have different spinnability when being used in different spinning plants and at different times.

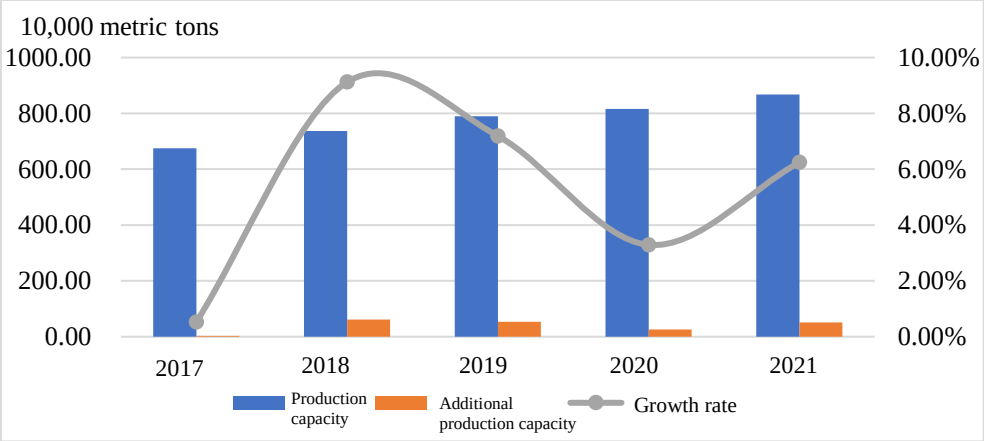
II. Staple Fiber Supply and Demand

(I) Production capacity and output

1. Development

As the world's largest producer and consumer of staple fibers, China produces and consumes 60% to 70% of the world's total. Since 2010, China's staple fiber industry has witnessed a history of expansion, stagnation, and re-expansion. In 2010, the production capacity of staple fibers expanded rapidly, intensifying competition among enterprises, and gradually eroding the profits of the industry. From 2013 to 2016, the growth of the production capacity slowed down as the price of staple fibers continued to drop due to the declining prices of crude oil and other petrochemical products. Some enterprises shut down their production capacity because of poor profits. After 2017, as China proceeded with its supply-side reform, the overall profits of the industry gradually rebounded, and additional production capacity was put into operation. According to the statistics of OilChem China, China's staple fiber production capacity showed a compound growth rate of 6.44% from 2017 to 2021 and reached 8.67 million metric tons in 2021.

Figure 6 China's Staple Fiber Production Capacity 2017-2020

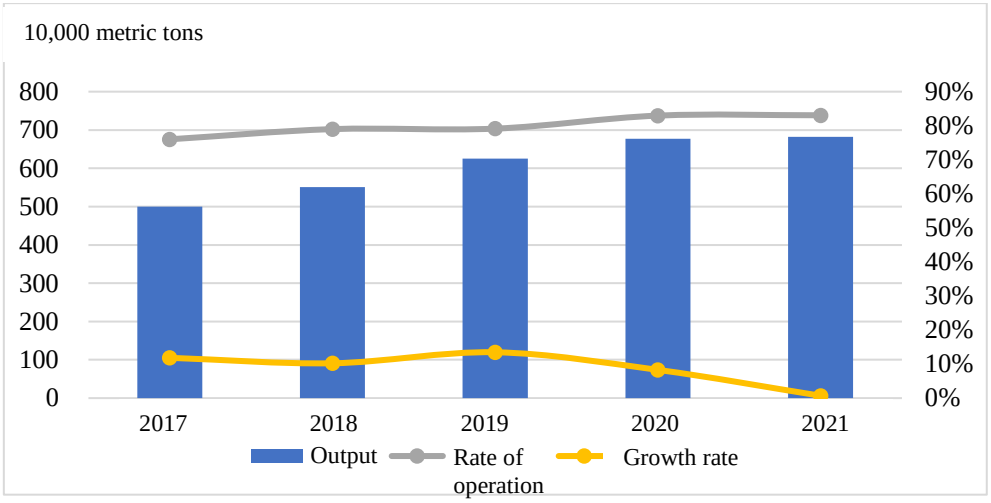


Source: OilChem China

With the expansion of the industry, the output of staple fibers maintained overall growth from

2017 to 2021, with a compound growth rate of 8.81% during the past nearly five years. In 2021, the total output of China's staple fibers was 6.82 million metric tons. An increase in output in recent years was mainly driven by higher downstream demands at home and abroad and the improved profitability of staple fiber producers, resulting in a higher rate of operation in the entire industry.

Figure 7 China's Staple Fiber Output 2017-2021



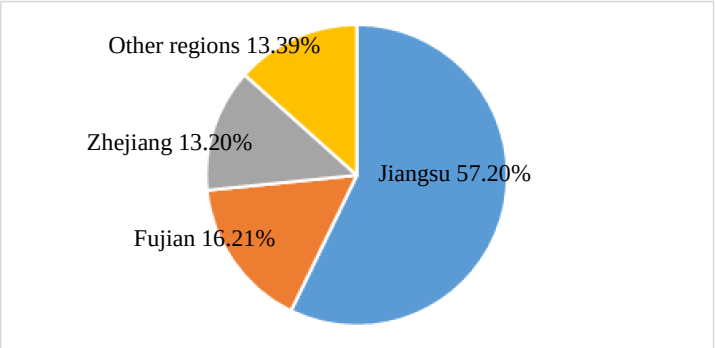
Source: OilChem China

In terms of product specifications, the 1.56dtex semi-dull staple fiber accounted for 49% of the total staple fiber output as the most produced virgin staple fiber product, the 1.33dtex bright staple fiber 13%, and other single-specification products a much lower percentage.

2. Distribution

The distribution of China's staple fiber production capacity is relatively concentrated. Based on changes in the production capacity of staple fibers over the last five years, East China has been showing the highest concentration of production capacity. In 2021, East China accounted for 93.27% of China's total staple fiber production capacity, including 57.20% from Jiangsu, 16.21% from Fujian, and 13.20% from Zhejiang. The three provinces are the major producers of staple fibers and the benchmark delivery points of the polyester staple fiber futures. The three provinces have a large production capacity partly due to the abundant production capacity of raw materials for PTA and partly due to their advantages in development level, transportation, export, and proximity to the downstream consumer market.

Figure 8 Staple Fiber Production Capacity by Region in 2021

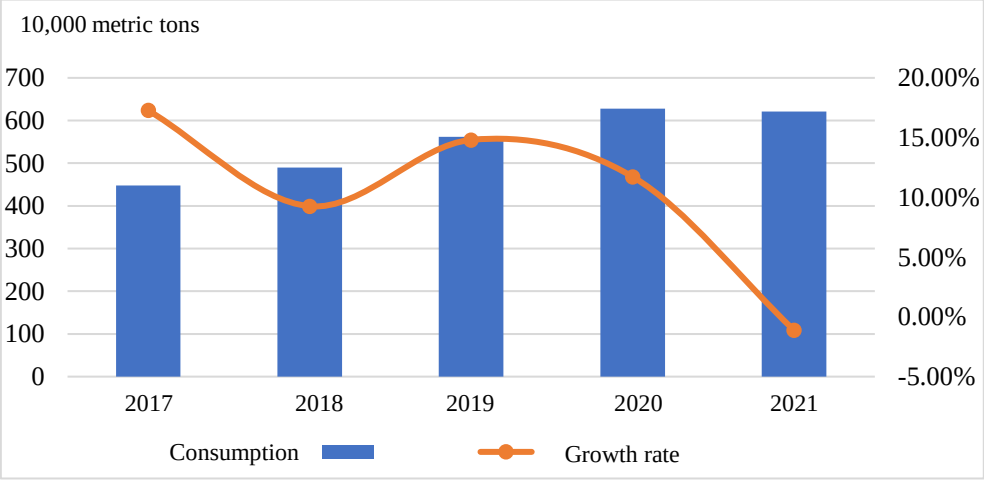


Source: OilChem China

(II) Consumption

As the essential raw materials for the textile industry, staple fibers are mainly used in the downstream apparel and home textile industries. As the living standards of Chinese residents continue to improve, the demand for garments and home textiles has gradually increased. Over the past five years, the actual consumption of staple fibers in China has maintained slow growth. In 2021, however, there was a substantial drop in the growth of the overall demand due to the operational difficulties of the textile industry caused by the severe pandemic situation overseas, given that most of the staple fiber products are used in the textile industry. In 2021, China's consumption of staple fibers reached 6,208,500 metric tons.

Figure 9 China's Consumption of Staple Fibers 2017-2021

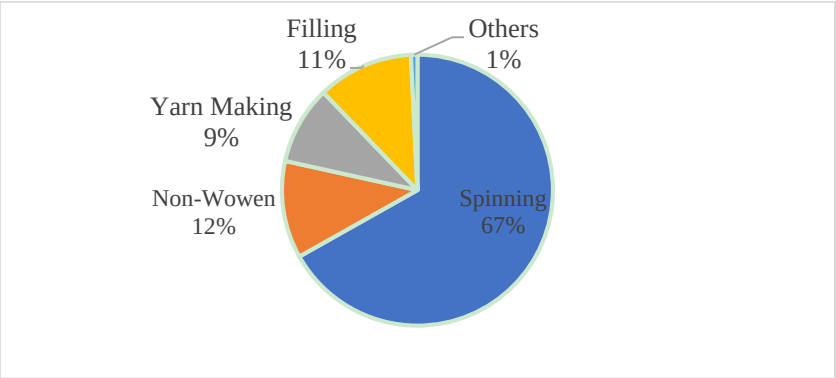


Source: OilChem China

In recent years, the demand for staple fibers in the conventional spinning industry has grown slowly. With the increasingly fierce competition in the conventional spinning sector, most of the Chinse staple fiber producers have adjusted their product structure, resulting in a gradual decline in the proportion of consumption of staple fibers by the conventional spinning sector,

which was 67% in 2021, while that of consumption of staple fibers by the non-woven (mainly spun lace) and filling industries has increased rapidly.

Figure 10 Consumption Structure of Staple Fibers in 2021

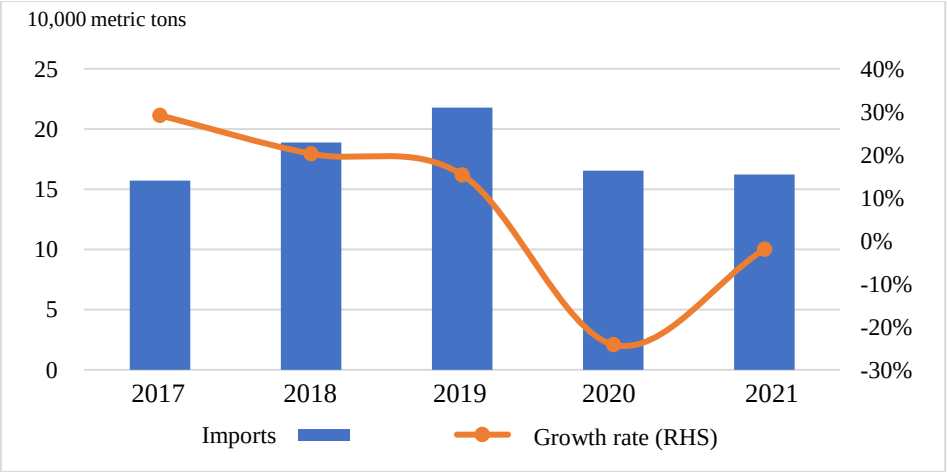


Source: OilChem China

(III) Imports and exports

China has a relatively low import dependence on staple fibers, with an annual import of about 200,000 metric tons of a limited number of staple fiber products with differentiated specifications or some products with extremely low prices. As China develops more differentiated and high-quality staple fiber products and homemade raw materials create a combined cost advantage, China's staple fiber imports show a downward trend. According to customs data, China's staple fiber imports totaled 162,100 metric tons in 2021, down 1.94% year-on-year (YoY).

Figure 11 China's Staple Fiber Imports and Growth 2017–2021

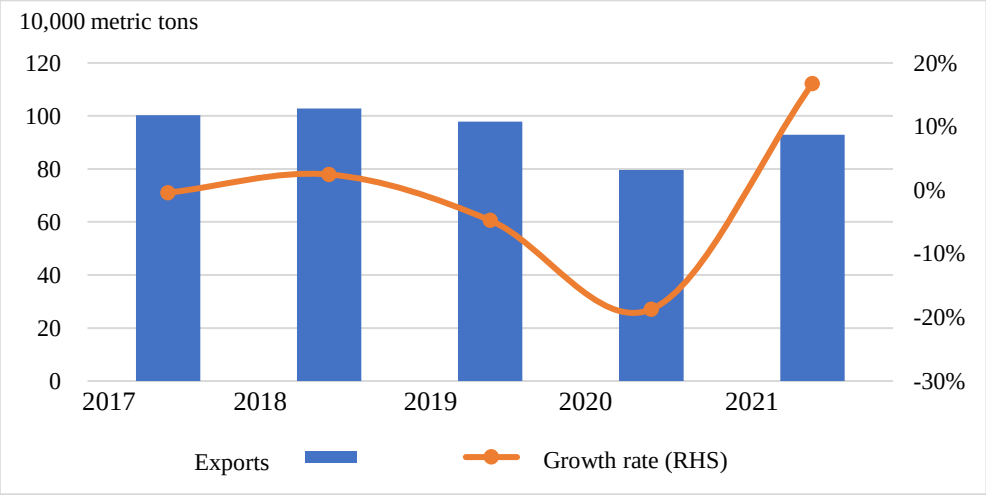


Source: OilChem China

China's overall staple fiber exports declined from 2017 to 2020. In 2020, China's exports did not increase mainly due to a high export barrier arising from ongoing trade frictions and the

outbreak of COVID-19. In 2021, China's staple fiber exports grew as China saw a surge in production capacity, and the overseas local supply of staple fibers was impaired by the pandemic situation. According to customs data, China's staple fiber exports totaled 929,000 metric tons in 2021, up 16.75% YoY.

Figure 12 China's Staple Fiber Exports and Growth 2017 - 2021



Source: OilChem China

(IV) Domestic trades

China generally sees an east-to-west and north-south staple fiber trade flow. In the physical market, staple fibers flow from east to west as the eastern provinces Jiangsu, Fujian, and Zhejiang are major staple fiber producers, and the western provinces including Shandong, Hubei, Jiangxi, and Hebei staple fiber consumers with little or no staple fiber production capacity. Jiangsu's staple fibers mostly flow to Shandong, Hebei, and other regions, Zhejiang's staple fibers to Jiangxi, Hubei, and other regions, and Fujian's staple fibers to Jiangxi, Hubei, Guangdong, and other regions. Meanwhile, the interconnection of Jiangsu, Fujian, and Zhejiang markets enables Fujian-Zhejiang, Jiangsu-Fujian, and other inter-region sales, leading to the north-to-south trade flow.

Figure 13 China's Staple Fiber Trade Flow

Source: Huarui Information

Currently, staple fiber trades are dominated by direct sales and supported by distribution, with a ratio of about 7:3 between them. Under the direct sales model, staple fibers are sold by producers directly to downstream consumers, while under the distribution model, staple fibers are sold by producers to traders, who then re-sell them to consumers. Considering that the major production regions of staple fibers are not identical to the major consumption regions, most of the staple fiber producers will adopt the distribution model when initially entering the markets outside their region for the rapid development of the markets and, after establishing a stable customer base, will tend to use the direct sales model. As the domestic staple fiber market becomes more mature, staple fibers have become oversupplied in recent years, intensifying market competition. To reduce sales costs and enhance customer engagement, producers have gradually reduced the proportion of the distribution model. In China, Fujian has the lowest distribution ratio due to the concentrated distribution of staple fiber producers and consumers.

(V) Shipment

In China, staple fibers are transported mainly by truck, ship, and train, with truck and ship transportation as the dominant one. Costs are a major consideration when the mode of transportation is selected. For example, staple fibers produced in Jiangsu are transported mostly by ship when being sold to remote coastal regions or the upstream and midstream regions of the Yangtze River, by truck in case of short-distance transportation within the province or transportation to inland regions not along the Yangtze River, and by train when being shipped to Sichuan, Shaanxi, or other inland regions.

The shipment of physical staple fibers is not restricted by shipment distance. For an individual producer, the sales distance of staple fibers often depends on whether the price of the staple fibers plus the transportation costs remains competitive. Staple fibers produced in Jiangsu and Zhejiang can be sold to the Shandong and Hebei markets and transported by ship to Hubei and Hunan and as far as to Sichuan and Chongqing; those produced in Fujian can also be sold to Jiangxi, Guangdong, Zhejiang, Jiangsu, and other regions, or by sea to Shandong due to the

lower costs of ocean shipment.

As for shipment volume, the loading capacity of long-distance trucks equipped with a typical 13-meter trailer can reach about 30 metric tons of staple fibers (80 packages) per truck. A single ship is affected by the regional consumption of staple fibers in terms of loading capacity and usually travels to Shandong, Hubei, and other regions with greater consumption in a full loading condition and to Northeast China and other regions with lesser consumption mostly by container. The loading capacity of marine containers is about 26 metric tons (70 packages) per container.

III. Polyester Staple Fiber Futures Contract

Polyester Staple Fiber Futures Contract Specifications

Product	Polyester Staple Fiber
Trading Unit	5 metric tons/lot
Price Quotation	Chinese yuan (CNY)/metric ton
Minimum Price Fluctuation	CNY2/metric ton
Daily Price Limit	±4% of the settlement price of the previous trading day and as provided for in the *Measures for the Administration of Futures Trading Risk Control of Zhengzhou Commodity Exchange*
Minimum Trading Margin	5% of contract value
Contract Months	January, February, March, April, May, June, July, August, September, October, November, and December
Trading Hours	Monday to Friday (except public holidays) 9:00 a.m.-11:30 a.m. 1:30 p.m.-3:00 p.m. (Beijing time) Other trading hours specified by Zhengzhou Commodity Exchange
Last Trading Day	The 10th trading day of the delivery month
Last Delivery Day	The 13th trading day of the delivery month
Grade and Quality	As specified by the *Measures for the Administration of Futures Delivery of Zhengzhou Commodity Exchange*
Delivery Point	Designated by Zhengzhou Commodity Exchange
Delivery Method	Physical Delivery
Product Code	PF
Listing Exchange	Zhengzhou Commodity Exchange

IV. Basic Trading Rules

(I) Margin Requirements

A polyester staple fiber futures contract has a minimum Trading Margin rate of 5% of contract value.

The Trading Margin rate of a polyester staple fiber futures contract is set based on its trading periods and varies as below:

Trading period	Trading Margin rate
From listing to the 15th calendar day of the month preceding the delivery month	5% of contract value
From the 16th calendar day to the last calendar day of the month preceding the delivery month	10% of contract value
Delivery month	20% of contract value

(II) Price Limit

A polyester staple fiber futures contract has a price limit of ±4% of the settlement price of the previous trading day.

If the Zhengzhou Commodity Exchange (the "Exchange") adjusts the Trading Margin rate and price limit of polyester staple fiber futures contracts according to the *Measures for the Administration of Risk Control of Zhengzhou Commodity Exchange* and other rules of the Exchange, such adjusted values shall apply.

(III) Position Limit

No position limit is applicable to futures brokerage Members. For a non-futures brokerage Member or client, the position limit of a polyester staple fiber futures contract varies as follows:

<table>
<tr><th>Trading period</th><th colspan="2">Maximum long position or short position held by a non-futures brokerage Member or client (Lot)</th></tr>
<tr><td rowspan="2">From listing to the 15th calendar day of the month preceding the delivery month</td><td>Open interest < 100,000</td><td>10,000</td></tr>
<tr><td>Open interest≥100,000</td><td>10% of open interest</td></tr>
<tr><td>From the 16th calendar day to the last calendar day of the month preceding the delivery month</td><td colspan="2">1,500</td></tr>
<tr><td>Delivery month</td><td colspan="2">300
(0 for individuals)</td></tr>
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