

# Production and Market of Paraformaldehyde in China 2024

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## **Executive summary**

In the past decade, China's paraformaldehyde industry has steadily developed. The capacity and output of PF increased at a CAGR of 3.2% and 2.2% from 2014 to 2023, respectively.

## **Production**

Domestic PF production is mainly distributed in Hebei, Jiangsu, and Shandong with sufficient methanol supply.

From 2018 to 2023, a total of 11 new PF enterprises were added in China. At the same time, due to stricter environmental policies or unsatisfactory performance, a total of 18 companies stopped producing PF and withdrew from the market. During this period, China's PF capacity expanded from 541,000 t/a to 717,000 t/a. At present, there are 28 PF producers in China. Compared with foreign markets where capacity growth has largely stopped, the Chinese PF market is full of vitality and energy.

## **Import and Export**

In 2020, China's export volume of PF exceeded its import volume for the first time, gradually transforming from a net importer of PF to a major exporter of PF. In 2023, China imported 19,443 tonnes of PF. The top three import sources are Taiwan Province, Spain, and Indonesia, the volume combined accounting for 93.7% of the total.

From 2014 to 2018, China's PF export volume continued to decline. In 2019, the downward trend reversed as Taiwan's PF supply declined, leading to a year-on-year increase of 63.8% in China's PF exports. From 2019 to 2023, China's PF export volume maintained growth for five consecutive years. In 2023, China exported a total of 50,085 tonnes of PF, with the top three destinations (Nigeria, Djibouti, and South Korea) accounting for 53.8% of the total export volume.

## **Technology**

The main technologies for PF production in China are rake drying method and spray drying method. Although the rake drying method still lags behind the spray drying method in terms of quality and environmental friendliness, it is adopted by most Chinese PF manufacturers due to low investment. In 2023, a total of 20 PF manufacturers adopted the rake drying method, their capacity combined accounting for 70.7% of national total.

## **Price**

Generally speaking, the price fluctuations of PF in China are largely influenced by raw materials, methanol or

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formaldehyde. In 2023, PF price showed a V-shaped trend, following fluctuations in formaldehyde and methanol prices.

### **Consumption**

In China, PF is mainly consumed in industries such as agrochemical, resin, and pharmaceutical. The agrochemical industry is the largest downstream sector of PF, accounting for 75.5% of the total domestic PF consumption in 2023. Glyphosate (AEA pathway) is the largest end-use market, with the PF consumption accounting for 71.6% of the national total in 2023. The second largest downstream sector in China is the resin industry. In 2023, PF consumption in the resin industry accounted for 20.7% of the national total.

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## **Methodology**

### **Introduction**

This report is the 20th edition, based on the former one finished in April 2023, focusing on the situation of China's paraformaldehyde (PF) industry in 2023 and Q1 2024, as well as forecasting its future development trend. The report is formulated in April 2024 and aims to disclose the latest production and market information of China's PF industry. The data for 2023 and before are based on CCM's database and other various sources as mentioned in the section of methodology below.

The report is based on data sourced by diverse methods, which are listed as follows:

#### **- Desk research**

Desk research includes access to published magazines, journals, government statistics, industry statistics, customs statistics, association seminars as well as information on the Internet. Much work has gone into the compilation and analysis of the information obtained. Where necessary, information has been checked and discussed internally related to market structure and performance characteristics as key producers, key end users, production levels, end user demand and so on.

#### **- Telephone interview**

CCM carried out extensive telephone interviews with almost all producers to get detailed information about production, market, competition, future plan, etc.

Interviewees include producers, end users, traders, material suppliers, associations involved, industry experts.

#### **- Network search**

CCM employs a network to contact industry participants by using B2B websites and software.

#### **- Data processing and presentation**

The data collected and compiled was variously sourced from:

- CCM's database
- Published articles from periodicals, magazines, journals and third-party databases
- Statistics from governments and international institutes

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- Telephone interviews with domestic producers, joint ventures, service suppliers and government agencies
  - Third-party data providers
  - Customs statistics
  - Comments from industrial experts
  - Professional databases
  - Information from the Internet

The data has been combined and cross-checked to ensure that this report is as accurate and methodologically sound as possible. Throughout the process, a series of discussions were held within CCM to systematically analyse the data and draw appropriate conclusions.

### **Abbreviation**

YoY: year on year

CAGR: compound annual growth rate

PF: paraformaldehyde

AEA: aminoethanoic acid (glycine)

HCN: hydrogen cyanide

IDA: iminodiacetic acid

IDAN: iminodiacetonitrile

DEA: diethanolamine

POM: polyformaldehyde

N/A: not available

MDI: methylene diphenyl diisocyanate

BDO: 1,4-butanediol

CAS: Chemical Abstracts Service

COVID-19: Coronavirus Disease 2019

*Note: Apparent consumption = output + import – export*

### **Unit**

t: tonne, equals to metric tonne in this report

/t: per tonne

t/a: tonne per year, tonne per annum

kg: kilogram

USD: currency unit in the US, also called US dollar

Table 1 Regions covered

| Region (Chinese mainland) | Name   |
|---------------------------|--|
| Province (22)             | Heilongjiang, Jilin, Anhui, Fujian, Liaoning, Hebei, Shandong, Gansu, Qinghai, Henan, Sichuan, Jiangsu, Hubei, Hunan, Jiangxi, Zhejiang, Guangdong, Shaanxi, Hainan, Shanxi, Guizhou, Yunnan |
| Autonomous region (5)     | Guangxi, Inner Mongolia, Tibet, Xinjiang, Ningxia  |
| Municipality (4)          | Beijing, Shanghai, Tianjin, Chongqing  |

Source:CCM

Table 2 Exchange rate USD/CNY, Jan. 2013–March 2023

| Year | Jan.   | Feb.   | March  | April  | May    | June   | July   | Aug.   | Sept.  | Oct.   | Nov.   | Dec.   | Average |
|------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| 2013 | 6.2787 | 6.2842 | 6.2743 | 6.2471 | 6.1970 | 6.1718 | 6.1725 | 6.1708 | 6.1588 | 6.1393 | 6.1372 | 6.1160 | 6.1920  |
| 2014 | 6.1043 | 6.1128 | 6.1358 | 6.1553 | 6.1636 | 6.1557 | 6.1569 | 6.1606 | 6.1528 | 6.1441 | 6.1432 | 6.1238 | 6.1428  |
| 2015 | 6.1272 | 6.1339 | 6.1507 | 6.1302 | 6.1143 | 6.1161 | 6.1167 | 6.3056 | 6.3691 | 6.3486 | 6.3666 | 6.4476 | 6.2288  |
| 2016 | 6.5527 | 6.5311 | 6.5064 | 6.4762 | 6.5315 | 6.5874 | 6.6774 | 6.6474 | 6.6715 | 6.7442 | 6.8375 | 6.9182 | 6.6425  |
| 2017 | 6.8918 | 6.8713 | 6.8932 | 6.8845 | 6.8827 | 6.8019 | 6.7772 | 6.7148 | 6.5909 | 6.6493 | 6.6300 | 6.6067 | 6.7662  |
| 2018 | 6.5079 | 6.3045 | 6.3352 | 6.2764 | 6.3670 | 6.4078 | 6.6157 | 6.8293 | 6.8347 | 6.8957 | 6.9670 | 6.9431 | 6.6070  |
| 2019 | 6.8482 | 6.7081 | 6.6957 | 6.7193 | 6.7344 | 6.8896 | 6.8716 | 6.8938 | 7.0883 | 7.0726 | 7.0437 | 7.0262 | 6.8826  |
| 2020 | 6.9614 | 6.9249 | 6.9811 | 7.0771 | 7.0690 | 7.1315 | 7.0710 | 6.9980 | 6.8498 | 6.7796 | 6.7050 | 6.5921 | 6.9284  |
| 2021 | 6.5408 | 6.4623 | 6.4754 | 6.5584 | 6.4895 | 6.3572 | 6.4709 | 6.4660 | 6.4680 | 6.4604 | 6.4192 | 6.3693 | 6.4615  |
| 2022 | 6.3794 | 6.3580 | 6.3014 | 6.3509 | 6.5672 | 6.6651 | 6.6863 | 6.7467 | 6.8821 | 7.0992 | 7.2081 | 7.1225 | 6.6972  |
| 2023 | 6.9475 | 6.7492 | 6.9400 | 6.8805 | 6.9054 | 7.0965 | 7.2157 | 7.1283 | 7.1788 | 7.1789 | 7.1778 | 7.1104 | 7.0424  |
| 2024 | 7.0770 | 7.1049 | 7.1059 | -      | -      | -      | -      | -      | -      | -      | -      | -      | -       |

Source:People's Bank of China

## 1 Market information of paraformaldehyde (PF)

### 1.1 Global overview of PF

Worldwide PF production is mainly distributed in China, Spain, the US, Germany, etc. Mainland China is the largest PF producing area with 717,000 t/a production capacity, and PF capacity beyond Mainland China was over 290,000 t/a in 2023.

The top three PF producers beyond Mainland China in 2023 were Ercros S.A., Celanese Corporation and Chang Chun Plastics Co., Ltd. (CCP), with capacity of 115,000 t/a, 50,000 t/a and 35,000 t/a respectively. The capacity of PF of CCP remained unchanged in 2019–2023.

Table 1.1-1 PF producers beyond Mainland China, 2023

| No. | Company                               | Country/region  | Specification | PF capacity, t/a |
|-----|---------------------------------------|-----------------|---------------|------------------|
| 1   | Ercros S.A.                           | Spain           | 89%–98%       | 115,000          |
| 2   | Celanese Corporation                  | The US          | 91%–97%       | 50,000           |
| 3   | Chang Chun Plastics Co., Ltd.         | Taiwan Province | 88%, 92%±1%   | 35,000           |
| 4   | Prefere Resins Holding GmbH           | Germany         | 89%–97%       | 30,000           |
| 5   | Mitsubishi Gas Chemical Company, Inc. | Japan           | 86%, 92%      | 11,000           |
| 6   | U-JIN Chemical Co., Ltd.              | South Korea     | N/A           | 10,000           |
| 7   | PT Dover Chemical                     | Indonesia       | 92±1%, 96±1%  | 10,000           |
| 8   | Sina Chemical Industries Company      | Iran            | 96%           | 10,000           |
| 9   | Methanol Chemicals Company            | Saudi Arabia    | 93±1%, 96±1%  | 7,000            |
| 10  | Venlon Enterprises Ltd.               | India           | 93±1%, 96±1%  | 5,000            |
| 11  | Allied Resins & Chemicals Ltd.        | India           | N/A           | N/A              |
| 12  | Adhesivos S.A. de C.V.                | Mexico          | 90%–92%       | N/A              |
| 13  | Synthite Limited                      | The UK          | 82%–97%       | N/A              |
| 14  | Uralchimplast                         | Russia          | 94%–98%       | N/A              |

Note:INEOS Paraform GmbH & Co. KG completed the sale of its melamines and paraformaldehyde businesses to Prefere Resins Holding GmbH in 2019.

Source:CCM

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## 1.2 PF development in China

In the early 1970s, Shanghai Solvent Plant began to produce PF. 37% formaldehyde was concentrated into 70% solvent, and then PF was synthesized on the existence of catalyst concentrated sulfuric acid. The earliest producers included Shanghai Solvent Plant and Jilin Petrochemical Company. At that time, they only produced solid formaldehyde with poor quality.

Till 1992, the PF with low polymerization degree was exploited and produced by Jilin Petrochemical Company. The producing technology and quality of PF had been improved a lot. After the technical improvement, the PF capacity in Jilin Petrochemical Company reached 2,000 t/a in 1995, but it could only produce low content (90%) instead of high content (95%).

In 1996, there were a few companies producing PF, including Xinle Dongyuan Jinhua Co., Ltd. (PF capacity: 1,000 t/a), Jilin Petrochemical Company (PF capacity: 1,000 t/a), Shanghai Solvent Plant (PF capacity: 500 t/a), Wuxi Pesticide Factory (PF capacity: 500 t/a) and Taiyuan Organic Chemical Factory (PF capacity: 500 t/a). There were also two companies under construction, including Jiamusi Chemical Factory (PF capacity: 2,000 t/a) and one company in Henan Province.

In 1998 Jilin Petrochemical Company stopped producing 95% PF due to immature technology. Since 1998, the import volume of PF had increased a lot, greatly impacting the domestic producers whose technology was immature. As a result, some small ones such as Wuxi Pesticide Factory had to stop production.

The active producers of PF in 1998 included Shanghai Solvent Plant (PF capacity: 2,500 t/a), Heilongjiang Jiamusi No. 5 Chemical Factory (PF capacity: 2,000 t/a), Anhui Chuzhou Fertilizer Factory (PF capacity: 1,000 t/a), Xinle Dongyuan Jinhua Co., Ltd. (PF capacity: 1,000 t/a), Jilin Shijinggou United Chemical Factory (PF capacity: 500 t/a) and Zhejiang Haiyan Pesticide Plant (PF capacity: 500 t/a).

In July 1999, Jiangsu Nantong Jiangshan Co., Ltd. introduced technology from Eurotecnica, and it launched PF production with a capacity of 10,000 t/a in 2003.

In 2001, the capacity of PF was around 14,000 t/a in China. However, the annual output of PF was only 3,000 tonnes–4,000 tonnes. The low production in China was attributed to the high production cost and the inefficient production technology. Some domestic producers claimed to produce PF with content of 95%, yet its water solubility was poor, needing 30 minutes to dissolve. In contrast, the imported ones could dissolve in water in 10 minutes.

In 2002, the capacity of PF in China was around 27,200 t/a, and the output was up to 16,540 tonnes. By early 2002, there had been only four active PF producers in China, including Hebei Xinhua Co., Ltd., Shanghai Solvent Plant,



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Anhui Chuzhou Fertilizer Factory and Jiangsu Jinghuang Chemical Co., Ltd. Some companies planned to install PF production lines, including Guangxi Liuzhou Chemical Industry Group Co., Ltd. and Shanghai Shenxing Chemical Co., Ltd.

In 2003, the average production cost of PF was about USD725/t among domestic producers, while the average market price of PF was much lower—USD469/t. Thus, producers in China were less competitive than overseas companies in PF price.

In 2004–2005, 18 companies had been engaged in the production of PF. Among them, 9 were active in the PF production; 9 had stopped the production. In addition, 4 companies had been confirmed to be potential producers. There was a new PF producer in 2005, namely Zhejiang Jiarun Chemical Co., Ltd.

In 2006, there were about 11 active PF producers in China with a total capacity of 90,500 t/a. The number of active PF producers increased to 14 in 2007 and the capacity rose to 232,000 t/a, up by about 156% over the previous year, mainly attributed to great capacity expansion of some manufacturers.

Stimulated by the flourishing glyphosate market, China began to expand PF production since 2007. Many companies, especially those formalin producers, entered into the PF production, and many former PF producers expanded their PF production. This upsurge of PF new projects and expansion projects greatly expanded PF capacity from 232,000 t/a in 2007 to 347,000 t/a in 2008, increasing by nearly 50%. In 2008, there were 24 active PF producers in China, and the total PF output was about 122,671 tonnes, increasing by about 54.6% over the previous year.

In 2009, though the global financial crisis heavily struck the glyphosate industry, which led to the demand downturn and price fall of glyphosate and then greatly impacted the PF industry, there were still many new producers engaged in PF production, and production expansions were still going on. In 2009, there were 28 PF producers in China, including 26 active producers and 2 idle ones. The total capacity and output of these 28 PF producers were 418,000 t/a and 126,100 tonnes, increasing by 20.5% and 2.8% year on year respectively. And there were two potential PF producers at that time.

In 2010, there were 27 companies in China which had been confirmed to be engaged in PF production. 22 of them were active in PF production; 5 were idle. China owned a total PF capacity of 459,000 t/a and output of 132,000 tonnes that year. And there were 3 potential companies during this period.

In 2011, the total capacity of PF reached 467,000 t/a, 1.7% higher than that in 2010. Six companies stopped PF production after a long time of idle situation in 2011. This mainly resulted from the overcapacity of PF, the downturn of glyphosate market and their lack of competitiveness.

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In 2012, the domestic PF capacity decreased to 413,000 t/a, but the output increased greatly to 184,000 tonnes with a year on year growth rate of 31.4%, which was mainly caused by the increasing demand from the domestic glyphosate industry.

In 2013, the PF capacity increased along with the launch of some new PF production lines and the output increased to 212,500 tonnes, driven by the increasing demand from the domestic glyphosate industry.

In 2014, the capacity of PF increased to 538,000 t/a with the launch of Jiangsu Sanmu Group Co., Ltd.'s new PF production line with a capacity of 20,000 t/a, and the national output increased to 235,000 tonnes.

In 2015, the capacity of PF increased to 642,000 t/a because several new producers have finished their construction of PF projects and put them into operation. The output of PF also increased to 248,500 tonnes due to the increasing domestic demand.

In 2016, the capacity and output of PF increased to 670,000 t/a and 270,000 tonnes, respectively. Due to the increasing domestic demand, the apparent consumption of PF increased by 12.4%.

In 2017 and 2018, the domestic PF capacity decreased to 589,000 t/a and 541,000 t/a respectively, since some producers stopped PF production due to stricter environmental protection policies or poor performance.

In 2019–2022, the capacity of PF increased from 560,000 t/a to 667,000 t/a in China. During this period, there were some new entrants and expansion projects. In 2019, Nantong Jiangtian's 35,000 t/a expansion project was built up and put into production. Shijiazhuang Yaze Chemical Co., Ltd.'s 25,000 t/a project and Shandong Zhengxin New Energy Co., Ltd.'s 40,000 t/a project were completed and put into operation in 2020. And at the end of 2020, Ningxia Huaye Fine Chemical Co., Ltd.'s 30,000 t/a project was built up. However, some producers chose to exit the industry in this period. For instance, Hebei Xinhua Co., Ltd. ceased production in 2020 for failing to meet the conditions of relocation and development. In late Dec., 2022, Zhenjiang LCY Performance Materials Co., Ltd. terminated the production due to the policy to protect the ecological environment in the Yangtze River Economic Belt.

In 2023, China's PF capacity expanded further to 717,000 t/a. The going into operation or commissioning of three PF projects (30,000 t/a each at Qinyang Yongrun Chemical Industry Co., Ltd., Yacoo Technology (Anqing) Co., Ltd. and Hutubi Ruiyuantong Chemical Co., Ltd.) increased China's PF capacity by 90,000 t/a. The year also witnessed 40,000 t/a PF capacity withdrawn from the domestic market, including 30,000 t/a in Zhenjiang LCY Performance Materials Co., Ltd. with its shutdown in Dec. 2022 and 10,000 t/a in Nanhe Huayang Silicon Industry Co., Ltd. with its company cancellation in May 2023.

### **1.3 Properties of PF**

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## - Physical properties

Table 1.3-1 Basic information of paraformaldehyde

|                     |  |
|---------------------|--|
| CAS number          | 30525-89-4   |
| Molecular formula   | $\text{OH}(\text{CH}_2\text{O})_n\text{H}$ (n = 8-100) |
| Appearance          | white crystalline solid                                |
| Density             | $1.42 \text{ g}\cdot\text{cm}^{-3}$ (25 °C)            |
| Melting point       | 120 °C–170 °C  |
| Flash point         | 70 °C  |
| Self-ignition point | 300 °C   |

Source:CCM

PF can dissolve in water and turn into formaldehyde. It also dissolves in sodium hydroxide solution. It is insoluble in ethanol and aether.

It is easy to be decomposed into formaldehyde when meeting strong acids, strong alkali or in high temperatures.

The species of PF include low concentration (91%–93%) and high concentration (95%–97%).

## - Technology in brief

PF can be obtained via dehydration and fusculation of formaldehyde solvent. It is a kind of solid grain, with the content of 92%–97%.

The pathways for PF production include catalyst process and spraying drying process (without catalyst). Apart from 91%–92% PF, catalyst process can produce 95% PF, but spraying drying process can only produce 91%–92% PF.

The process steps of PF production include vacuum concentration, polymerization, drying, sieving and packaging.

Table 1.3-2 Unit consumption of PF (per tonne) through the catalyst process of production

| Item             | Unit     | Unit consumption |
|------------------|----------|------------------|
| 37% Formaldehyde | tonne    | 3.7              |
| Catalyst         | kilogram | 10               |
| Ammonia          | kilogram | 100              |
| Electricity      | kWh      | 400              |
| Steam            | tonne    | 5                |

Source:CCM

## 2 Production situation of PF in China

### 2.1 Producers of PF in China

42 companies related to PF were studied. As of March 2024, CCM finds,

- 26 of them were active producers;
- 2 of them suspended production;
- 14 of them were potential producers.

The new entrants, Qinyang Yongrun Chemical Industry Co., Ltd. (formerly the Qinyang Yongrun Technology Development Co., Ltd.) and Yacoo Technology (Anqing) Co., Ltd. started production in March 2023. Hutubi Ruiyantong Chemical Co., Ltd.'s 30,000 t/a PF project was put into trial production in late 2023 and officially launched the product into the market in early 2024. All PF that they produce are granular: Qinyang Yongrun and Hutubi Ruiyantong produce 92% and 96% granule, and Anqing Yacoo can only produce 92% granule at present. It should be noted that another 30,000 t/a PF project (96% granule) of Anqing Yacoo is under construction and the new line is expected to be put into operation in late 2024.

Zhenjiang LCY Performance Materials Co., Ltd., since its shutdown in late 2022, transferred its facilities and production technology to Anhui Ruibai New Material Co., Ltd. in June 2023. Currently, Anhui Ruibai is demolishing and installing the facilities, and it disclosed that the work could be completed by May 2024 at the earliest.

Table 2.1-1 Location and technology source of PF producers in China, as of March 2024

| No. | Producer  | Abbreviation      | Location         | Status, as of March 2024 | Launch time | Technology source                         | Specification |
|-----|---|-------------------|------------------|--------------------------|-------------|---|---------------|
| 1   | Fuhua Tongda Agro-chemical Technology Co., Ltd. (Fuhua Tongda Chemical Co., Ltd.) | Fuhua Tongda      | Sichuan Province | Active                   | 2014        | Domestic                                  | 96%           |
| 2   | Hebei Jintaida Chemical Co., Ltd.   | Hebei Jintaida    | Hebei Province   | Active                   | 2013        | Wuxi Suyang Chemicals Equipment Co., Ltd. | 96%           |
| 3   | Hebei Yuhang Chemical Co., Ltd.   | Hebei Yuhang      | Hebei Province   | Active                   | 1999        | Wuxi Suyang Chemicals Equipment Co., Ltd. | 95%–97%       |
| 4   | Nantong Jiangtian Chemical Co.,   | Nantong Jiangtian | Jiangsu Province | Active                   | Aug. 2003   | GEA Niro                                  | 96%, 98%      |

|    |  |                        |                                  |        |            |  |        |
|----|--|------------------------|----------------------------------|--------|------------|--|--------|
|    | Ltd.   |                        |                                  |        |            |  |        |
| 5  | Hengshui Yinhe Chemical Co., Ltd.                    | Hengshui Yinhe         | Hebei Province                   | Active | May 2002   | Wuxi Suyang Chemicals Equipment Co., Ltd.    | 96%±1% |
| 6  | Weifang Xudong Chemical Co., Ltd.                    | Weifang Xudong         | Shandong Province                | Active | March 2007 | Wuxi Suyang Chemicals Equipment Co., Ltd.    | >95%   |
| 7  | Anhui Denuo Chemical Co., Ltd.                       | Anhui Denuo            | Anhui Province                   | Active | 2004       | Hebei Xinhua                                 | 96%    |
| 8  | Jiangsu Sanmu Group Co., Ltd.                        | Jiangsu Sanmu          | Jiangsu Province                 | Active | 2014       | Jiangsu Kaimao Chemical Technology Co., Ltd. | 92%    |
| 9  | Zibo Qixing Chemical Technology Co., Ltd.            | Zibo Qixing            | Shandong Province                | Active | 2014       | Wuxi Suyang Chemicals Equipment Co., Ltd.    | 96%    |
| 10 | Linqu Outai Chemical Co., Ltd.                       | Linqu Outai            | Shandong Province                | Active | 2008       | Wuxi Suyang Chemicals Equipment Co., Ltd.    | 96%    |
| 11 | Linyi Shengyang Chemical Co., Ltd.                   | Linyi Shengyang        | Shandong Province                | Active | 2008       | Domestic                                     | 96%    |
| 12 | Inner Mongolia Jiaquan Chemical Technology Co., Ltd. | Inner Mongolia Jiaquan | Inner Mongolia Autonomous Region | Active | 2015       | Wuxi Suyang Chemicals Equipment Co., Ltd.    | 96%    |
| 13 | Qingzhou Hengxing Chemical Co., Ltd.                 | Qingzhou Hengxing      | Shandong Province                | Active | 2006       | Domestic                                     | 96%±1% |
| 14 | Xinjiang Dearsun Chemical Co., Ltd.                  | Xinjiang Dearsun       | Xinjiang Uygur Autonomous Region | Active | 2016       | Wuxi Suyang Chemicals Equipment Co., Ltd.    | 96%    |
| 15 | Weifang Huifeng Chemical Co., Ltd.                   | Weifang Huifeng        | Shandong Province                | Active | 2017       | Wuxi Suyang Chemicals Equipment Co., Ltd.    | 96%    |
| 16 | Hubei Trisun Chemicals Co., Ltd.                     | Hubei Trisun           | Hubei Province                   | Active | 2018       | Domestic                                     | 96%    |

|    |  |                    |                                  |        |            |  |          |
|----|--|--------------------|----------------------------------|--------|------------|--|----------|
| 17 | Xinjiang Wanchang New Energy Co., Ltd.   | Xinjiang Wanchang  | Xinjiang Uygur Autonomous Region | Active | 2018       | Domestic                                   | 92%, 96% |
| 18 | Dongying Fangzheng Chemical Co., Ltd.  | Dongying Fangzheng | Shandong Province                | Active | 2018       | Domestic                                   | 96%      |
| 19 | Ningxia Jinhai Xinning Chemical Co., Ltd.  | Ningxia Xinning    | Ningxia Hui Autonomous Region    | Active | 2018       | Wuxi Suyang Chemicals Equipment Co., Ltd.  | 96%      |
| 20 | Shandong Zhengxin New Energy Co., Ltd.   | Shandong Zhengxin  | Shandong Province                | Active | Jan. 2020  | Domestic                                   | 96%      |
| 21 | Gansu Taier Fine Chemical Co., Ltd. (Gansu Tailu Technology Chemical Co., Ltd.)                | Gansu Taier        | Gansu Province                   | Active | 2020       | Linyi Taier                                | 95%±1%   |
| 22 | Shijiazhuang Yaze Chemical Co., Ltd.   | Shijiazhuang Yaze  | Hebei Province                   | Active | 2020       | Domestic                                   | 96%      |
| 23 | Ningxia Huaye Fine Chemical Co., Ltd.  | Ningxia Huaye      | Ningxia Hui Autonomous Region    | Active | 2021       | Hebei Yuhang Chemical Co., Ltd.            | 96%      |
| 24 | Qinyang Yongrun Technology Development Co., Ltd. (Qinyang Yongrun Chemical Industry Co., Ltd.) | Qinyang Yongrun    | Henan Province                   | Active | March 2023 | N/A  | 92%, 96% |
| 25 | Yacoo Technology (Anqing) Co., Ltd.  | Anqing Yacoo       | Anhui Province                   | Active | March 2023 | Jiangsu Huda Chemical Technology Co., Ltd. | 92%      |
| 26 | Hutubi Ruiyuantong Chemical Co., Ltd.  | Hutubi Ruiyuantong | Xinjiang Uygur Autonomous Region | Active | 2023       | Domestic                                   | 92%, 96% |

|    |   |                      |                                  |           |      |   |        |
|----|---|----------------------|----------------------------------|-----------|------|---|--------|
| 27 | Anhui Hongyuan Chemical Technology Co., Ltd.            | Anhui Hongyuan       | Anhui Province                   | Suspended | 2017 | Wuxi Suyang Chemicals Equipment Co., Ltd. | 96%    |
| 28 | Hubei Yihua Chemical Industry Co., Ltd.                 | Hubei Yihua          | Hubei Province                   | Suspended | 2017 | Wuxi Suyang Chemicals Equipment Co., Ltd. | 96%    |
| 29 | Anhui Ruibai New Material Co., Ltd.                     | Anhui Ruibai         | Anhui Province                   | Potential | /    | N/A                                       | 92%    |
| 30 | Jining Huiquan Chemical Co., Ltd.                       | Jining Huicui        | Shandong Province                | Potential | /    | N/A                                       | N/A    |
| 31 | Dingyuan County Linxing Chemical Co., Ltd.              | Dingyuan Linxing     | Anhui Province                   | Potential | /    | N/A                                       | N/A    |
| 32 | Juancheng County Zhanbang Chemical Co., Ltd.            | Juancheng Zhanbang   | Shandong Province                | Potential | /    | Domestic                                  | 97%±2% |
| 33 | Ningxia Ningshun New Material Co., Ltd.                 | Ningxia Ningshun     | Ningxia Hui Autonomous Region    | Potential | /    | N/A                                       | 96%    |
| 34 | Xinjiang Shunyuan Chemical Technology Co., Ltd.         | Xinjiang Shunyuan    | Xinjiang Uygur Autonomous Region | Potential | /    | N/A                                       | N/A    |
| 35 | Qinzhou Juli New Energy Technology Co., Ltd.            | Qinzhou Juli         | Guangxi Autonomous Region        | Potential | /    | N/A                                       | N/A    |
| 36 | Anhui Hehong Chemical Co., Ltd.                         | Anhui Hehong         | Anhui Province                   | Potential | /    | N/A                                       | 95%    |
| 37 | Wen'an County Decheng New Material Technology Co., Ltd. | Decheng New Material | Hebei Province                   | Potential | /    | N/A                                       | N/A    |



|    |  |                    |                                  |           |   |     |     |
|----|--|--------------------|----------------------------------|-----------|---|-----|-----|
| 38 | Shandong Linfeng New Material Technology Co., Ltd. | Shandong Linfeng   | Shandong Province                | Potential | / | N/A | 95% |
| 39 | Guangxi Guifulin Technology Co., Ltd.              | Guangxi Guifulin   | Guangxi Zhuang Autonomous Region | Potential | / | N/A | 95% |
| 40 | Shanshan Shenglian New Energy Technology Co., Ltd. | Shanshan Shenglian | Xinjiang Uygur Autonomous Region | Potential | / | N/A | N/A |
| 41 | Gansu Hongfu Weiye Technology Co., Ltd             | Hongfu Weiye       | Gansu Province                   | Potential | / | N/A | N/A |
| 42 | Hebei Yuanlu Chemical Co., Ltd                     | Hebei Yuanlu       | Hebei Province                   | Potential | / | N/A | N/A |

Note:Hubei Trisun Chemicals Co., Ltd. merged its wholly-owned subsidiary Hubei Xingxin Materials Co., Ltd. After the merger, Hubei Trisun continues to operate, while Hubei Xingxin was cancelled on 1 March, 2021.

Source:CCM

Table 2.1-2 Capacity and output of major PF producers in China, 2021–Q1 2024E

| No. | Producer          | 2021          |               | 2022          |               | 2023          |               | Q1 2024E      |               |
|-----|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|     |                   | Capacity, t/a | Output, tonne | Capacity, t/a | Output, tonne | Capacity, t/a | Output, tonne | Capacity, t/a | Output, tonne |
| 1   | Fuhua Tongda      | 60,000        | 58,000        | 60,000        | 57,000        | 60,000        | 58,000        | 60,000        | 13,200        |
| 2   | Hebei Jintaida    | 40,000        | 26,000        | 40,000        | 25,000        | 40,000        | 22,300        | 40,000        | 5,600         |
| 3   | Hebei Yuhang      | 30,000        | 18,200        | 30,000        | 17,800        | 30,000        | 15,500        | 30,000        | 2,500         |
| 4   | Nantong Jiangtian | 80,000        | 59,000        | 80,000        | 62,000        | 80,000        | 69,200        | 80,000        | 15,500        |
| 5   | Hengshui Yinhe    | 30,000        | 8,000         | 30,000        | 8,000         | 30,000        | 7,200         | 30,000        | 1,600         |
| 6   | Weifang Xudong    | 10,000        | 4,200         | 10,000        | 3,800         | 10,000        | 2,800         | 10,000        | 700           |
| 7   | Anhui Denuo       | 20,000        | 3,000         | 20,000        | 2,000         | 20,000        | 1,500         | 20,000        | 400           |
| 8   | Jiangsu Sanmu     | 20,000        | 5,400         | 20,000        | 6,000         | 20,000        | 8,600         | 20,000        | 800           |
| 9   | Zibo Qixing       | 20,000        | 5,000         | 20,000        | 5,000         | 20,000        | 5,400         | 20,000        | 900           |

|              |                        |                |                |                |                |                |                |                |               |
|--------------|------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|
| 10           | Linqu Outai            | 6,000          | 600            | 6,000          | 500            | 6,000          | 500            | 6,000          | 0             |
| 11           | Linyi Shengyang        | 6,000          | 1,000          | 6,000          | 1,000          | 6,000          | 1,000          | 6,000          | 500           |
| 12           | Inner Mongolia Jiaquan | 15,000         | 6,000          | 15,000         | 7,000          | 15,000         | 6,000          | 15,000         | 1,300         |
| 13           | Qingzhou Hengxing      | 6,000          | 2,000          | 6,000          | 1,800          | 6,000          | 1,600          | 6,000          | 400           |
| 14           | Xinjiang Dearsun       | 40,000         | 14,000         | 40,000         | 10,000         | 40,000         | 9,500          | 40,000         | 2,400         |
| 15           | Weifang Huifeng        | 10,000         | 3,200          | 10,000         | 3,000          | 10,000         | 2,400          | 10,000         | 500           |
| 16           | Hubei Trisun           | 33,000         | 32,400         | 33,000         | 32,000         | 33,000         | 32,400         | 33,000         | 5,400         |
| 17           | Xinjiang Wanchang      | 20,000         | 6,000          | 20,000         | 8,000          | 20,000         | 11,400         | 20,000         | 3,000         |
| 18           | Dongying Fangzheng     | 6,000          | 2,000          | 6,000          | 3,000          | 6,000          | 2,100          | 6,000          | 500           |
| 19           | Ningxia Xinning        | 30,000         | 8,000          | 30,000         | 7,000          | 30,000         | 5,600          | 30,000         | 1,400         |
| 20           | Shandong Zhengxin      | 40,000         | 5,000          | 40,000         | 6,000          | 40,000         | 5,300          | 40,000         | 900           |
| 21           | Gansu Taier            | 20,000         | 2,000          | 20,000         | 5,000          | 20,000         | 4,200          | 20,000         | 1,200         |
| 22           | Shijiazhuang Yaze      | 25,000         | 3,000          | 25,000         | 3,000          | 25,000         | 2,200          | 25,000         | 400           |
| 23           | Ningxia Huaye          | 30,000         | 3,000          | 30,000         | 4,000          | 30,000         | 3,400          | 30,000         | 1,400         |
| 24           | Qinyang Yongrun        | /              | /              | /              | /              | 30,000         | 3,200          | 30,000         | 100           |
| 25           | Anqing Yacoo           | /              | /              | /              | /              | 30,000         | 4,100          | 30,000         | 1,500         |
| 26           | Hutubi Ruiyuantong     | /              | /              | /              | /              | 30,000         | 100            | 30,000         | 700           |
| 27           | Anhui Hongyuan         | 10,000         | 0              | 10,000         | 0              | 10,000         | 0              | 10,000         | 0             |
| 28           | Hubei Yihua            | 20,000         | 0              | 20,000         | 0              | 20,000         | 0              | 20,000         | 0             |
| Others       |                        | 40,000         | 33,600         | 40,000         | 24,800         | 0              | 0              | 0              | 0             |
| <b>Total</b> |                        | <b>667,000</b> | <b>308,600</b> | <b>667,000</b> | <b>302,700</b> | <b>717,000</b> | <b>285,500</b> | <b>717,000</b> | <b>62,800</b> |

Note: "E" means estimated.

Source: CCM

Table 2.1-3 Operating rate and output share of major PF producers in China, 2021–Q1 2024E

| No. | Producer | Operating rate |  |  |  | Output share |  |  |  |
|-----|----------|----------------|--|--|--|--------------|--|--|--|
|     |          |                |  |  |  |              |  |  |  |
|     |          |                |  |  |  |              |  |  |  |

|    |                        | 2021  | 2022  | 2023  | Q1 2024E | 2021  | 2022  | 2023  | Q1 2024E |
|----|------------------------|-------|-------|-------|----------|-------|-------|-------|----------|
| 1  | Fuhua Tongda           | 96.7% | 95.0% | 96.7% | 88.0%    | 18.8% | 18.8% | 20.3% | 21.0%    |
| 2  | Hebei Jintaida         | 65.0% | 62.5% | 55.8% | 56.0%    | 8.4%  | 8.3%  | 7.8%  | 8.9%     |
| 3  | Hebei Yuhang           | 60.7% | 59.3% | 51.7% | 33.3%    | 5.9%  | 5.9%  | 5.4%  | 4.0%     |
| 4  | Nantong Jiangtian      | 73.8% | 77.5% | 86.5% | 77.5%    | 19.1% | 20.5% | 24.2% | 24.7%    |
| 5  | Hengshui Yinhe         | 26.7% | 26.7% | 24.0% | 21.3%    | 2.6%  | 2.6%  | 2.5%  | 2.5%     |
| 6  | Weifang Xudong         | 42.0% | 38.0% | 28.0% | 28.0%    | 1.4%  | 1.3%  | 1.0%  | 1.1%     |
| 7  | Anhui Denuo            | 15.0% | 10.0% | 7.5%  | 8.0%     | 1.0%  | 0.7%  | 0.5%  | 0.6%     |
| 8  | Jiangsu Sanmu          | 27.0% | 30.0% | 43.0% | 16.0%    | 1.7%  | 2.0%  | 3.0%  | 1.3%     |
| 9  | Zibo Qixing            | 25.0% | 25.0% | 27.0% | 18.0%    | 1.6%  | 1.7%  | 1.9%  | 1.4%     |
| 10 | Linqu Outai            | 10.0% | 8.3%  | 8.3%  | 0.0%     | 0.2%  | 0.2%  | 0.2%  | 0.0%     |
| 11 | Linyi Shengyang        | 16.7% | 16.7% | 16.7% | 33.3%    | 0.3%  | 0.3%  | 0.4%  | 0.8%     |
| 12 | Inner Mongolia Jiaquan | 40.0% | 46.7% | 40.0% | 34.7%    | 1.9%  | 2.3%  | 2.1%  | 2.1%     |
| 13 | Qingzhou Hengxing      | 33.3% | 30.0% | 26.7% | 26.7%    | 0.6%  | 0.6%  | 0.6%  | 0.6%     |
| 14 | Xinjiang Dearsun       | 35.0% | 25.0% | 23.8% | 24.0%    | 4.5%  | 3.3%  | 3.3%  | 3.8%     |
| 15 | Weifang Huifeng        | 32.0% | 30.0% | 24.0% | 20.0%    | 1.0%  | 1.0%  | 0.8%  | 0.8%     |
| 16 | Hubei Trisun           | 98.2% | 97.0% | 98.2% | 65.5%    | 10.5% | 10.6% | 11.3% | 8.6%     |
| 17 | Xinjiang Wanchang      | 30.0% | 40.0% | 57.0% | 60.0%    | 1.9%  | 2.6%  | 4.0%  | 4.8%     |
| 18 | Dongying Fangzheng     | 33.3% | 50.0% | 35.0% | 33.3%    | 0.6%  | 1.0%  | 0.7%  | 0.8%     |
| 19 | Ningxia Xinning        | 26.7% | 23.3% | 18.7% | 18.7%    | 2.6%  | 2.3%  | 2.0%  | 2.2%     |
| 20 | Shandong Zhengxin      | 12.5% | 15.0% | 13.3% | 9.0%     | 1.6%  | 2.0%  | 1.9%  | 1.4%     |
| 21 | Gansu Taier            | 10.0% | 25.0% | 21.0% | 24.0%    | 0.6%  | 1.7%  | 1.5%  | 1.9%     |
| 22 | Shijiazhuang Yaze      | 12.0% | 12.0% | 8.8%  | 6.4%     | 1.0%  | 1.0%  | 0.8%  | 0.6%     |
| 23 | Ningxia Huaye          | 10.0% | 13.3% | 11.3% | 18.7%    | 1.0%  | 1.3%  | 1.2%  | 2.2%     |
| 24 | Qinyang Yongrun        | /     | /     | 10.7% | 1.3%     | /     | /     | 1.1%  | 0.2%     |

|               |                    |              |              |              |              |               |               |               |               |
|---------------|--------------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|
| 25            | Anqing Yacoo       | /            | /            | 13.7%        | 20.0%        | /             | /             | 1.4%          | 2.4%          |
| 26            | Hutubi Ruiyuantong | /            | /            | 0.3%         | 9.3%         | /             | /             | 0.0%          | 1.1%          |
| 27            | Anhui Hongyuan     | 0.0%         | 0.0%         | 0.0%         | 0.0%         | 0.0%          | 0.0%          | 0.0%          | 0.0%          |
| 28            | Hubei Yihua        | 0.0%         | 0.0%         | 0.0%         | 0.0%         | 0.0%          | 0.0%          | 0.0%          | 0.0%          |
| <b>Others</b> |                    | <b>84.0%</b> | <b>62.0%</b> | <b>0.0%</b>  | <b>0.0%</b>  | <b>10.9%</b>  | <b>8.2%</b>   | <b>0.0%</b>   | <b>0.0%</b>   |
| <b>Total</b>  |                    | <b>46.3%</b> | <b>45.4%</b> | <b>39.8%</b> | <b>35.0%</b> | <b>100.0%</b> | <b>100.0%</b> | <b>100.0%</b> | <b>100.0%</b> |

Note:1. Due to rounding, the total may not equal 100.0%.

2. "E" means estimated.

Source:CCM

Table 2.1-4 List of producers having stopped PF production in China, 2020–Q1 2024

| No. | Producer                                      | Location          | Starting year | Closed year | Specification | Capacity, t/a |
|-----|---|-------------------|---------------|-------------|---------------|---------------|
| 1   | Nanhe Huayang Silicon Industry Co., Ltd.      | Hebei Province    | 2014          | 2023        | 96%           | 10,000        |
| 2   | Zhenjiang LCY Performance Materials Co., Ltd. | Jiangsu Province  | 2002          | 2022        | 92%           | 30,000        |
| 3   | Hebei Xinhua Co., Ltd.                        | Hebei Province    | 1993          | 2020        | 96%           | 5,000         |
| 4   | Linyi Liheng Chemical Co., Ltd.               | Shandong Province | 2005          | 2020        | 96%±1%        | 3,000         |

Source:CCM

## 2.2 Capacity and output of PF

After years of rapid growth, China's PF capacity kept increasing from 90,500 t/a in 2006 to 467,000 t/a in 2011, but it decreased to 413,000 t/a in 2012 because several small PF producers, which had weak competitiveness under the circumstances of overcapacity and sluggish PF market, stopped PF production. The PF capacity increased sharply in 2013 along with the launch of some new PF production lines and had a slight increase to 538,000 t/a in 2014 because Jiangsu Sanmu launched its 20,000 t/a PF project.

In 2015, four PF producers stopped production, but five companies started commercial production of PF, namely Fuhua Tongda (the former Leshan Hongya Chemical Co., Ltd.) with capacity of 60,000 t/a, Zibo Qixing with capacity of 20,000 t/a, Nanhe Huayang with capacity of 10,000 t/a, Shandong Linsen with capacity of 12,000 t/a, and Inner Mongolia Jiaquan with capacity of 15,000 t/a.

In 2016, it was found that there were three more enterprises producing PF as well, namely Linyi Ruisheng with capacity of 10,000 t/a, Qingzhou Hengxing with capacity of 6,000 t/a, and Linyi Liheng with capacity of 3,000 t/a. In addition, Xinjiang Dearsun's 20,000 t/a PF project (1st phase of 40,000 t/a PF project) was finished and put into production in 2016. The capacity of PF increased to 670,000 t/a in 2016, up by 4.4% year on year.

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In 2017, China's PF capacity decreased to 589,000 t/a, though three companies (Weifang Huifeng, Anhui Hongyuan, Hubei Yihua) finished construction of their PF production lines with total capacity of 40,000 t/a. Yet the same year saw five companies (Chengdu Weite, Jinan Xiangrui, Hebei Hongchen, Linyi Yongda, Taizhou Zhongrong) with total capacity of 81,000 t/a stop PF production completely and two companies (Hengshui Yinhe, Linyi Taier) dismantle a part of their production units.

In 2018, China's PF capacity kept decreasing to 541,000 t/a, and 11 companies stopped PF production completely because of stricter environmental protection policies or poor performance, though 4 companies (Hubei Xingxin, Xinjiang Wanchang, Dongying Fangzheng, Ningxia Xinning) started PF production.

In 2019, China's PF capacity increased to 560,000 t/a, along with the launch of Nantong Jiangtian's 35,000 t/a production unit, though 2 companies stopped PF production completely.

Along with stably increasing domestic demand, China's PF output kept stable in 2016–2018, ranging between 267,000 tonnes and 273,000 tonnes. It increased to 283,800 tonnes in 2019, driven by increasing demand at home and abroad.

In 2020, China's PF capacity kept increasing to 637,000 t/a, along with the launch of three projects (Shandong Zhengxin with 40,000 t/a, Gansu Taier 20,000 t/a and Shijiazhuang Yaze 25,000 t/a), and the output increased to over 295,000 tonnes, though two companies stopped PF production.

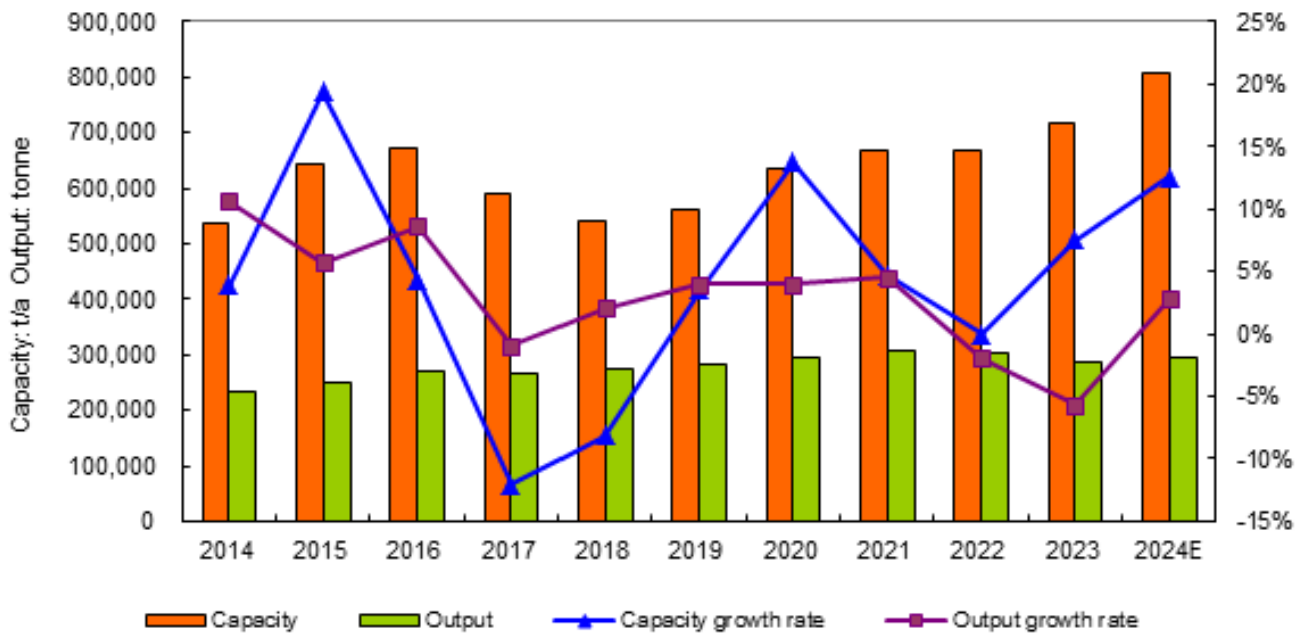
In 2021, both the capacity and output of PF went up in China, reaching 667,000 t/a and 308,600 tonnes respectively. There came a new entrant, Ningxia Huaye; its 30,000 t/a production line was built up at the end of 2020. No producer chose to exit the industry this year.

In 2022, the capacity of PF in China remained at 667,000 t/a, while the output dropped slightly to 302,700 tonnes. It should be noted that Zhenjiang LCY stopped the 30,000 t/a production line late this year.

In 2023, capacity of PF in China increased to 717,000 t/a, but the output of PF in 2023 decreased to 285,500 tonnes. Almost all enterprises producing powder PF saw a decline in output. Due to Zhenjiang LCY's withdrawal from the market, five other granular PF producers (Nantong Jiangtian, Xinjiang Wanchang, Jiangsu Sanmu, Qinyang Yongrun and Anqing Yacoo) seized a larger share in domestic granular PF market in 2023; there were obvious increases in their output.

In 2024, it is expected that Anhui Ruibai's 60,000 t/a PF project and Anqing Yacoo's another 30,000 t/a PF project will be put into operation. China's PF production capacity will further increase to 807,000 t/a.

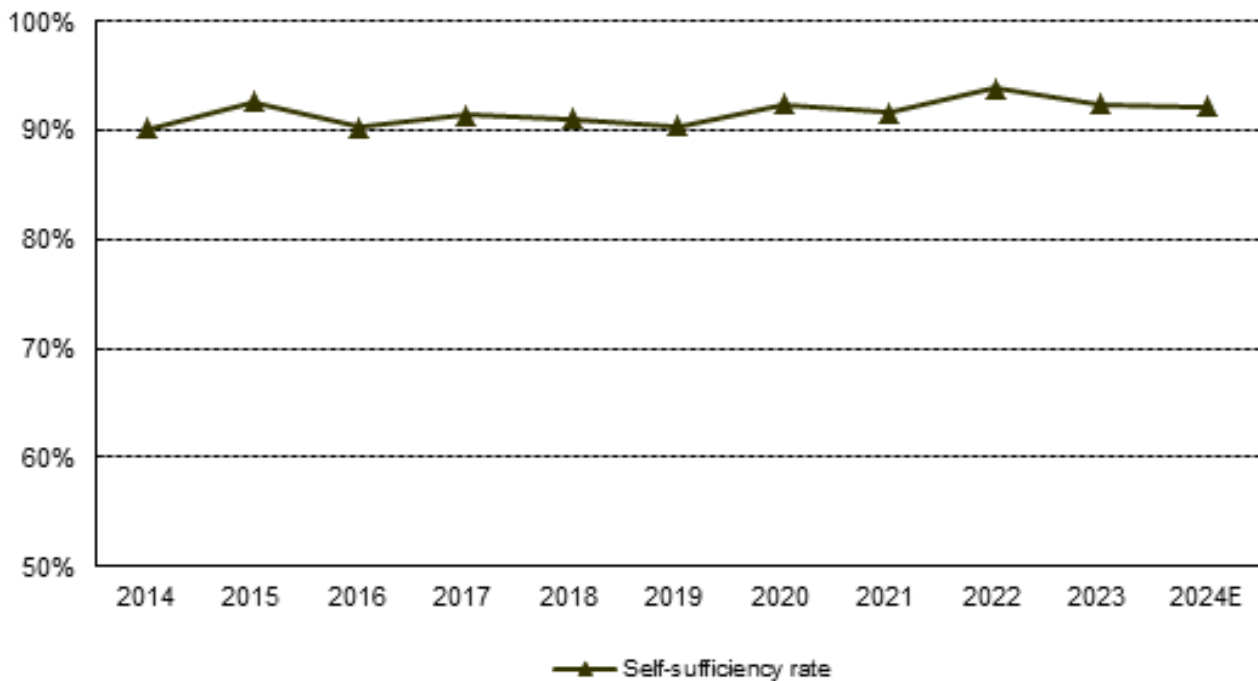
Figure 2.2-1 Capacity and output of PF in China, 2014–2024E



Note: "E" means estimated.

Source: CCM

Figure 2.2-2 Self-sufficiency rate of PF in China, 2014–2024E



Note: "E" means estimated.

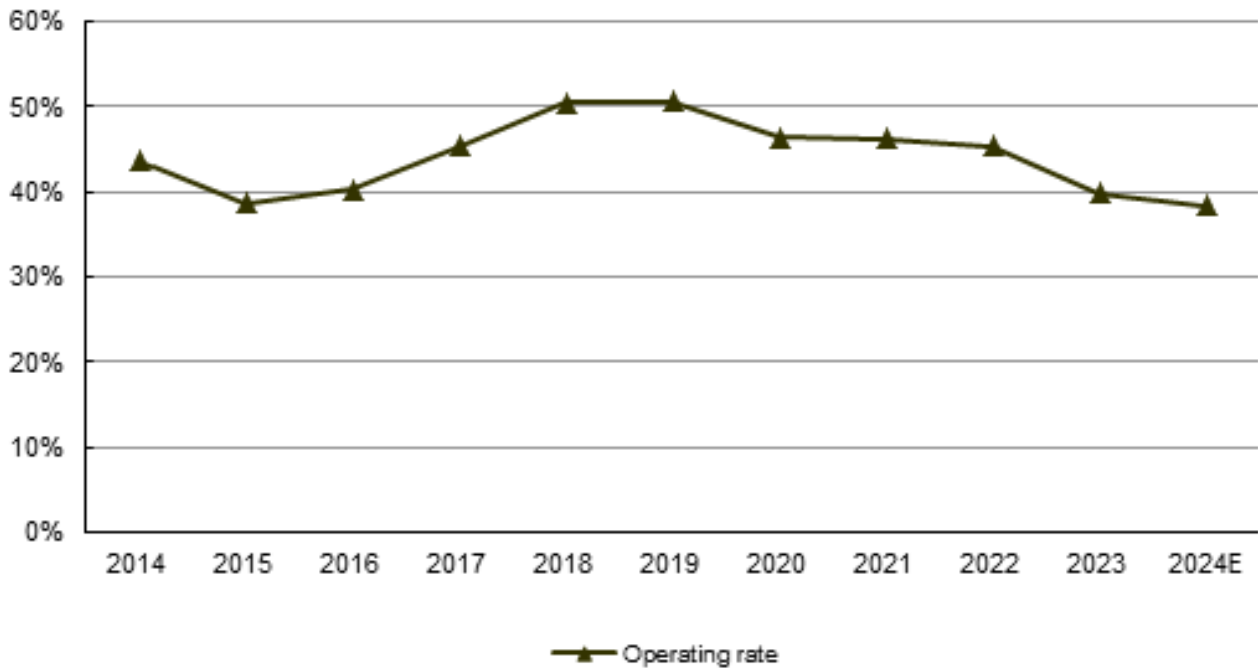
Source: CCM

The operating rate of China's PF industry was relatively low in 2010–2017, below 50%, because of serious overcapacity. The rate increased to 51% in 2018, because a number of producers stopped PF production completely and the output rose slightly driven by increased domestic demand. It kept going up in 2019, even though the capacity

also increased. It declined in 2020, along with the launch of three projects.

Given reduced demand caused by the COVID-19 pandemic, the operating rate of China's PF industry maintained at around 46% in 2020–2022. In 2023, dragged by weak demand from the glyphosate industry, China's PF output saw a year-on-year decrease. It is expected that downtrend of the operating rate will continue in 2024.

Figure 2.2-3 Operating rate of PF in China, 2014–2024E



Note: "E" means estimated.

Source: CCM

### 2.3 Price of PF

China's PF capacity has been growing so rapidly that the demand growth could not catch up with it. Overcapacity has remained serious in recent years. As a result, PF producers' bargaining power became weaker. Meanwhile, the profit rate in PF industry has been decreasing. Now the ex-works price of PF quoted by most domestic producers is affected by the following factors:

- The price of imported PF
- The profit rate of downstream products, especially glyphosate
- The price of methanol, an important raw material of PF

The main factor affecting PF price is the raw material. Monthly ex-works prices of PF and methanol in China from 2013 to 2022 showed that PF price fluctuated along with methanol price.

The ex-works price of PF kept increasing in 2013, and it reached a new high in Dec. at about USD941/t. The rise was

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mainly driven by the increasing price of methanol and increasing demand for PF from the domestic glyphosate industry. However, a reverse trend was witnessed in 2014, the price of PF decreasing from USD900/t in Jan. to USD799/t in Dec., which was mainly affected by the falling price of methanol and the overcapacity of PF from the domestic glyphosate industry.

At the beginning of 2015, the ex-works price of PF in China had a sharp decrease, and hit USD617/t in March 2015. After a temporary recovery in April, the ex-works price of PF started to decrease from USD783/t in April to USD675/t in Dec. As the price of methanol and imported PF kept decreasing, the domestic ex-works price of PF decreased as well.

In 2016, the overall ex-works price of PF was lower than that in 2015. In Q1–Q3 2016, the price declined from USD704/t in Jan. to USD559/t in Sept. The ex-works price fluctuation of PF was mainly affected by its upstream raw materials' price fall (especially methanol). However, the ex-works price began to increase in Q4 2016, due to the recovery of demand for glyphosate.

In 2017, the ex-works price of PF followed an upward trend on the whole thanks to increasing raw material price and recovery of glyphosate market.

In 2018, the annual average ex-works price of PF continued to increase, reaching about USD897/t. Major reasons are increasing prices of formaldehyde and methanol, and production cuts of some PF producers triggered by stringent environmental protection inspections, especially in Shandong and Hebei.

In Q1 2019, the ex-works price of PF increased a little. Then in Q2–Q4, it showed a general downward trend, following falls in the prices of formaldehyde and methanol.

In 2020, due to the impact of COVID-19, and capacity release of new PF projects, especially in West China and North China (cost advantage, less influence from environmental protection), the price of PF dropped to the lowest at USD571/t in Aug. Later, with rising raw material prices and increasing demand for PF, the price has kept rising. Especially at the end of 2020, amid continuous rise of methanol price, environmental protection restrictions in winter, high demand from downstream wood-based panel industry, and decreased supply of formaldehyde and the rising price, PF price jumped.

In 2021, the ex-works price of PF rebounded strongly, peaking at about USD1,200/t in Nov., mainly affected by a sharp rise in methanol price. Production cost of methanol increased, since the price of coal was kept at a high level. In addition, prices of PF downstream products kept going up in 2021, especially the price of glyphosate, which also supported PF price rise to some extent.

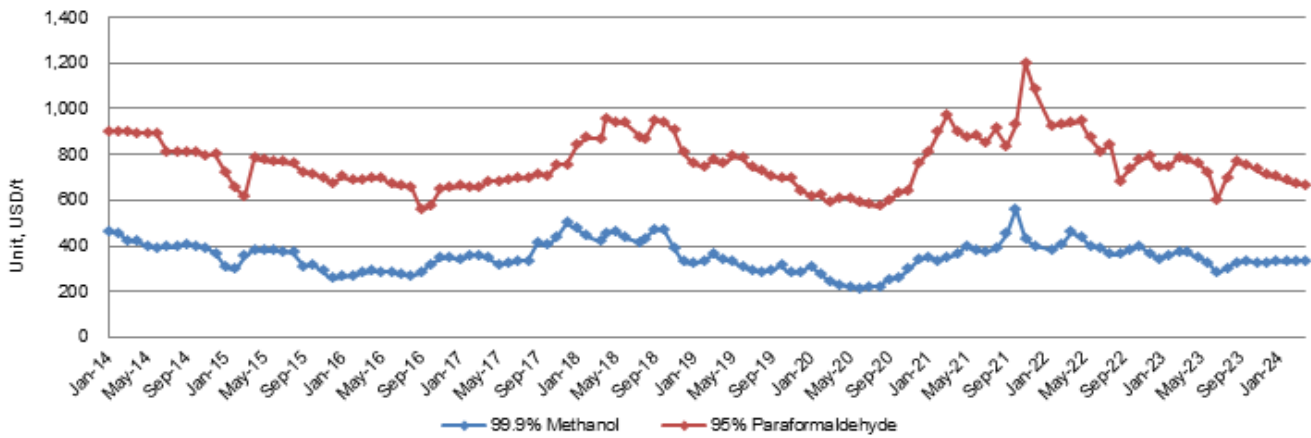
In 2022, the ex-works price of PF saw a decline in general with some fluctuations. Due to shrinking methanol prices and sluggish demand, the market confidence was dampened to some extent.

In 2023, the monthly ex-works price of PF fluctuated significantly, showing a V-shaped trend overall, which is basically consistent with the price trend of methanol. In June, due to poor downstream market demand, the ex-works



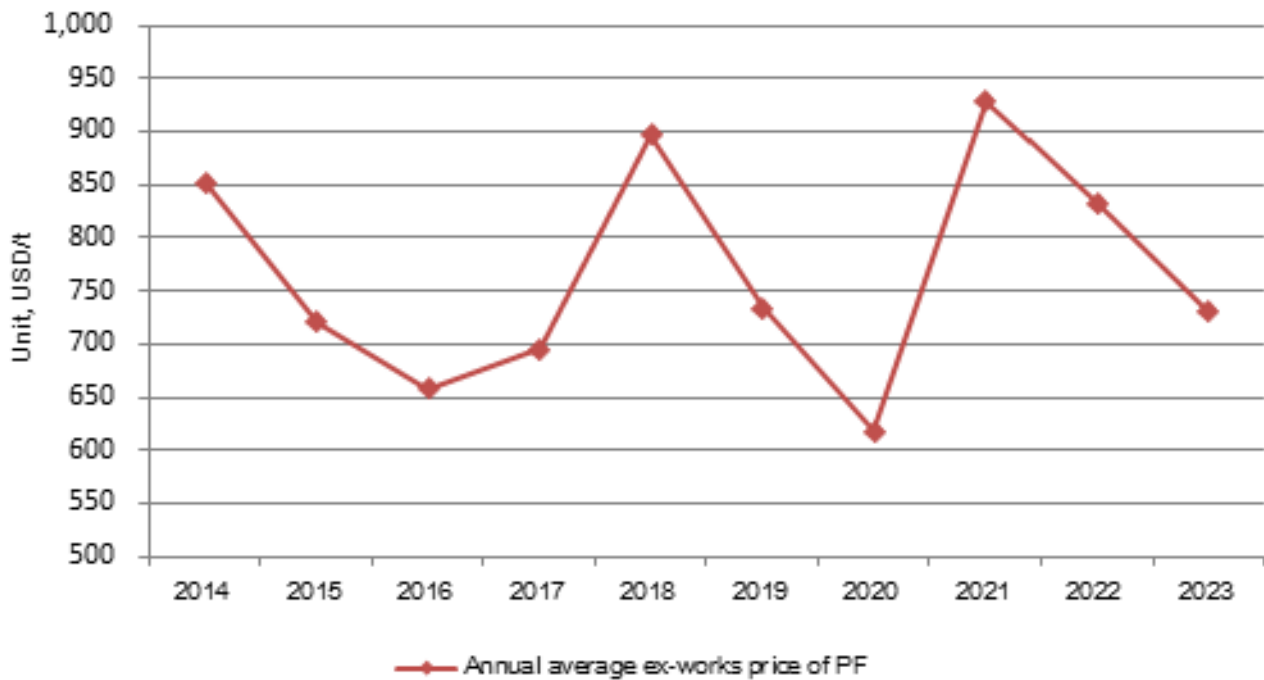
price of PF dropped to its lowest point in nearly two years, at USD602/t.

Figure 2.3-1 Monthly ex-works price of 95% PF and 99.9% methanol in China, Jan. 2014–March 2024



Source:CCM

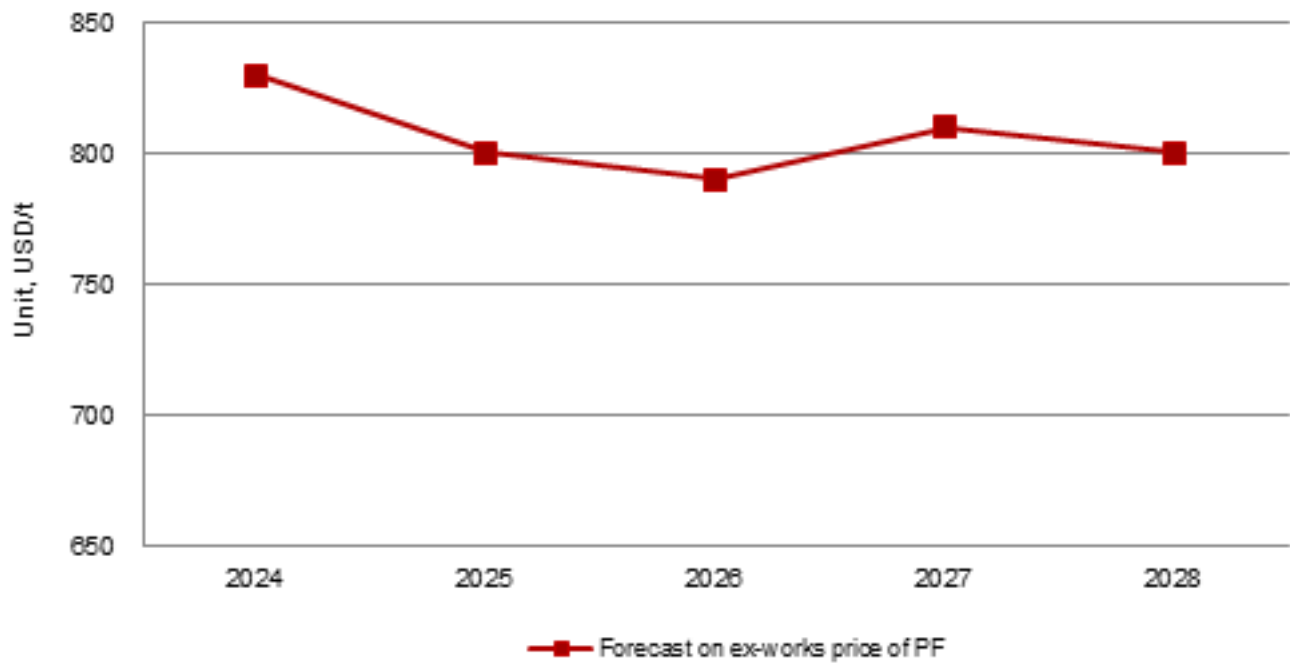
Figure 2.3-2 Annual average ex-works price of PF in China, 2014–2023



Source:CCM

On the whole, after 2015, annual average price of PF bounced up in 2018 and reached a new peak in 2021 from the 2020 trough. However, in 2022 and 2023, due to the unstable prices of methanol and formaldehyde, as well as poor downstream demand, China's PF prices fell for two consecutive years. After taking production costs, profits and demand into consideration, it is projected that the ex-works price of PF in China will fluctuate around USD800/t in 2024–2028.

Figure 2.3-3 Forecast on ex-works price of PF in China, 2024–2028



Source:CCM

Table 2.3-1 Quotation of PF in China by producer, March 2024

| No. | Producer               | Ex-works price in March 2024, USD/t |
|-----|------------------------|-------------------------------------|
| 1   | Fuhua Tongda           | N/A                                 |
| 2   | Hebei Jintaida         | 96% powder: 675                     |
| 3   | Hebei Yuhang           | N/A                                 |
| 4   | Nantong Jiangtian      | 96% granule: 957; 92% granule: 873  |
| 5   | Hengshui Yinhe         | 96% powder: 633                     |
| 6   | Weifang Xudong         | 96% powder: 675                     |
| 7   | Anhui Denuo            | N/A                                 |
| 8   | Jiangsu Sanmu          | N/A                                 |
| 9   | Zibo Qixing            | 96% powder: 690                     |
| 10  | Linqu Outai            | N/A                                 |
| 11  | Linyi Shengyang        | 96% powder: 760                     |
| 12  | Inner Mongolia Jiaquan | 96% powder: 605                     |
| 13  | Qingzhou Hengxing      | 96% powder: 647                     |
| 14  | Xinjiang Dearsun       | 96% powder: 830                     |
| 15  | Weifang Huifeng        | 96% powder: 704                     |
| 16  | Hubei Trisun           | N/A                                 |
| 17  | Xinjiang Wanchang      | 92% granule: 718                    |
| 18  | Dongying Fangzheng     | N/A                                 |
| 19  | Ningxia Xinning        | 96% powder: 605                     |
| 20  | Shandong Zhengxin      | N/A                                 |
| 21  | Gansu Taier            | 96% powder: 563                     |
| 22  | Shijiazhuang Yaze      | N/A                                 |
| 23  | Ningxia Huaye          | 96% powder: 591                     |

|    |                    |                          |
|----|--------------------|--------------------------|
| 24 | Qinyang Yongrun    | 92% and 96% granule: 704 |
| 25 | Anqing Yacoo       | N/A                      |
| 26 | Hutubi Ruiyuantong | 92% and 96% granule: 675 |

Source:CCM

#### 2.4 New dynamics of raw material of PF—formaldehyde

Chinese PF producers use 37% or 50% formaldehyde to produce PF, depending on their production technologies. Generally speaking, production with rake drying method adopts 37% or 50% formaldehyde, and that with spray drying method uses 50% formaldehyde.

Table 2.4-1 Information on formaldehyde by major PF producers in China, as of March 2024

| No. | Producer               | Technology source of formaldehyde production | Source of formaldehyde | Concentration of formaldehyde |
|-----|------------------------|--|------------------------|-------------------------------|
| 1   | Fuhua Tongda           | Domestic                                     | Captive production     | 50%                           |
| 2   | Hebei Jintaida         | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 45%–50%                       |
| 3   | Hebei Yuhang           | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 37%                           |
| 4   | Nantong Jiangtian      | GEA Niro                                     | Captive production     | 37%–55%                       |
| 5   | Hengshui Yinhe         | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 37%                           |
| 6   | Weifang Xudong         | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 37%, 50%                      |
| 7   | Anhui Denuo            | Hebei Xinhua                                 | Captive production     | 37%                           |
| 8   | Jiangsu Sanmu          | Jiangsu Kaimao Chemical Technology Co., Ltd. | Captive production     | 37%                           |
| 9   | Zibo Qixing            | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 50%                           |
| 10  | Linqu Outai            | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 37%                           |
| 11  | Linyi Shengyang        | Domestic                                     | Captive production     | 37%                           |
| 12  | Inner Mongolia Jiaquan | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 50%                           |
| 13  | Qingzhou Hengxing      | Domestic                                     | Captive production     | 37%                           |
| 14  | Xinjiang Dearsun       | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 50%                           |
| 15  | Weifang Huifeng        | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 37%                           |
| 16  | Hubei Trisun           | Domestic                                     | Captive production     | 52%                           |
| 17  | Xinjiang Wanchang      | Domestic                                     | Captive production     | 37%                           |
| 18  | Dongying Fangzheng     | Domestic                                     | Captive production     | 37%                           |
| 19  | Ningxia Xinning        | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 37%                           |
| 20  | Shandong Zhengxin      | Domestic                                     | Captive production     | 37%                           |
| 21  | Gansu Taier            | Linyi Taier                                  | Captive production     | 50%                           |
| 22  | Shijiazhuang Yaze      | Domestic                                     | Captive production     | 50%                           |
| 23  | Ningxia Huaye          | Wuxi Suyang Chemicals Equipment Co., Ltd.    | Captive production     | 37%                           |

|    |                    |                 |                    |         |
|----|--------------------|-----------------|--------------------|---------|
| 24 | Qinyang Yongrun    | Johnson Matthey | Captive production | 37%     |
| 25 | Anqing Yacoo       | Domestic        | Captive production | 55%     |
| 26 | Hutubi Ruiyuantong | Domestic        | Captive production | 50%–55% |

Source:CCM

#### 2.4.1 Supply of formaldehyde in China

Table 2.4.1-1 Production, import, export and apparent consumption of formaldehyde in China, 2014–2023

| Year | Capacity, t/a | Output, tonne | Growth rate of output | Import volume, tonne | Export volume, tonne | Apparent consumption, tonne |
|------|---------------|---------------|-----------------------|----------------------|----------------------|-----------------------------|
| 2014 | 34,000,000    | 18,590,000    | 28.9%                 | 47                   | 11,101               | 18,578,946                  |
| 2015 | 35,000,000    | 14,556,000    | -21.7%                | 13                   | 10,334               | 14,545,679                  |
| 2016 | 35,000,000    | 15,866,000    | 9.0%                  | 1                    | 8,902                | 15,857,099                  |
| 2017 | 36,000,000    | 12,851,000    | -19.0%                | 1                    | 8,466                | 12,842,535                  |
| 2018 | 36,000,000    | 12,500,000    | -2.7%                 | 1                    | 8,300                | 12,491,701                  |
| 2019 | 36,000,000    | 13,100,000    | 4.8%                  | 3                    | 11,768               | 13,088,234                  |
| 2020 | 36,160,000    | 11,900,000    | -9.2%                 | 5                    | 12,537               | 11,887,468                  |
| 2021 | 37,010,000    | 14,580,000    | 22.5%                 | 2                    | 4,243                | 14,575,759                  |
| 2022 | 39,770,000    | 15,908,000    | 9.1%                  | 16                   | 1,347                | 15,906,670                  |
| 2023 | 43,670,000    | 16,310,000    | 2.5%                  | 2                    | 1,598                | 16,308,404                  |

Source:CCM

Formaldehyde is a basic and low value-added chemical. As liquid formaldehyde is inconvenient to transport, formaldehyde is usually consumed in the surrounding areas close to the producing area to reduce freight charges. And both the import and export volume of the product in China are quite small.

In China, formaldehyde is mainly consumed in the production of adhesive, polyformaldehyde (POM), pentaerythritol, MDI, BDO, etc.

In 2013–2014, the output of formaldehyde in China kept an uptrend, but in 2015 the formaldehyde industry suffered a severe downturn, at a year-on-year decrease of 21.7% in formaldehyde output.

Although formaldehyde output edged up in 2016, operating rates of formaldehyde producers dropped in 2017 triggered by plummeting downstream consumption. This was because major downstream wood flooring factories suspended or reduced production during central and provincial environmental protection inspections. The output kept

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decreasing in 2018, influenced by environmental protection inspections, industrial park relocation, decreasing demand, etc., but it rebounded in 2019.

In 2020, affected by the COVID-19 pandemic, the demand from downstream real estate and other industries reduced, and the operating rate of formaldehyde industry was lower than that in 2019.

In 2021, the output of formaldehyde increased by 22.5% year on year to 14,580,000 tonnes. Main reasons for the significant increase in output are as follows:

- Due to strong demand from downstream industries, the operating rate of formaldehyde industry went up.
- Some new production capacity went into operation.

Thanks to accelerated formaldehyde project relocation to industrial parks, about 2.8 million t/a new formaldehyde capacity was released in 2022; the capacity and output of formaldehyde in China both saw growth.

In 2023, the capacity of formaldehyde in China continued to expand, reaching 43,670,000 t/a and the output grew by 2.5% year on year. As China's chemical enterprises have been paying increasing attention to the construction of upstream and downstream industry chain support to reduce production costs, more and more enterprises have been equipped with formaldehyde production lines for downstream products, resulting in an increase in formaldehyde capacity.

#### **2.4.2 Price of formaldehyde in China**

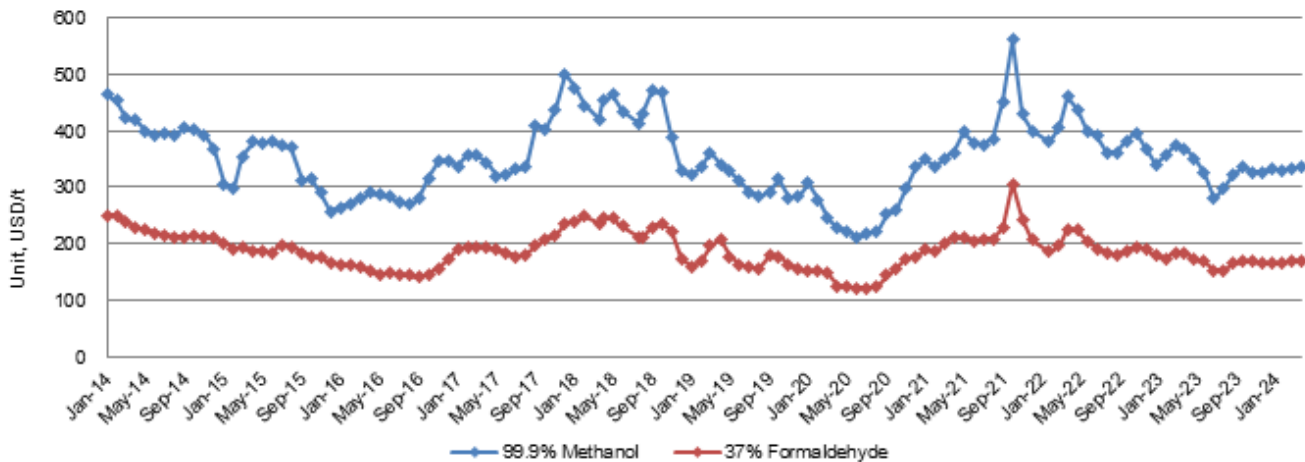
Methanol is the main raw material of formaldehyde. At present, the production of one tonne of formaldehyde needs about 0.43 tonne of refined methanol. The raw material cost accounts for around 90% of the total production cost of formaldehyde in China. The price of formaldehyde is primarily decided by methanol price.

During 2014–2015, the ex-works price of 99.9% purified methanol fluctuated amid a decline on the whole, being USD258/t in Dec. 2015; then it rebounded, coming up to USD499/t in Dec. 2017. Starting from 2018, the price saw another downward trend, with several fluctuations though; it decreased from USD476/t in Jan. 2018 to USD210/t in June 2020, a new low since 2010. However, in 2021, the price rebounded because of rising coal prices, peaking in Oct. at USD561/t, a new high since 2009. In 2022, driven by high prices of coal and natural gas, the methanol price remained high and fluctuating. The overall methanol price in 2023 showed a V-shaped trend. In H1 2023, coal was in a low season, so coal price declined, which drove down the production cost and price of methanol. In H2, methanol price briefly increased and remained stable after Sept., following coal price changes due to coal mine safety inspections and production restrictions in Q3 and stable supply-demand relation in Q4.

The ex-works price of 37% formaldehyde usually fluctuates with the price of methanol. From Jan. 2014 to Sept. 2016, the price in China decreased almost continuously, ending at USD141/t. Then it rebounded and reached USD245/t in May 2018. It entered another round of downtrend with fluctuations though, decreasing from USD231/t in June 2018 to USD122/t in July 2020. During Aug. 2020–Oct. 2021, the ex-works price of 37% formaldehyde in China was on an

overall uptrend; it soared to USD307/t in Oct. 2021. In 2022, the formaldehyde price hovered around USD200/t. The price of formaldehyde slightly increased at the beginning of 2023, but since April, the price went down quickly and after a rebound in Aug. the price remained relatively stable from Sept. 2023 to March 2024.

Figure 2.4.2-1 Monthly ex-works prices of 37% formaldehyde and 99.9% purified methanol in China, Jan. 2014–March 2024



Source:CCM

## 2.5 Industrial affairs of PF in China

In Jan. 2013, Jiangsu Sanmu's 20,000 t/a PF project was determined, and Jiangsu Kaimao Chemical Technology Co., Ltd. (formed by the technical team of Jiangsu Hengmao Machinery Manufacture Co., Ltd.) was the appointed company that took charge of the project.

On 26 May, 2013, the environmental impact assessment of Hebei Jintaida Chemical Co., Ltd.'s methanol project (250,000 t/a of formaldehyde, 135,000 t/a of methylal, 60,000 t/a of chloromethane, 40,000 t/a of PF, 10,000 t/a of utropine, etc.), was published for the second time.

On 27 May, 2013, a 30,000 t/a PF project of Nanhe Huayang was approved by the local government.

In June 2013, the environmental impact assessment of Leshan Hongya's PF project (60,000 t/a of PF, 150,000 t/a of formaldehyde and 10,000 t/a of urotropine) was published for the first time. In Aug. 2013, the environmental impact assessment of this project was published for the second time.

In July 2013, the environmental impact assessment of Guang'an Haochuan Chemical Co., Ltd.'s PF project (100,000 t/a of formaldehyde, 6,000 t/a of PF and 2 million pieces of impregnated paper) was published for the second time.

In Oct. 2013, 20,000 t/a PF production lines of Jiangsu Sanmu, adopting spray drying method, were built up by Jiangsu Kaomao Chemical Technology Co., Ltd.

In Dec. 2013, Zibo Qixing's PF project (40,000 t/a of PF, 200,000 t/a of formaldehyde and 30,000 t/a of methylal) was approved.

In June 2015, the environmental impact assessment of Xinjiang Wanchang's PF project with a capacity of 40,000 t/a was approved.

On 4 Aug., 2015, the environmental impact assessment of Xinjiang Dearsun's PF project (200,000 t/a of



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formaldehyde, 100,000 t/a of methylal and 40,000 t/a of PF) was approved. The PF capacity of the project's first phase was 20,000 t/a.

In Dec. 2015, Dongying Fangzheng finished the construction of its PF project with a capacity of 6,000 t/a.

On 13 Jan., 2016, the environmental impact assessment of Ningxia Duoli's PF project with a capacity of 20,000 t/a was published for the first time.

On 21 March 2016, the environmental impact assessment of Qinyang Yongrun's PF expansion with a capacity of 30,000 t/a was published for the first time.

In March 2016, Xinjiang Dearsun's PF project was completed and put into production.

In 2016, Nantong Jiangtian reconstructed and upgraded its PF production line, changing its technology from rake drying to spray drying and increasing the capacity from 10,000 t/a to 25,000 t/a.

On 4 Feb., 2017, the assessment report on the control effect of occupational risks resulted from the 50% formaldehyde and PF projects (with a capacity of 50,000 t/a and 10,000 t/a respectively) in Anhui Hongyuan was released.

In March 2017, Qinyang Yongrun and Kingland Energy and Technology Co., Ltd. signed an investment contract that Qinyang Yongrun constructed a PF project with a capacity of 30,000 t/a for Kingland Energy and Technology Co., Ltd.

In July 2017, land pre-examination of Qinzhou Juli New Energy Technology Co., Ltd.'s polyoxymethylene dimethyl ether project (1st phase include: 80,000 t/a formaldehyde, 20,000 t/a methylal, 20,000 t/a PF, etc.) was approved.

In November 2017, the environmental impact assessment information of Ningxia Huaye Fine Chemical Co., Ltd.'s project of formaldehyde and its downstream products (450,000 t/a formaldehyde, 80,000 t/a methylal, 90,000 t/a PF, 30,000 t/a urotropine, etc.) was posted.

In January 2018, the environmental impact assessment of Anhui Dafeng Chemical Co., Ltd. project (80,000 t/a formaldehyde, 30,000 t/a PF, 50,000 t/a urea-formaldehyde resin, 15,000 t/a urotropine) was published for the first time. However, the company was closed in Aug. 2022.

In November 2018, the environment impact report of Anhui Quansheng Chemical Co., Ltd.'s PF project with a capacity of 30,000 t/a was approved. Besides, the environment impact report of Shijiazhuang Yaze Chemical Co., Ltd.'s project (160,000 t/a formaldehyde, 25,000 t/a PF, 10,000 t/a urotropine, 20,000 t/a liquid ammonia) t/a was published, and the environment impact report of Gansu Taier Fine Chemical Co., Ltd.'s project (400,000 t/a formaldehyde, 100,000 t/a methylal, 60,000 t/a PF, 60,000 t/a urotropine) was also published.

Sixteen companies stopped PF production completely in 2017–2018, caused by stricter environmental protection policy, poor performance, etc.

In January 2019, the environment impact report of Jining Huiquan Chemical Co., Ltd.'s relocation project (1st phase: 100,000 t/a formaldehyde, 50,000 t/a adhesive; 2nd phase: 100,000 t/a formaldehyde, 30,000 t/a PF) was published.

In January 2019, the 2,320,000 t/a formaldehyde and resin environment-friendly new material project of Wen'an County Decheng New Material Technology Co., Ltd. was announced (1st phase: 960,000 t/a formaldehyde; 2nd

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phase: 960,000 t/a formaldehyde, 60,000 t/a PF, and 500,000 t/a melamine formaldehyde resin, etc.).

In April 2019, the environmental impact assessment information of Juancheng County Zhanbang Chemical Co., Ltd.'s 480,000 t/a formaldehyde (1st phase) and deep-processing project (600,000 t/a urea-formaldehyde resin, 30,000 t/a PF, etc.) was published. However, in July 2021, the project was adjusted, and the capacity for PF was changed to 10,000 t/a.

In August 2019, the environmental impact assessment information of Hubei Xingxin Materials Co., Ltd.'s 65,000 t/a PF project was published for the first time.

In Jan. 2020, the environment impact report of Ningxia Ningshun New Material Co., Ltd.'s formaldehyde, polyol as well as downstream deep-processing project (1st phase: 200,000 t/a formaldehyde, 20,000 t/a pentaerythritol; 2nd phase: 10,000 t/a neopentyl glycol; 3rd phase: 100,000 t/a formaldehyde, 20,000 t/a PF, etc.; 4th phase: 10,000 t/a calcium formate, etc.) was published for the first time.

In March 2020, the environmental impact assessment information of Dingyuan County Linxing Chemical Co., Ltd.'s 70,000 t/a urea-formaldehyde resin technical transformation project (1st phase) and 10,000 t/a PF (2nd phase) was published.

In Aug. 2020, in accordance with the resolutions of the shareholders meeting of Hubei Trisun Chemicals Co., Ltd. and the shareholders' decision of Hubei Xingxin Materials Co., Ltd., Hubei Trisun planned to merge its wholly-owned subsidiary Hubei Xingxin. After the merger, Hubei Trisun continued to operate, while Hubei Xingxin was cancelled on 1 March, 2021.

In Oct. 2020, the environment impact report of Anhui Hehong Chemical Co., Ltd. 's project (90,000 t/a PF, etc.) was published for the first time.

In Nov. 2020, the environment impact report of Hutubi Ruiyuantong Chemical Co., Ltd.'s 30,000 t/a PF and 50,000 t/a methylal expansion project was published for the first time.

In Feb. 2021, the environment impact report of Xinjiang Shunyuan Chemical Technology Co., Ltd.'s project (1st phase: 200,000 t/a formaldehyde, 200,000 t/a urea-formaldehyde resin and 50,000 t/a PF; 2nd phase: 50,000 t/a urotropine and 300,000 t/a formaldehyde) was published for the first time.

In June 2021, the environment impact report of Yake Technology (Anqing) Co., Ltd.'s project (1st phase: 240,000 t/a formaldehyde, 60,000 t/a PF, etc.) was published.

In July 2021, the environment impact report of Shandong Linfeng New Material Technology Co., Ltd.'s project (1st phase: 400,000 t/a formaldehyde solution, ect.; 2nd phase: 60,000 t/a PF, 200,000 t/a urea formaldehyde concentrate (UFC), ect.) was published.

In Nov. 2021, Nantong Jiangtian Chemical Co., Ltd. decided to launch a relocation project, in response to government's call to withdraw chemical enterprises from 1km-range to the Yangtze River. This project will build production lines for 100,000 t/a PF, 20,000 t/a modified engineering plastics polyformaldehyde and 9,000 t/a green

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environment-friendly textile auxiliary series, and set up a green intelligent factory. The construction started in March 2022, and is expected to be completed in Dec. 2025. Before the project is finished and the lines are put into operation, the company would maintain production in the existing plant, in order to ensure sound production and operation.

In Nov. 2021, the environment impact report of Guangxi Guifulin Technology Co., Ltd.'s project (720,000 t/a formaldehyde, 100,000 t/a PF, ect.) was published.

In Feb. 2022, the environment impact report of Anhui Ruibai New Material Co., Ltd.'s project (50,000 t/a propyl acetate, 50,000 t/a butyl acetate, 360,000 t/a formaldehyde and 60,000 t/a PF) was published.

In June 2022, a 30,000 t/a PF project of Hebei Yuanlu Chemical Co., Ltd. was approved by the Ecology and Environment Bureau of Xingtai City, Hebei province.

In Dec. 2022, Zhenjiang LCY Performance Materials Co., Ltd. closed its 30,000 t/a PF production line in Zhenjiang City, Jiangsu Province, in a response to government's call to withdraw chemical enterprises from 1km-range to the Yangtze River and thus protect the eco-environment along the Yangtze River Economic Belt.

In Feb. 2023, the environment impact report of Shanshan Shenglian New Energy Technology Co., Ltd.'s project (60,000 t/a PF and 100,000 t/a sodium methoxide) was published.

In March 2023, Qinyang Yongrun Technology Development Co., Ltd.'s 30,000 t/a production line was put into production, and Yacoo Technology (Anqing) Co., Ltd.'s 30,000 t/a production line was put into trial production. At the same time, Gansu Hongfu Weiye Technology Co., Ltd.'s project (20,000 t/a PF, etc.) was approved by the Ecology and Environment Bureau of Jiuquan City, Gansu province.

In June 2023, Zhenjiang LCY Performance Materials Co., Ltd. transferred its facilities and production technology to Anhui Ruibai New Material Co., Ltd.

At the end of 2023, Hutubi Ruiyuantong Chemical Co., Ltd.'s 30,000 t/a PF production line was put into operation.

## **2.6 Cost structure of PF producers in China**

Table 2.6-1 Production cost of granular PF produced by spray drying technology, March 2024

| Production cost, USD/t | Item                         | Proportion, % |
|------------------------|------------------------------|---------------|
| 673                    | Raw material                 | 74.7          |
|                        | Labor                        | 2.8           |
|                        | Energy                       | 2.7           |
|                        | Manufacturing and management | 19.8          |

Source:CCM

Table 2.6-2 Production cost of powder PF produced by rake drying technology, March 2024

| Production cost, USD/t | Item                         | Proportion, % |
|------------------------|------------------------------|---------------|
| 599                    | Raw material                 | 72.8          |
|                        | Labor                        | 3.0           |
|                        | Energy                       | 3.5           |
|                        | Manufacturing and management | 20.7          |

Source:CCM

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### 3 Import & export analysis of PF

#### 3.1 Overall situation of PF trading

The domestic PF is more and more popular with customers at home and abroad, because of its high quality and low price in recent years. From 2010 to 2014, the export volume of PF in China kept increasing, while the import volume of PF fluctuated.

In 2015, both export volume and import volume of PF in China decreased, down by 2.0% and 22.6% respectively compared with those in 2014.

In 2016, the export volume of PF in China continued to decrease while the import volume rebounded. Specifically, the PF export volume decreased by 2.2% year on year; the import volume increased by 48.4%, from 18,351 tonnes in 2015 to 27,228 tonnes in 2016.

In 2017, both export and import volumes of PF in China decreased, down by 10.5% and 13.0% year on year respectively.

In 2018, the export volume of PF kept declining, down by 11.6% year on year, while the import volume of PF increased, up by 6.5% year on year.

In 2019, both export volume and import volume of PF in China increased, up by 63.8% and 10.0% respectively compared with those in 2018.

In 2020, the export volume of PF continued to grow, up by 24.3% year on year, while the import volume of PF fell by 20.9%. At the same time, the export volume of PF exceeded the import volume for the first time since 2001, by about 6,000 tonnes.

In 2021, both import and export volumes of PF in China increased, up by 10.9% and 49.5% respectively year on year.

In 2022, China's import volume of PF saw a sharp decrease compared with previous years, plunging to the lowest level in the past decade. Given insufficient downstream demand, high import price and improved quality of domestic products, the domestic imports witnessed a decline. In contrast, the export volume kept on rising, thanks to strong demand amidst inadequate product availability overseas due to low production activities.

In 2023, the import volume and export volume of PF in China increased by 16.3% and 6.6% year on year, respectively. At the same time, annual average import price and export price decreased by 18.5% and 14.6% year on

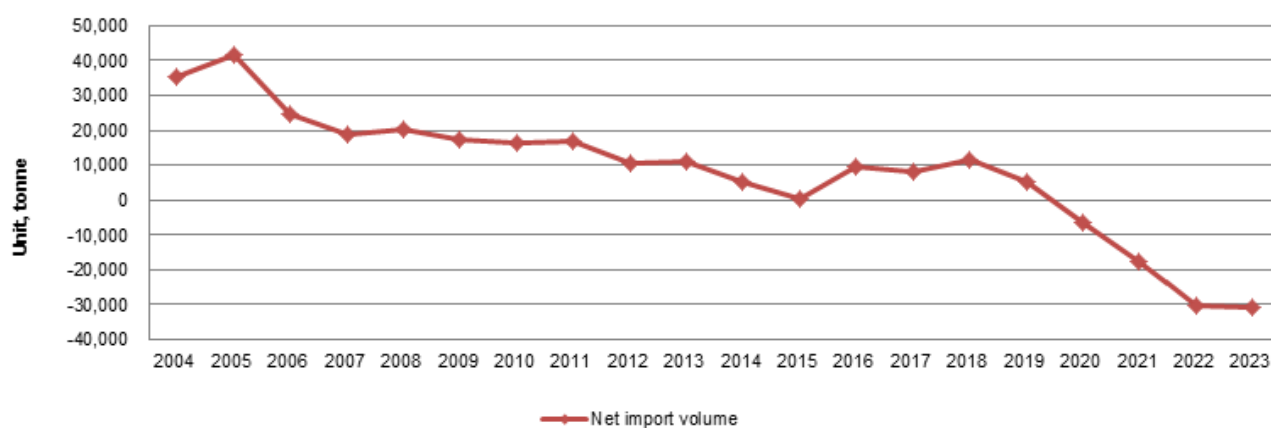
year, respectively.

Table 3.1-1 China's imports and exports of PF, 2004–2023

| Year | Import        |            |                      | Export        |            |                      |
|------|---------------|------------|----------------------|---------------|------------|----------------------|
|      | Volume, tonne | Value, USD | Average price, USD/t | Volume, tonne | Value, USD | Average price, USD/t |
| 2004 | 36,418        | 17,413,685 | 478                  | 1,035         | 519,427    | 502                  |
| 2005 | 41,963        | 24,355,821 | 580                  | 287           | 364,806    | 1,269                |
| 2006 | 27,337        | 15,128,357 | 553                  | 2,673         | 1,752,222  | 656                  |
| 2007 | 23,255        | 17,535,251 | 754                  | 4,620         | 3,926,334  | 850                  |
| 2008 | 21,324        | 19,152,962 | 898                  | 1,091         | 1,247,598  | 1,144                |
| 2009 | 19,651        | 11,174,350 | 569                  | 2,485         | 1,351,392  | 544                  |
| 2010 | 23,123        | 15,326,157 | 663                  | 6,844         | 3,958,553  | 578                  |
| 2011 | 25,840        | 19,885,472 | 770                  | 9,173         | 6,805,720  | 742                  |
| 2012 | 22,882        | 18,082,675 | 790                  | 12,196        | 9,325,042  | 765                  |
| 2013 | 28,098        | 24,315,107 | 865                  | 17,144        | 14,539,425 | 848                  |
| 2014 | 23,695        | 21,321,657 | 900                  | 18,244        | 16,440,267 | 901                  |
| 2015 | 18,351        | 14,242,131 | 776                  | 17,877        | 13,033,631 | 729                  |
| 2016 | 27,228        | 16,693,127 | 613                  | 17,478        | 10,253,062 | 587                  |
| 2017 | 23,682        | 16,169,213 | 683                  | 15,644        | 10,702,508 | 684                  |
| 2018 | 25,216        | 19,396,069 | 769                  | 13,837        | 11,752,717 | 849                  |
| 2019 | 27,747        | 19,721,149 | 711                  | 22,660        | 16,120,527 | 711                  |
| 2020 | 21,952        | 13,785,257 | 628                  | 28,157        | 16,271,518 | 578                  |
| 2021 | 24,339        | 20,254,740 | 832                  | 42,084        | 35,485,792 | 843                  |
| 2022 | 16,718        | 17,202,637 | 1,029                | 46,989        | 39,715,532 | 845                  |
| 2023 | 19,443        | 16,309,286 | 839                  | 50,085        | 36,145,723 | 722                  |

Source: China Customs & CCM

Figure 3.1-1 Net import volume of PF in China, 2004–2023



Source: China Customs & CCM

### 3.2 Import analysis of PF 2023

#### - Import volume

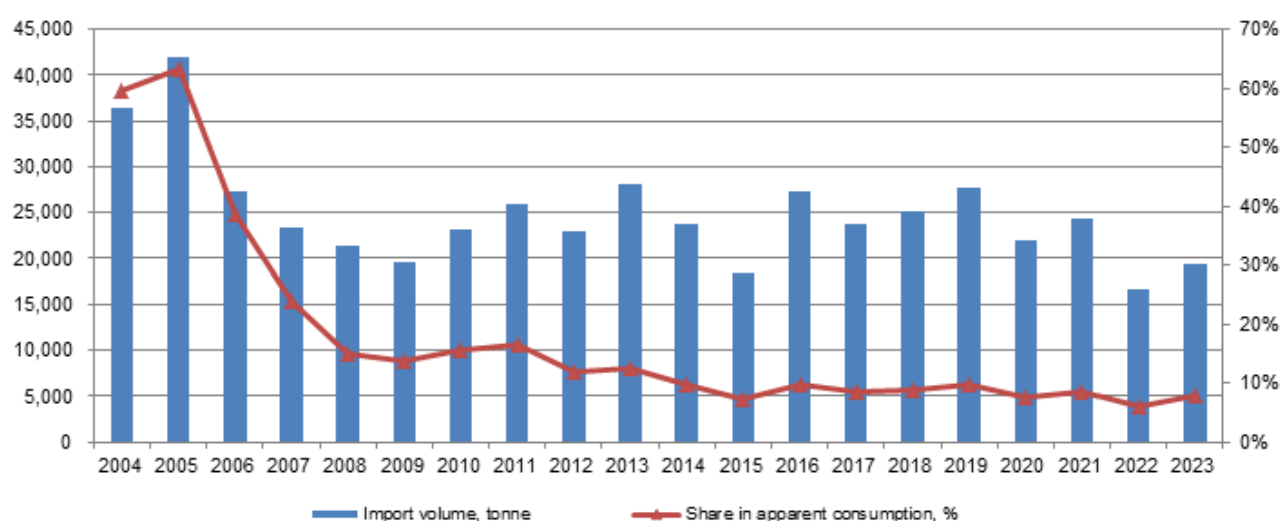
Annual import volume of PF was 36,000 tonnes–48,000 tonnes during 2000–2005 in China, and a historical high, 47,281 tonnes, was witnessed in 2003. After 2005, the annual import volume fell below 30,000 tonnes, and its share in apparent consumption decreased sharply to less than 20% in 2008–2013 and further to less than 10% since 2014, because of the stably increasing output of homemade PF.

In 2013, the import volume of PF rebounded to 28,098 tonnes, driven by the fast demand growth from the domestic resin industry. Yet the import volume of PF kept decreasing during 2014–2015 because of the sufficient supply of domestic PF, and the import volume was only 18,351 tonnes in 2015, the lowest in 2000–2021.

In 2016–2021, affected by the imbalance between supply and demand, the import volume of PF fluctuated between 21,500 tonnes–28,000 tonnes. In 2022, under limited trading activities, China's import volume of PF saw a significant decline, slashed by 31.3% year on year to 16,718 tonnes.

In 2023, the import volume of PF in China significantly increased, mainly due to the withdrawal of Zhenjiang LCY from the market and the shift of some granular PF consumers to import PF from abroad.

Figure 3.2-1 Import volume of PF and its share in PF apparent consumption in China, 2004–2023



Source: China Customs & CCM

### - Import origin

Spain, Taiwan Province and the US were the top three PF origins for China in 2010–2018, during which China's PF import volume from these three regions took up almost 93.1%–99.9% of the total.

Spain has always been the top import origin before 2016. However, the share from Spain decreased from 55.9% in 2010 to 40.3% in 2016 and 41.8% in 2017, while that from Taiwan Province rose from 26.0% in 2010 to 50.3% in 2016 and 46.2% in 2017. The main reason was the narrowing gap between the PF import prices of Spain and Taiwan Province and later the PF price of Taiwan Province has been less than that of Spain since 2013.

In 2018, Spain won back the No. 1 position, and China imported 1,620 tonnes of PF from Indonesia, a new but vigorous comer.

In 2019, the top three PF origins for China were Spain, Taiwan Province and Indonesia. And the PF import volume from these three regions took up 91.4% of the total.

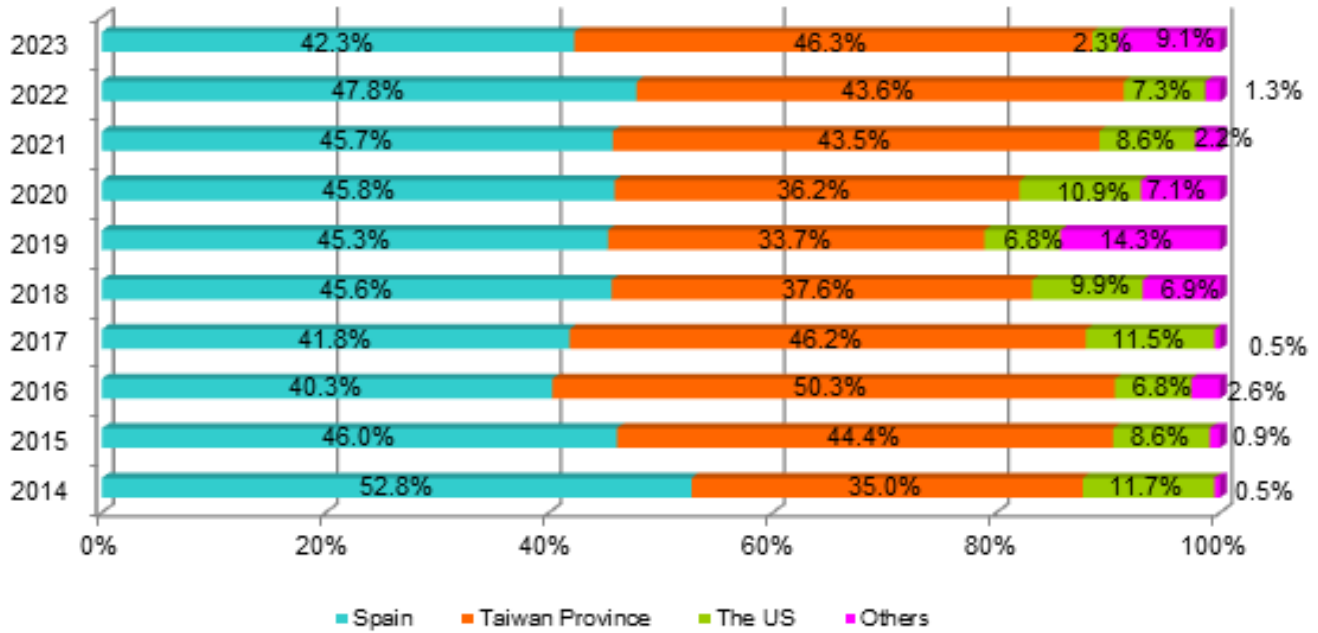
In 2020, the US returned to the third largest PF origin. In 2020–2022, the top three PF origins remained unchanged: Spain, Taiwan Province and the US; their combined share of the total import volume climbed from 92.9% to 98.7%. Though Indonesia ranked fourth in this period, its volume and share had decreased greatly from the 2019 levels since 2020.

In 2023, Taiwan Province overtook Spain as the largest source of PF imports into China, with the import reaching 9,001 tonnes, accounting for 46.3% of China's total import volume. In addition, China's import of PF from Indonesia



increased by 354.6% year on year, reaching 1,000 tonnes. However, the volume imported from the US decreased by 63.2% year on year to only 448 tonnes.

Figure 3.2-2 Share of imported PF volume to China by origin, 2014–2023



Source: China Customs & CCM

Table 3.2-1 Origins of China's imported PF, 2019–2023

| Country /origin | 2019          |                   |              | 2020          |                   |              | 2021          |                   |              | 2022          |                   |              | 2023          |                   |              |
|-----------------|---------------|-------------------|--------------|---------------|-------------------|--------------|---------------|-------------------|--------------|---------------|-------------------|--------------|---------------|-------------------|--------------|
|                 | Volume, tonne | Value, USD        | Price, USD/t | Volume, tonne | Value, USD        | Price, USD/t | Volume, tonne | Value, USD        | Price, USD/t | Volume, tonne | Value, USD        | Price, USD/t | Volume, tonne | Value, USD        | Price, USD/t |
| Spain           | 12,560        | 9,260,199         | 737          | 10,064        | 6,266,063         | 623          | 11,121        | 9,251,155         | 832          | 7,997         | 8,790,482         | 1,099        | 8,218         | 7,109,760         | 865          |
| Taiwan Province | 9,345         | 6,161,531         | 659          | 7,947         | 4,604,826         | 579          | 10,589        | 8,453,506         | 798          | 7,283         | 6,663,276         | 915          | 9,001         | 7,221,522         | 802          |
| The US          | 1,877         | 1,671,151         | 890          | 2,384         | 1,984,230         | 832          | 2,096         | 2,024,950         | 966          | 1,216         | 1,460,875         | 1,201        | 448           | 524,022           | 1,170        |
| Indonesia       | 3,460         | 2,242,081         | 648          | 1,540         | 875,320           | 568          | 532           | 479,220           | 901          | 220           | 228,400           | 1,038        | 1,000         | 924,103           | 924          |
| Others          | 505           | 386,187           | 765          | 17            | 54,818            | 3,322        | 1             | 45,909            | 41,547       | 2             | 59,604            | 33,169       | 776           | 529,879           | 683          |
| <b>Total</b>    | <b>27,747</b> | <b>19,721,149</b> | <b>711</b>   | <b>21,952</b> | <b>13,785,257</b> | <b>628</b>   | <b>24,339</b> | <b>20,254,740</b> | <b>832</b>   | <b>16,718</b> | <b>17,202,637</b> | <b>1,029</b> | <b>19,443</b> | <b>16,309,286</b> | <b>839</b>   |

Source: China Customs & CCM

#### - Import price

The major factors influencing PF's import price are the supply-demand dynamics of PF in the market and the price of crude oil.

With the price increase of raw materials thanks to the recovery of global economy, the import price of PF in China kept an uptrend since Dec. 2009, reaching USD965/t in April 2014, a peak after the global financial crisis.

Crude oil was in overcapacity and its price still kept a downtrend in 2015. The overcapacity and low price of crude oil almost affected the global macroeconomic environment. The import price of PF had much to do with the crude oil price. The import price of PF in China was down to USD673/t in Dec. 2015 from USD853/t at the end of 2014. In 2016, the overall import price was lower than that in 2015, with monthly price going down from USD672/t in Jan. to USD579/t in Dec.

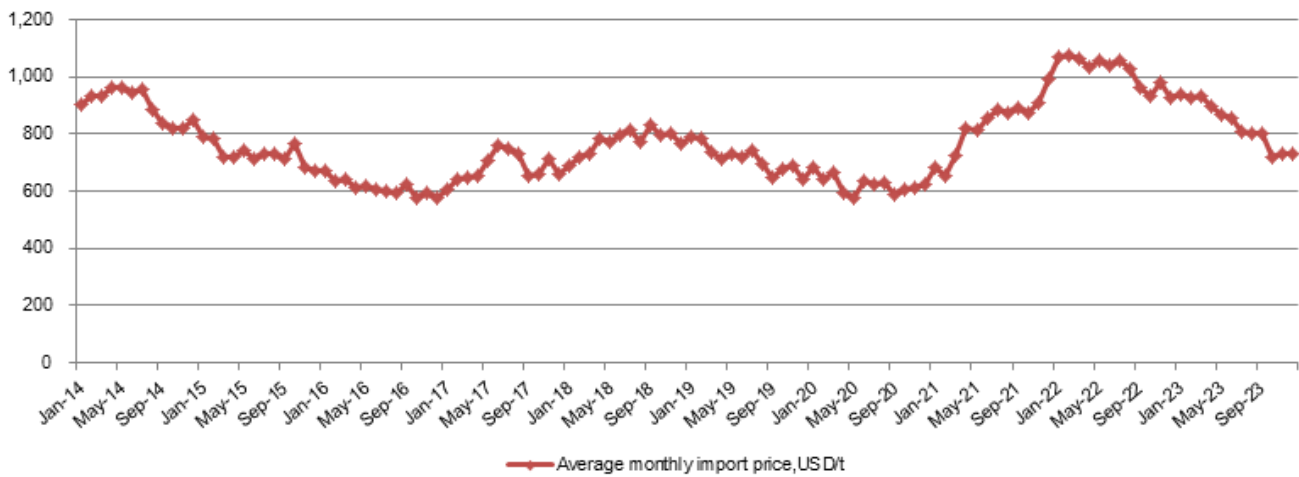
The general trend changed in 2017, the import price went higher with an annual average price of USD683/t. In 2018, the price kept increasing with an annual average price of USD769/t.

In 2019, the import price of PF averaged USD711/t, down some 7% year on year. In 2020, the annual average price continued to decrease, down about 12% over the previous year.

The annual average import price of PF jumped to USD832/t in 2021 from USD628/t in 2020, up by 32.5% year on year. In 2022, the annual average price further increased to USD1,029/t, since prices of methanol and natural gas were high in the international market.

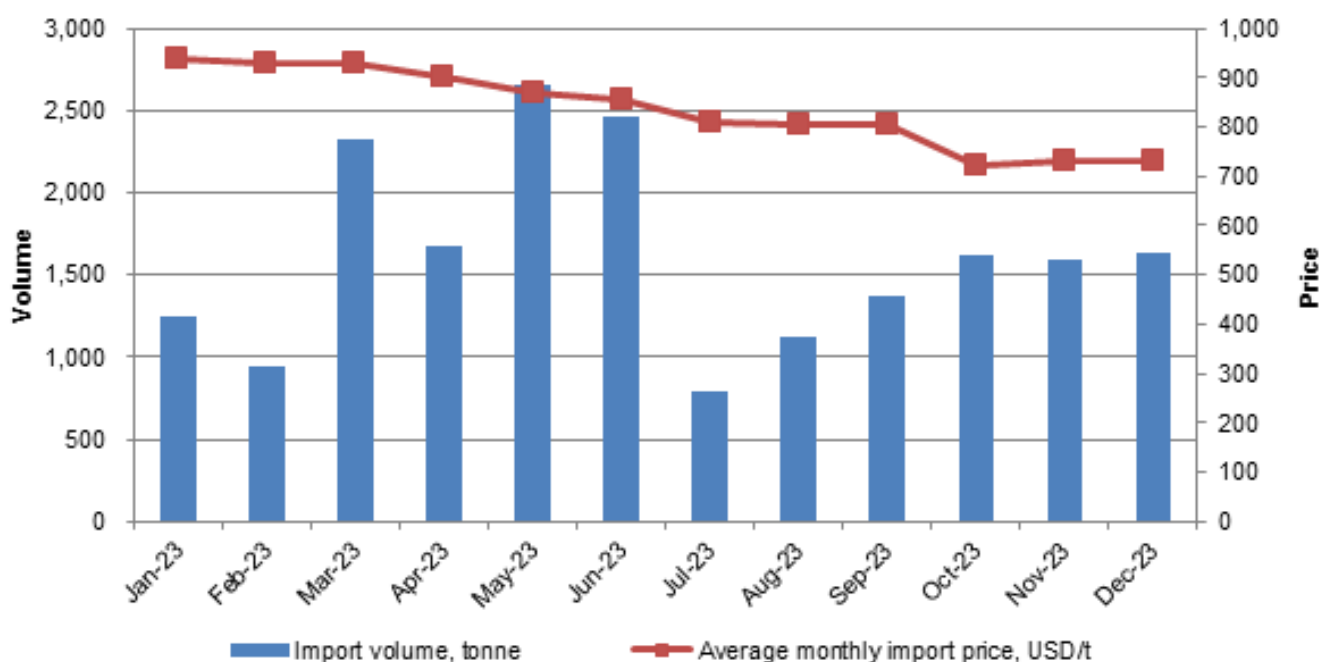
In 2023, the annual average import price of PF was USD839/t, down by 18.5% year on year. In May, the unit price for importing 170 tonnes of PF from Russia was USD497/t, which was the lowest import price for the year. The highest import price for the year occurred in Jan., when 48 tonnes of PF were imported from the US at a price of USD1,267/t.

Figure 3.2-3 China's import price of PF by month, 2014–2023



Source: China Customs & CCM

Figure 3.2-4 China's imports of PF by month, 2023



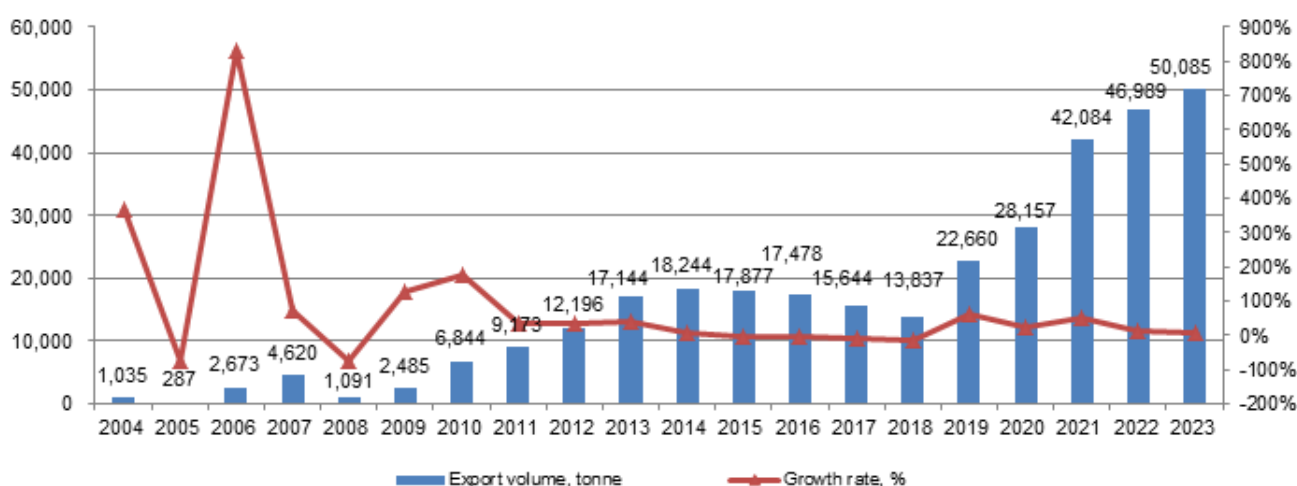
Source: China Customs & CCM

### 3.3 Export analysis of PF 2023

From 2012 to 2014, the export volume of PF from China kept increasing. However, it kept decreasing in 2015–2018, due to the decline in demand from resin production abroad. In 2019–2023, PF export from China saw significant year-on-year increases, the volume reaching 50,085 tonnes in 2023.

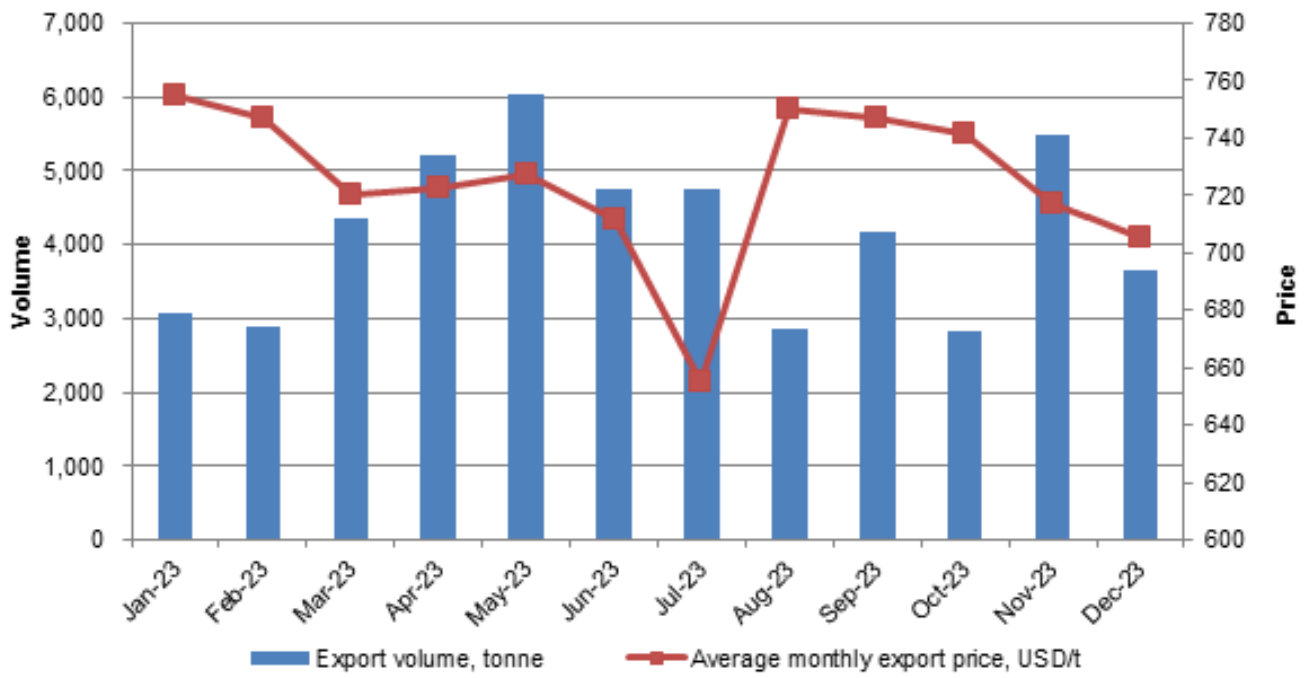
In 2021–2022, the top five export destinations of China's PF with a volume over 3,000 tonnes were Djibouti, South Korea, Nigeria, Kenya and Myanmar. In 2023, Nigeria was the largest export destination of China's PF, the amount reaching 10,161 tonnes, a year-on-year increase of 50.8%.

Figure 3.3-1 China's export volume of PF, 2004–2023



Source: China Customs & CCM

Figure 3.3-2 China's exports of PF by month, 2023



Source: China Customs & CCM

Table 3.3-1 Export destinations of China's PF, 2019–2023

| No.       | 2019            |               |              | 2020            |               |              | 2021            |               |              | 2022            |               |              | 2023            |               |              |
|-----------|-----------------|---------------|--------------|-----------------|---------------|--------------|-----------------|---------------|--------------|-----------------|---------------|--------------|-----------------|---------------|--------------|
|           | Country /region | Volume, tonne | Price, USD/t | Country /region | Volume, tonne | Price, USD/t | Country /region | Volume, tonne | Price, USD/t | Country /region | Volume, tonne | Price, USD/t | Country /region | Volume, tonne | Price, USD/t |
| 1         | South Korea     | 7,632         | 711          | South Korea     | 6,711         | 586          | Djibouti        | 7,965         | 798          | Djibouti        | 9,680         | 791          | Nigeria         | 10,161        | 672          |
| 2         | Ethiopia        | 1,995         | 686          | Djibouti        | 3,797         | 541          | South Korea     | 7,654         | 836          | South Korea     | 9,423         | 911          | Djibouti        | 8,625         | 713          |
| 3         | Kenya           | 1,789         | 757          | Ethiopia        | 3,758         | 577          | Nigeria         | 7,464         | 876          | Nigeria         | 6,736         | 865          | South Korea     | 8,159         | 801          |
| 4         | Djibouti        | 1,563         | 762          | Nigeria         | 3,248         | 579          | Kenya           | 4,077         | 854          | Kenya           | 5,295         | 835          | Kenya           | 5,441         | 695          |
| 5         | Angola          | 1,363         | 752          | Kenya           | 2,300         | 613          | Myanmar         | 3,968         | 865          | Myanmar         | 3,850         | 853          | Tanzania        | 4,316         | 716          |
| 6         | Tanzania        | 1,258         | 747          | Tanzania        | 1,588         | 643          | Bangladesh      | 2,482         | 779          | Bangladesh      | 2,448         | 775          | Myanmar         | 4,004         | 687          |
| 7         | Thailand        | 959           | 750          | Bangladesh      | 1,513         | 440          | Tanzania        | 2,020         | 850          | Tanzania        | 2,043         | 847          | Taiwan Province | 1,413         | 785          |
| 8         | Myanmar         | 945           | 683          | Taiwan Province | 1,391         | 631          | Angola          | 1,257         | 871          | Cameroon        | 1,346         | 786          | South Africa    | 1,300         | 758          |
| 9         | Taiwan Province | 913           | 693          | Angola          | 581           | 560          | Thailand        | 1,135         | 882          | Angola          | 1,170         | 795          | Angola          | 1,299         | 688          |
| 10        | Nigeria         | 866           | 729          | Cameroon        | 570           | 578          | Taiwan Province | 1,123         | 828          | India           | 889           | 768          | Cambodia        | 828           | 830          |
| 11        | Bangladesh      | 789           | 649          | Thailand        | 529           | 592          | Ethiopia        | 725           | 862          | Taiwan Province | 763           | 891          | Cameroon        | 717           | 653          |
| Sub-total |                 | 20,072        | 709          | Sub-total       | 25,986        | 576          | Sub-total       | 39,868        | 841          | Sub-total       | 43,642        | 842          | Sub-total       | 46,262        | 719          |

|              |               |            |              |               |            |              |               |            |              |               |            |              |               |            |
|--------------|---------------|------------|--------------|---------------|------------|--------------|---------------|------------|--------------|---------------|------------|--------------|---------------|------------|
| Others       | 2,588         | 728        | Others       | 2,171         | 596        | Others       | 2,216         | 892        | Others       | 3,347         | 887        | Others       | 3,823         | 750        |
| <b>Total</b> | <b>22,660</b> | <b>711</b> | <b>Total</b> | <b>28,157</b> | <b>578</b> | <b>Total</b> | <b>42,084</b> | <b>843</b> | <b>Total</b> | <b>46,989</b> | <b>845</b> | <b>Total</b> | <b>50,085</b> | <b>722</b> |

Source: China Customs & CCM

### 3.4 Export levy of PF (VAT & tax rebate)

Table 3.4-1 Export tax rate of PF in China

| Starting date | Expiry date | VAT rate, % | Export rebate rate, % |
|---------------|-------------|-------------|-----------------------|
| 2004/1/1      | 2004/12/31  | 17          | 13                    |
| 2005/1/1      | 2005/12/31  | 17          | 13                    |
| 2006/1/1      | 2007/6/30   | 17          | 13                    |
| 2007/7/1      | 2008/11/30  | 17          | 5                     |
| 2008/12/1     | 2012/12/31  | 17          | 9                     |
| 2013/1/1      | 2018/4/30   | 17          | 9                     |
| 2018/5/1      | 2018/10/31  | 16          | 9                     |
| 2018/11/1     | 2019/3/31   | 16          | 10                    |
| 2019/4/1      | 2020/3/19   | 13          | 10                    |
| 2020/3/20     | 2100/12/31  | 13          | 13                    |

Note: 1. Export rebate refers to refunds of the value-added tax (VAT) and consumption tax (CT) actually paid by the exporting enterprises on exported goods during the production and circulation process.

2. VAT is a consumption tax on goods and services that is levied at each stage of the supply chain where value is added, from initial production to the point of sale.

Source: China Customs