CCM Data & Business Intelligence

Production and Market of Paraformaldehyde in China

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Executive summary

China's paraformaldehyde (PF) industry has witnessed a steady development in the past ten years. The output of PF increased greatly, with a CAGR of 5.9% from 2012 to 2021.

- Production

Domestic PF production is mainly distributed in Hebei, Jiangsu, and Shandong, relying on abundant supply of methanol and convenient transportation.

Because of stricter environmental protection policies or poor performance, 11 companies stopped PF production completely in 2018 and two companies stopped production in 2019 and 2020 respectively. The number of PF producers in China decreased from 34 in 2017 to 27 in 2021. The national total capacity increased with fluctuations in 2017–2021, rising to 667,000 t/a in 2021, and the output in China rose from 267,500 tonnes in 2017 to 308,600 tonnes in 2021, driven by increasing demand at home and abroad.

- Import and export

Before 2020, China is a net PF importer. However, China's PF import volume was less than export for the first time in 2020. In 2021, China imported 24,339 tonnes of PF. The top three import origins were Spain, Taiwan Province and the US, with a combined share of 97.8% of the total.

China's export volume of PF kept decreasing in 2015–2018. The downtrend reversed in 2019, with PF export volume jumping by 63.8% year on year to 22,660 tonnes, due to a decline in PF supply in Taiwan Province. As COVID-19 hit hard foreign production of PF in 2021, China's PF export increased to 42,084 tonnes, up nearly 50% year on year.

The PF export volume of the top five destinations (Djibouti, South Korea, Nigeria, Kenya and Myanmar, over 3,000 tonnes each) in 2021 together accounted for 74.0% of year's national total.

- Technology

In China, there are two main technologies to produce PF, namely rake drying method and spray drying method. Although the rake drying method still lags behind the spray drying method both in quality and environmental friendliness, it is adopted by most Chinese PF producers due to its low investment amount. In 2021, 21 PF producers adopted rake drying method with a share of 70.0% by capacity.

- Price

Generally, the price fluctuation of PF in China is greatly influenced by raw materials, methanol or formaldehyde. In 2021, the ex-works price of PF saw an uptrend, following the increasing prices of formaldehyde and methanol.

- Consumption

In China, PF is mainly consumed in agrochemical, resin and pharmaceutical industries, etc. The agrochemical industry is the largest consumption field of PF, taking up 79.5% of the total domestic PF consumption in 2021. Glyphosate technical (AEA pathway) is the largest end-use segment, and the consumption of PF in glyphosate accounted for 75.8% of the national total in 2021. The consumption of PF in resin industry occupied 17.1% share to the national total in 2021.

Methodology

Introduction

This report is the 18th edition, based on the former one finished in May 2021, focusing on the situation of China's paraformaldehyde (PF) industry in 2021 and Q1 2022, as well as forecasting its future development trend. The report is formulated in April 2022 and aims to disclose the latest production and market information of China's PF industry. The data for 2021 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
- 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 annual
kg: kilogram
USD: currency unit in the US, also called US dollar

Table 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 Exchange rate USD/CNY, Jan. 2012–March 2022

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
2012	6.3168	6.300	6.3081	6.2966	6.3062	6.3178	6.3235	6.3404	6.3395	6.3144	6.2953	6.2900	6.3136
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	-	-	-	-	-	-	-	-	-	-

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 667,000 t/a production capacity, and PF capacity beyond Mainland China was over 290,000 t/a in 2021.

The top three PF producers beyond Mainland China in 2021 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. Note that the capacity of PF of CCP remains unchange in 2019–2021 as no further information is available.

Table 1.1-1 PF producers beyond Mainland China, 2021

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%	35,000
4	INEOS Paraform GmbH & Co. KG	Germany	91%, 96%	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

Source: CCM

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, 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, especially Zhenjiang LCY General Chemical Co., Ltd., which expanded its PF capacity to 60,000 t/a in 2007 from 30,000 t/a in 2006.

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.

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 2019–2021, 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.

1.3 Properties of PF

- Physical properties

Table 1.3-1 Basic information of paraformaldehyde

CAS number	30525-89-4
Molecular formula	OH(CH2O)nH (n = 8-100)
Appearance	white crystalline solid
Density	1.42 g·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 turns into formaldehyde and 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 acid, strong alkali and in high temperature.

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

- Technology in brief

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

The pathways of producing PF 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 producing PF include vacuum concentration, polymerization, drying, sieving, package, etc.

Table 1.3-2 Unit consumption of PF (per tonne) through the catalytic 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

43 companies related to PF were studied. As of March 2022, CCM finds,
- 23 of them were active producers;
- 4 of them suspended production;
- 16 of them were potential producers.

These 16 potential producers include those finished construction but have not put into production yet, those under construction and those have just published environment impact assessment of PF projects as of March 2022.

Only Jiangsu Sanmu uses part of its PF for its own use, and it produces PF for resins/coatings.

Table 2.1-1 Location and technology source of PF producers in China, as of March 2022

No.	Producer	Abbreviation	Location	Status, as of March 2022	Launch time	Technology source	Specification
1	Zhenjiang LCY Performance Materials Co., Ltd.	Zhenjiang LCY	Jiangsu Province	Active	2002	LCY Spray prilling	92%
2	Fuhua Tongda Agro-chemical Technology Co., Ltd.	Fuhua Tongda	Sichuan Province	Active	2014	Domestic	96%
3	Hebei Jintaida Chemical Co., Ltd. (Xinle Yongxing Chemical Factory)	Hebei Jintaida	Hebei Province	Active	2013	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
4	Hebei Yuhang Chemical Co., Ltd.	Hebei Yuhang	Hebei Province	Active	1999	Wuxi Suyang Chemicals Equipment Co., Ltd.	95%–97%
5	Nantong Jiangtian Chemical Co., Ltd.	Nantong Jiangtian	Jiangsu Province	Active	Aug. 2003	GEA Niro	96%
6	Hengshui Yinhe Chemical Co., Ltd.	Hengshui Yinhe	Hebei Province	Active	May 2002	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%±1%
7	Weifang Xudong Chemical Co., Ltd.	Weifang Xudong	Shandong Province	Active	March 2007	Wuxi Suyang Chemicals Equipment Co., Ltd.	>95%
8	Anhui Denuo Chemical Co., Ltd.	Anhui Denuo	Anhui Province	Active	2004	Hebei Xinhua	96%
9	Jiangsu Sanmu Group Co., Ltd.	Jiangsu Sanmu	Jiangsu Province	Active	2014	Jiangsu Kaimao Chemical Technology Co., Ltd.	92%

No.	Producer	Abbreviation	Location	Status, as of March 2022	Launch time	Technology source	Specification
10	Zibo Qixing Chemical Technology Co., Ltd.	Zibo Qixing	Shandong Province	Active	2014	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
11	Linqu Outai Chemical Co., Ltd.	Linqu Outai	Shandong Province	Suspension	2008	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
12	Linyi Shengyang Chemical Co., Ltd.	Linyi Shengyang	Shandong Province	Active	2008	Domestic	96%
13	Inner Mongolia Jiaquan Chemical Technology Co., Ltd.	Inner Mongolia Jiaquan	Inner Mongolia Autonomous Region	Active	2015	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
14	Qingzhou Hengxing Chemical Co., Ltd.	Qingzhou Hengxing	Shandong Province	Active	2006	Domestic	96%±1%
15	Xinjiang Dearsun Chemical Co., Ltd.	Xinjiang Dearsun	Xinjiang Uygur Autonomous Region	Active	2016	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
16	Weifang Huifeng Chemical Co., Ltd.	Weifang Huifeng	Shandong Province	Active	2017	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
17	Hubei Trisun Chemicals Co., Ltd. (Hubei Xingxin Materials Co., Ltd.)	Hubei Trisun	Hubei Province	Active	2018	Domestic	96%
18	Xinjiang Wanchang New Energy Co., Ltd.	Xinjiang Wanchang	Xinjiang Uygur Autonomous Region	Active	2018	Domestic	92%
19	Dongying Fangzheng Chemical Co., Ltd.	Dongying Fangzheng	Shandong Province	Active	2018	Domestic	96%
20	Ningxia Jinhai Xinning Chemical Co., Ltd.	Ningxia Xinning	Ningxia Hui Autonomous Region	Active	2018	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
21	Shandong Zhengxin New Energy Co., Ltd.	Shandong Zhengxin	Shandong Province	Active	Jan. 2020	Domestic	96%

No.	Producer	Abbreviation	Location	Status, as of March 2022	Launch time	Technology source	Specification
22	Gansu Taier Fine Chemical Co., Ltd.	Gansu Taier	Gansu Province	Active	2020	Linyi Taier	95%±1%
23	Shijiazhuang Yaze Chemical Co., Ltd.	Shijiazhuang Yaze	Hebei Province	Active	2020	Domestic	96%
24	Anhui Hongyuan Chemical Technology Co., Ltd.	Anhui Hongyuan	Anhui Province	Suspension	2017	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
25	Nanhe Huayang Silicon Industry Co., Ltd.	Nanhe Huayang	Hebei Province	Suspension	2014	P&ID Co., Ltd.	96%
26	Hubei Yihua Chemical Industry Co., Ltd.	Hubei Yihua	Hubei Province	Suspension	2017	Wuxi Suyang Chemicals Equipment Co., Ltd.	96%
27	Qinyang Yongrun Technology Development Co., Ltd.	Qinyang Yongrun	Henan Province	Potential	/	N/A	N/A
28	Ningxia Huaye Fine Chemical Co., Ltd.	Ningxia Huaye	Ningxia Hui Autonomous Region	Active	Dec. 2020	Hebei Yuhang Chemcial Co., Ltd.	96%
29	Anhui Quansheng Chemical Co., Ltd.	Anhui Quansheng	Anhui Province	Potential	/	N/A	96%
30	Anhui Dafeng Chemical Co., Ltd.	Anhui Dafeng	Anhui Province	Potential	/	N/A	N/A
31	Jining Huiquan Chemical Co., Ltd.	Jining Huicui	Shandong Province	Potential	/	N/A	N/A
32	Dingyuan County Linxing Chemical Co., Ltd.	Dingyuan Linxing	Anhui Province	Potential	/	N/A	N/A
33	Juancheng County Zhanbang Chemical Co., Ltd.	Juancheng Zhanbang	Shandong Province	Potential	/	Domestic	97%±2%

No.	Producer	Abbreviation	Location	Status, as of March 2022	Launch time	Technology source	Specification
34	Ningxia Ningshun New Material Co., Ltd.	Ningxia Ningshun	Ningxia Hui Autonomous Region	Potential	/	N/A	96%
35	Xinjiang Shunyuan Chemical Technology Co., Ltd.	Xinjiang Shunyuan	Xinjiang Uygur Autonomous Region	Potential	/	N/A	N/A
36	Qinzhou Juli New Energy Technology Co., Ltd.	Qinzhou Juli	Guangxi Zhuang Autonomous Region	Potential	/	N/A	N/A
37	Hutubi Ruiyuantong Chemical Co., Ltd.	Hutubi Ruiyuantong	Xinjiang Uygur Autonomous Region	Potential	/	Domestic	N/A
38	Anhui Hehong Chemical Co., Ltd.	Anhui Hehong	Anhui Province	Potential	/	N/A	95%
39	Wen'an County Decheng New Material Technology Co., Ltd.	Decheng New Material	Hebei Province	Potential	/	N/A	N/A
40	Yake Technology (Anqing) Co., Ltd.	Yake Technology	Anhui Province	Potential	/	Domestic	92%
41	Shandong Linfeng New Material Technology Co., Ltd.	Shandong Linfeng	Shandong Province	Potential	/	N/A	95%
42	Guangxi Guifulin Technology Co., Ltd.	Guangxi Guifulin	Guangxi Zhuang Autonomous Region	Potential	/	N/A	95%
43	Anhui Ruibai New Materical Co., Ltd.	Anhui Ruibai	Anhui Province	Potential	/	N/A	92%

Note: Hubei Trisun Chemicals Co., Ltd. merged its wholly-owned subsidiary Hubei Xingxin. 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, 2019–Q1 2022

No.	Producer	Capacity, t/a				Output, tonne			
		2019	2020	2021	Q1 2022	2019	2020	2021	Q1 2022
1	Zhenjiang LCY Performance Materials Co., Ltd.	30,000	30,000	30,000	30,000	33,500	33,000	33,600	8,000
2	Fuhua Tongda Agro-chemical Technology Co., Ltd.	60,000	60,000	60,000	60,000	58,000	58,000	58,000	14,000
3	Hebei Jintaida Chemical Co., Ltd. (Xinle Yongxing Chemical Factory)	40,000	40,000	40,000	40,000	30,000	28,000	26,000	6,000
4	Hebei Yuhang Chemical Co., Ltd.	30,000	30,000	30,000	30,000	20,000	20,000	18,200	4,000
5	Nantong Jiangtian Chemical Co., Ltd.	80,000	80,000	80,000	80,000	41,000	40,000	59,000	16,000
6	Hengshui Yinhe Chemical Co., Ltd.	30,000	30,000	30,000	30,000	8,500	8,000	8,000	1,500
7	Weifang Xudong Chemical Co., Ltd.	10,000	10,000	10,000	10,000	5,000	5,000	4,200	1,000
8	Anhui Denuo Chemical Co., Ltd.	20,000	20,000	20,000	20,000	5,000	3,000	3,000	800
9	Jiangsu Sanmu Group Co., Ltd.	20,000	20,000	20,000	20,000	5,000	5,000	5,400	1,000
10	Zibo Qixing Chemical Technology Co., Ltd.	20,000	20,000	20,000	20,000	5,000	4,500	5,000	1,200
11	Linqu Outai Chemical Co., Ltd.	6,000	6,000	6,000	6,000	1,000	1,000	600	0
12	Linyi Shengyang Chemical Co., Ltd.	6,000	6,000	6,000	6,000	1,000	900	1,000	200
13	Inner Mongolia Jiaquan Chemical Technology Co., Ltd.	15,000	15,000	15,000	15,000	6,000	6,000	6,000	1,500
14	Qingzhou Hengxing Chemical Co., Ltd.	6,000	6,000	6,000	6,000	2,000	2,000	2,000	500
15	Xinjiang Dearsun Chemical Co., Ltd.	40,000	40,000	40,000	40,000	15,000	16,000	14,000	3,000
16	Weifang Huifeng Chemical Co., Ltd.	10,000	10,000	10,000	10,000	3,000	3,000	3,200	800

No.	Producer	Capacity, t/a				Output, tonne			
		2019	2020	2021	Q1 2022	2019	2020	2021	Q1 2022
17	Hubei Trisun Chemicals Co., Ltd. (Hubei Xingxin Materials Co., Ltd.)	33,000	33,000	33,000	33,000	23,000	33,000	32,400	6,500
18	Xinjiang Wanchang New Energy Co., Ltd.	20,000	20,000	20,000	20,000	8,000	6,000	6,000	1,200
19	Dongying Fangzheng Chemical Co., Ltd.	6,000	6,000	6,000	6,000	2,000	1,800	2,000	500
20	Ningxia Jinhai Xinning Chemical Co., Ltd.	30,000	30,000	30,000	30,000	8,000	8,000	8,000	1,500
21	Shandong Zhengxin New Energy Co., Ltd.	/	40,000	40,000	40,000	/	5,000	5,000	1,000
22	Gansu Taier Fine Chemical Co., Ltd.	/	20,000	20,000	20,000	/	3,000	2,000	800
23	Shijiazhuang Yaze Chemical Co., Ltd.	/	25,000	25,000	25,000	/	2,000	3,000	500
24	Anhui Hongyuan Chemical Technology Co., Ltd.	10,000	10,000	10,000	10,000	3,000	3,000	/	/
25	Nanhe Huayang Silicon Industry Co., Ltd.	10,000	10,000	10,000	10,000	/	/	/	/
26	Hubei Yihua Chemical Industry Co., Ltd.	20,000	20,000	20,000	20,000	/	/	/	/
27	Ningxia Huaye Fine Chemical Co., Ltd.	/	/	30,000	30,000	/	/	3,000	1,000
Others		8,000	0	0	0	800	0	0	0
Total		**560,000**	**637,000**	**667,000**	**667,000**	**283,800**	**295,200**	**308,600**	**72,500**

Note: 1. The capacity of Zhenjiang LCY was revised from 70,000 t/a to 30,000 t/a, and the data of its output was also revised. 2. The output of Hubei Trisun in 2020 was revised to 33,000 tonnes.
Source: CCM

Table 2.1-3 Operating rate and output share of major PF producers in China, 2019–Q1 2022

No.	Producer	Operating rate				Output share			
		2019	2020	2021	Q1 2022	2019	2020	2021	Q1 2022
1	Zhenjiang LCY Performance Materials Co., Ltd.	111.7%	110.0%	112.0%	106.7%	11.8%	11.2%	10.9%	11.0%
2	Fuhua Tongda Agro-chemical Technology Co., Ltd.	96.7%	96.7%	96.7%	93.3%	20.4%	19.6%	18.8%	19.3%
3	Hebei Jintaida Chemical Co., Ltd. (Xinle Yongxing Chemical Factory)	75.0%	70.0%	65.0%	60.0%	10.6%	9.5%	8.4%	8.3%
4	Hebei Yuhang Chemical Co., Ltd.	66.7%	66.7%	60.7%	53.3%	7.0%	6.8%	5.9%	5.5%
5	Nantong Jiangtian Chemical Co., Ltd.	51.3%	50.0%	73.8%	80.0%	14.4%	13.6%	19.1%	22.1%
6	Hengshui Yinhe Chemical Co., Ltd.	28.3%	26.7%	26.7%	20.0%	3.0%	2.7%	2.6%	2.1%
7	Weifang Xudong Chemical Co., Ltd.	50.0%	50.0%	42.0%	40.0%	1.8%	1.7%	1.4%	1.4%
8	Anhui Denuo Chemical Co., Ltd.	25.0%	15.0%	15.0%	16.0%	1.8%	1.0%	1.0%	1.1%
9	Jiangsu Sanmu Group Co., Ltd.	25.0%	25.0%	27.0%	20.0%	1.8%	1.7%	1.7%	1.4%
10	Zibo Qixing Chemical Technology Co., Ltd.	25.0%	22.5%	25.0%	24.0%	1.8%	1.5%	1.6%	1.7%
11	Linqu Outai Chemical Co., Ltd.	16.7%	16.7%	10.0%	0.0%	0.4%	0.3%	0.2%	0.0%
12	Linyi Shengyang Chemical Co., Ltd.	16.7%	15.0%	16.7%	13.3%	0.4%	0.3%	0.3%	0.3%
13	Inner Mongolia Jiaquan Chemical Technology Co., Ltd.	40.0%	40.0%	40.0%	40.0%	2.1%	2.0%	1.9%	2.1%
14	Qingzhou Hengxing Chemical Co., Ltd.	33.3%	33.3%	33.3%	33.3%	0.7%	0.7%	0.6%	0.7%
15	Xinjiang Dearsun Chemical Co., Ltd.	37.5%	40.0%	35.0%	30.0%	5.3%	5.4%	4.5%	4.1%
16	Weifang Huifeng Chemical Co., Ltd.	30.0%	30.0%	32.0%	32.0%	1.1%	1.0%	1.0%	1.1%
17	Hubei Trisun Chemicals Co., Ltd. (Hubei Xingxin Materials Co., Ltd.)	69.7%	100.0%	98.2%	78.8%	8.1%	11.2%	10.5%	9.0%
18	Xinjiang Wanchang New Energy Co., Ltd.	40.0%	30.0%	30.0%	24.0%	2.8%	2.0%	1.9%	1.7%

No.	Producer	Operating rate				Output share			
		2019	2020	2021	Q1 2022	2019	2020	2021	Q1 2022
19	Dongying Fangzheng Chemical Co., Ltd.	33.3%	30.0%	33.3%	33.3%	0.7%	0.6%	0.6%	0.7%
20	Ningxia Jinhai Xinning Chemical Co., Ltd.	26.7%	26.7%	26.7%	20.0%	2.8%	2.7%	2.6%	2.1%
21	Shandong Zhengxin New Energy Co., Ltd.	/	12.5%	12.5%	10.0%	/	1.7%	1.6%	1.4%
22	Gansu Taier Fine Chemical Co., Ltd.	/	15.0%	10.0%	16.0%	/	1.0%	0.6%	1.1%
23	Shijiazhuang Yaze Chemical Co., Ltd.	/	8.0%	12.0%	8.0%	/	0.7%	1.0%	0.7%
24	Anhui Hongyuan Chemical Technology Co., Ltd.	30.0%	30.0%	0.0%	0.0%	1.1%	1.0%	0.0%	0.0%
25	Nanhe Huayang Silicon Industry Co., Ltd.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
26	Hubei Yihua Chemical Industry Co., Ltd.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
27	Ningxia Huaye Fine Chemical Co., Ltd.	/	/	10.0%	13.3%	/	/	1.0%	1.4%
Others		10.0%	/	/	/	0.3%	0.0%	0.0%	0.0%
Total		**50.7%**	**46.3%**	**46.3%**	**43.5%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Note: The operating rate of Hubei Trisun increased significantly since 2020, mainly because Hubei Xingxin Materials Co., Ltd. was acquired by Hubei Trisun.
Source: CCM

Table 2.1-4 List of producers having stopped PF production in China, 2019–Q1 2022

No.	Producer	Location	Starting year	Closed year	Specification	Capacity, t/a
1	Hebei Xinhua Co., Ltd.	Hebei Province	1993	2020	96%	5,000
2	Linyi Liheng Chemical Co., Ltd.	Shandong Province	2005	2020	96%±1%	3,000
3	Linyi Ruisheng Chemical Reagent Co., Ltd.	Shandong Province	2015	2019	96%	10,000
4	Linyi Taier Chemtech Corp	Shandong Province	2007	2019	95%–97%	6,000

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.

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.

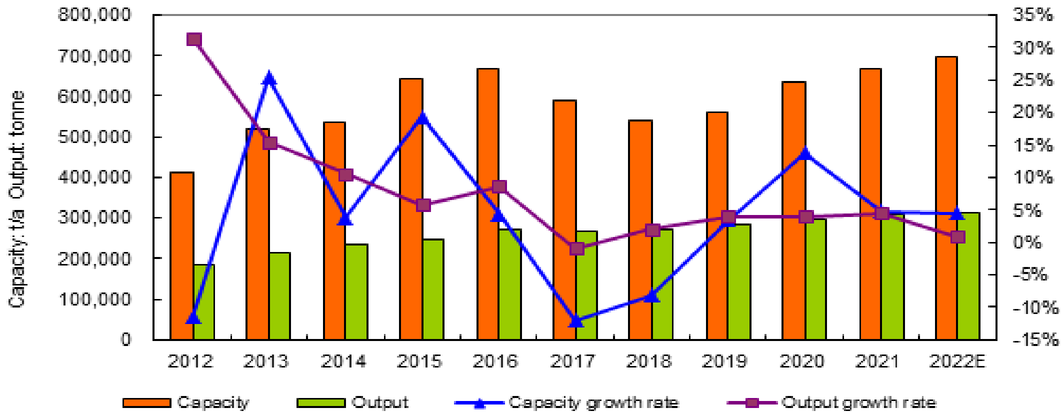
Along with stably increasing domestic demand, China's PF output kept stable in 2016–2018, ranging between 267,000 tonnes and 273,000 tonnes. It increased to 283,800 tonnes in 2019, driven by increasing demand at home and abroad.

In 2020, China's PF capacity kept increasing to 637,000 t/a, along with the launch of three projects (Shandong Zhengxin: 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.

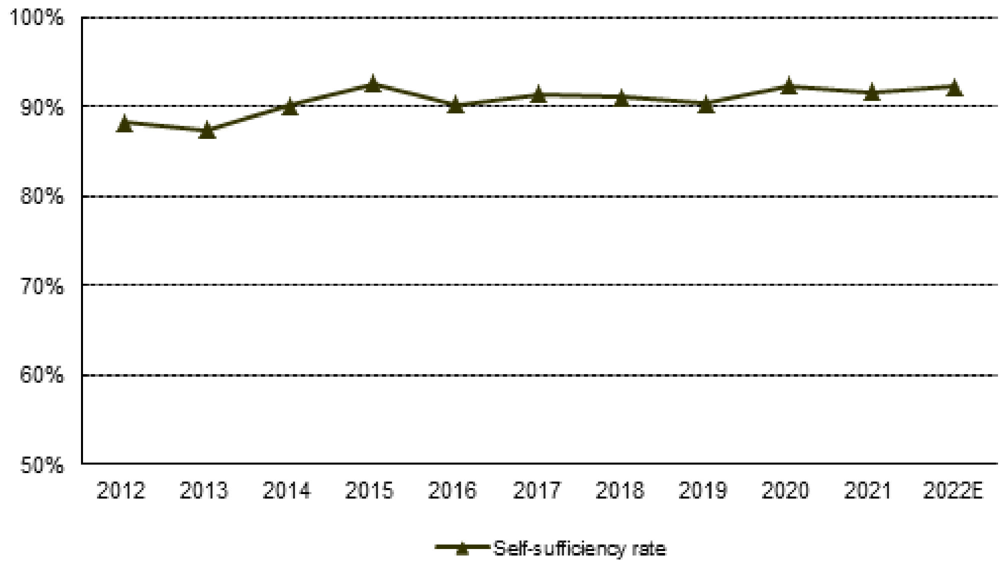
In 2022, it is expected that only Qinyang Yongrun Technology Development Co., Ltd.'s 30,000 t/a production line will be completed and put into production, and China's PF capacity may increase to about 697,000 t/a.

Figure 2.2-1 Capacity and output of PF in China, 2012–2022E



Note: "E" means estimated.
Source: CCM

Figure 2.2-2 Self-sufficiency rate of PF in China, 2012–2022E

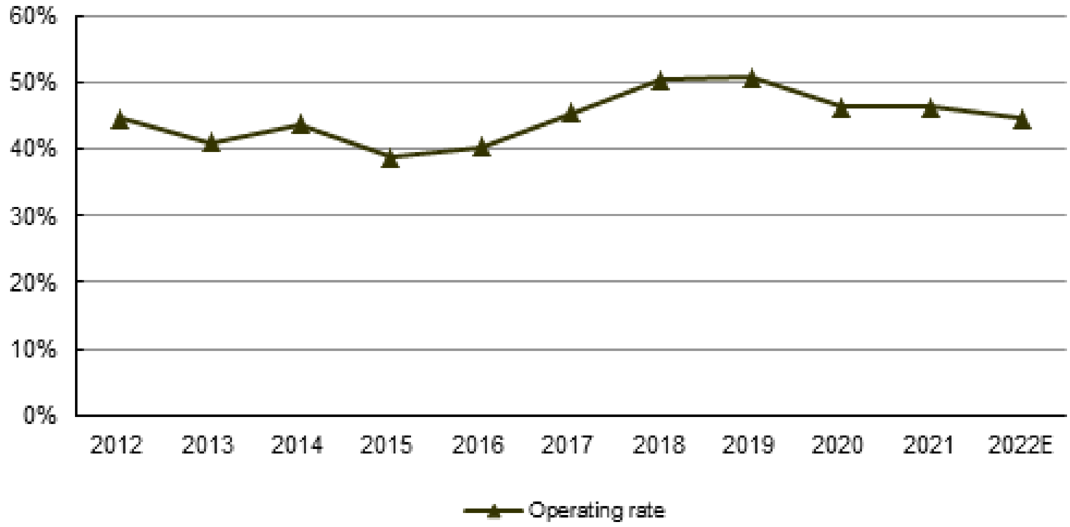


Note: "E" means estimated.
Source: CCM

The operating rate of China's PF industry was relatively low, less than 50% in 2010–2017, because of the serious overcapacity. The operating rate increased to 51% in 2018, because a number of producers stopped PF production completely and the output rose slightly driven by the increasing domestic demand. The rate kept going up in 2019, along with the rising output, though the capacity increased as well. It declined in 2020, along with the launch of three projects.

In 2021, the operating rate of China's PF industry remained the same as that in 2020, at 46.3%. However, it is expected that the rate will decline slightly in 2022 as the growth rate of demand is not as fast as that of PF capacity.

Figure 2.2-3 Operating rate of PF in China, 2012–2022E



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. The monthly ex-works prices of PF and methanol in China from 2012 to 2021 show that PF price fluctuates along with methanol price.

In 2012, the ex-works price of PF kept an uptrend, and it peaked in Nov. at about USD905/t. It kept increasing in 2013, and it reached a new high in Dec. at about USD941/t. From Jan. 2013 to Dec. 2013, the price kept rising mainly driven by the increasing price of methanol and increasing demand for PF from the domestic glyphosate industry.

In 2014, the ex-works price of PF kept 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.

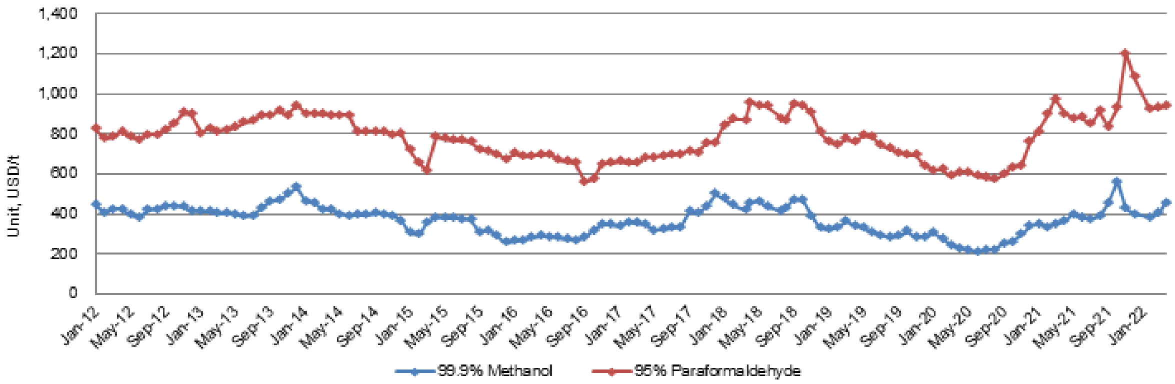
In Q1 2019, the ex-works price of PF increased a little. Then in Q2–Q4, it showed a general downward trend, following falls in the prices of formaldehyde and methanol.

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 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 Q1 2022, the ex-works price of PF was still at a high level though decreased a bit.

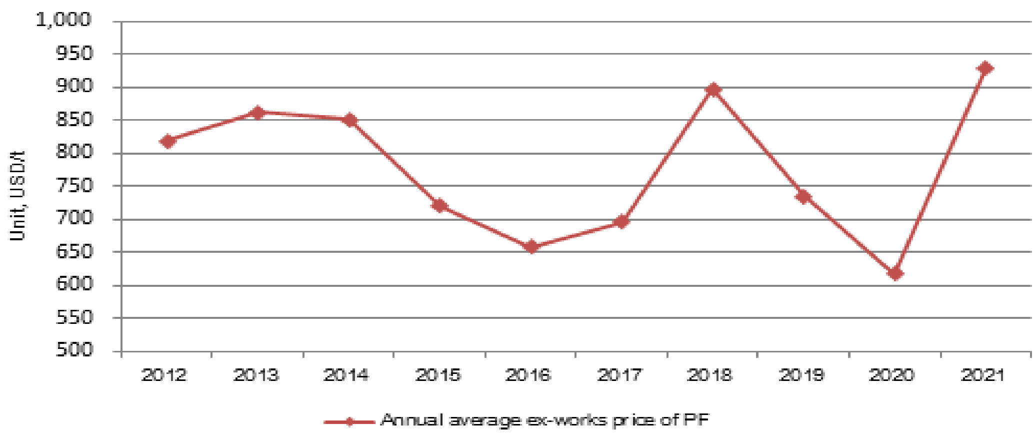
Figure 2.3-1 Monthly ex-works price of 95% PF and 99.9% methanol in China, Jan. 2012–March 2022



Source: CCM

On the whole, after 2015, the prices of methanol, formaldehyde reached a peak in 2018 first and in 2021, their prices hit a record high.

Figure 2.3-2 Annual average ex-works price of PF in China, 2012–2021



Source: CCM

Table 2.3-1 Quotation of PF in China by producer, March 2022

No.	Producer	Specification	Ex-works price, USD/t
1	Zhenjiang LCY Performance Materials Co., Ltd.	92%	/
2	Fuhua Tongda Agro-chemical Technology Co., Ltd.	96%	/
3	Hebei Jintaida Chemical Co., Ltd. (Xinle Yongxing Chemical Factory)	96%	825
4	Hebei Yuhang Chemical Co., Ltd.	95%–97%	825
5	Nantong Jiangtian Chemical Co., Ltd.	96%	1,238
6	Hengshui Yinhe Chemical Co., Ltd.	96%±1%	873
7	Weifang Xudong Chemical Co., Ltd.	>95%	873
8	Anhui Denuo Chemical Co., Ltd.	96%	/
9	Jiangsu Sanmu Group Co., Ltd.	92%	/
10	Zibo Qixing Chemical Technology Co., Ltd.	96%	873
11	Linqu Outai Chemical Co., Ltd.	96%	/
12	Linyi Shengyang Chemical Co., Ltd.	96%	857
13	Inner Mongolia Jiaquan Chemical Technology Co., Ltd.	96%	690
14	Qingzhou Hengxing Chemical Co., Ltd.	96%±1%	920
15	Xinjiang Dearsun Chemical Co., Ltd.	96%	/
16	Weifang Huifeng Chemical Co., Ltd.	96%	968
17	Hubei Trisun Chemicals Co., Ltd. (Hubei Xingxin Materials Co., Ltd.)	96%	/
18	Xinjiang Wanchang New Energy Co., Ltd.	92%	/
19	Dongying Fangzheng Chemical Co., Ltd.	96%	825
20	Ningxia Jinhai Xinning Chemical Co., Ltd.	96%	762
21	Shandong Zhengxin New Energy Co., Ltd.	96%	857
22	Gansu Taier Fine Chemical Co., Ltd.	95%±1%	841
23	Shijiazhuang Yaze Chemical Co., Ltd.	96%	/
24	Anhui Hongyuan Chemical Technology Co., Ltd.	96%	/
25	Nanhe Huayang Silicon Industry Co., Ltd.	96%	/
26	Hubei Yihua Chemical Industry Co., Ltd.	96%	/
27	Ningxia Huaye Fine Chemical Co., Ltd.	96%	825

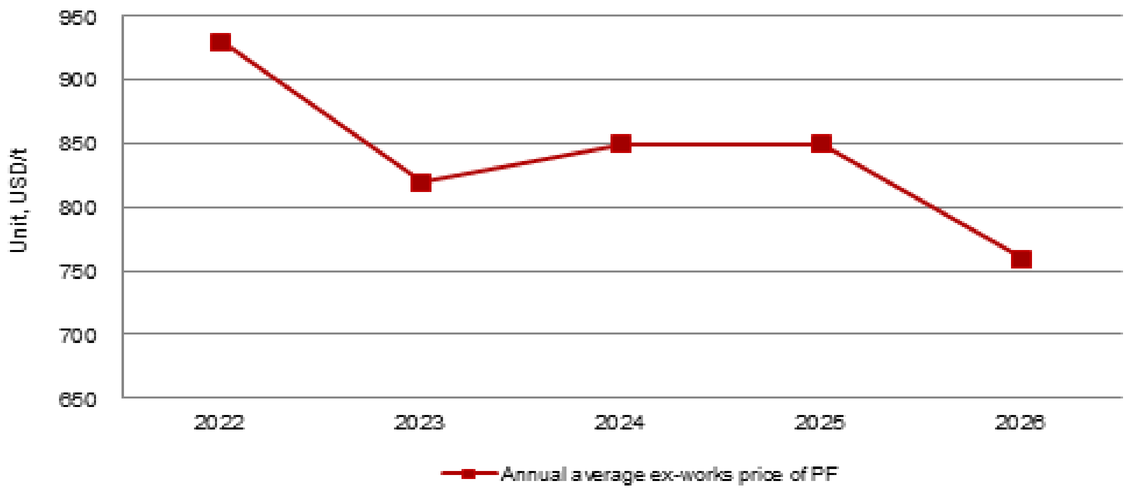
Source: CCM

China's ex-works price of PF is expected to stay on a high level in 2022. Main reasons are as follows:

- Cost: due to the high price of methanol, production cost for PF will increase.
- Supply: production of PF may be limited, and its market supply will be reduced, owing to the Dual-Control Policy on energy consumption and energy intensity.

In 2023–2025, the ex-works price of PF is expected to go down and drop below USD800/t after 2026, along with continuous expansion of domestic production capacity.

Figure 2.3-3 Forecast on ex-works price of PF in China, 2022–2026



Source: CCM

2.4 New dynamics of raw material of PF—formaldehyde

Chinese PF producers use 37% or 50% formaldehyde to produce PF, according to 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 2022

No.	Producer	Technology source of formaldehyde production	Source of formaldehyde	Concentration of formaldehyde
1	Zhenjiang LCY	LCY Spray prilling	Captive production	37%
2	Fuhua Tongda	Domestic	Captive production	50%
3	Hebei Jintaida	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	45%–50%
4	Hebei Yuhang	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	37%
5	Nantong Jiangtian	GEA Niro	Captive production	37%–55%
6	Hengshui Yinhe	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	37%
7	Weifang Xudong	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	37%, 50%
8	Anhui Denuo	Hebei Xinhua	Captive production	37%
9	Jiangsu Sanmu	Jiangsu Kaimao Chemical Technology Co., Ltd.	Captive production	37%
10	Zibo Qixing	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	50%
11	Linqu Outai	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	37%
12	Linyi Shengyang	Domestic	Captive production	37%

No.	Producer	Technology source of formaldehyde production	Source of formaldehyde	Concentration of formaldehyde
13	Inner Mongolia Jiaquan	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	50%
14	Qingzhou Hengxing	Domestic	Captive production	37%
15	Xinjiang Dearsun	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	50%
16	Weifang Huifeng	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	37%
17	Hubei Trisun	Domestic	Captive production	52%
18	Weifang Huifeng	Domestic	Captive production	37%
19	Dongying Fangzheng	Domestic	Captive production	37%
20	Ningxia Xinning	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	37%
21	Shandong Zhengxin	Domestic	Captive production	37%
22	Gansu Taier	Linyi Taier	Captive production	50%
23	Shijiazhuang Yaze	Domestic	Captive production	50%
24	Anhui Hongyuan	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	50%
25	Ningxia Huaye	Wuxi Suyang Chemicals Equipment Co., Ltd.	Captive production	37%

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, 2012–2021

Year	Capacity, t/a	Output, tonne	Growth rate of output	Import volume, tonne	Export volume, tonne	Apparent consumption, tonne
2012	31,570,000	13,077,000	30.3%	109	10,021	13,067,088
2013	32,800,000	14,423,000	10.3%	87	12,035	14,411,052
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

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 2012–2014, 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 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, the demand from downstream real estate and other industries reduced, and the operating rate of formaldehyde 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.

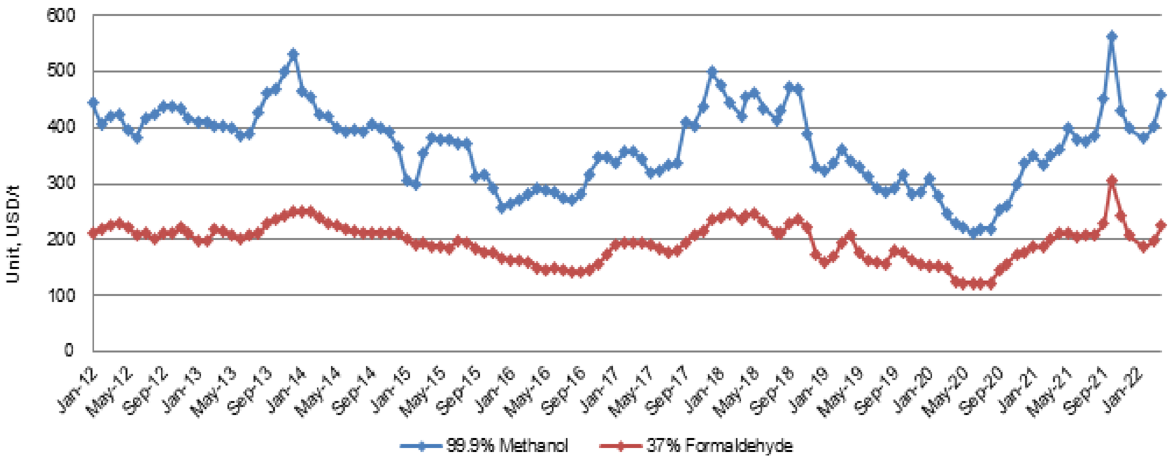
2.4.2 Price of formaldehyde in China

Methanol is the main raw material of formaldehyde. At present, the production of one tonne of formaldehyde needs about 0.43 tonne of refining 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.

In 2012–2013, the ex-works price of 99.9% purified methanol was relatively unstable, which enjoyed rise, but also suffered fall, reaching USD532/t in Dec. 2013. During 2014–2015, the ex-works price of 99.9% purified methanol fluctuated amid 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 price, peaking in Oct. at USD561/t, a new high since 2009.

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.

Figure 2.4.2-1 Monthly ex-works prices of 37% formaldehyde and 99.9% purified methanol in China, Jan. 2012–March 2022



Source: CCM

2.5 Industrial affair 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 urtropine, 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 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.

In Novermber 2018, the environmental impact assessment report of Anhui Quansheng Chemical Co., Ltd.'s PF project with a capacity of 30,000 t/a was approved. Besides, the environmental impact assessment 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 environmental impact assessment 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 environmental impact assessment report of Jining Huiquan Chemical Co., Ltd.'s relocation project (1st phase: 100,000 t/a formaldehyde, 50,000 t/a adhensive; 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 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 environmental impact assessment 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 environmental impact assessment 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 environmental impact assessment 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 environmental impact assessment 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 environmental impact assessment 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 assessment 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, the environment impact assessment 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 assessment report of Anhui Ruibai New Materical Co., Ltd.'s project (50,000 t/a propyl acetate, 50,000 t/a butyl acetate, 360,000 t/a formaldhyde and 60,000 t/a PF) was published.

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 decreasing 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 volume 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.

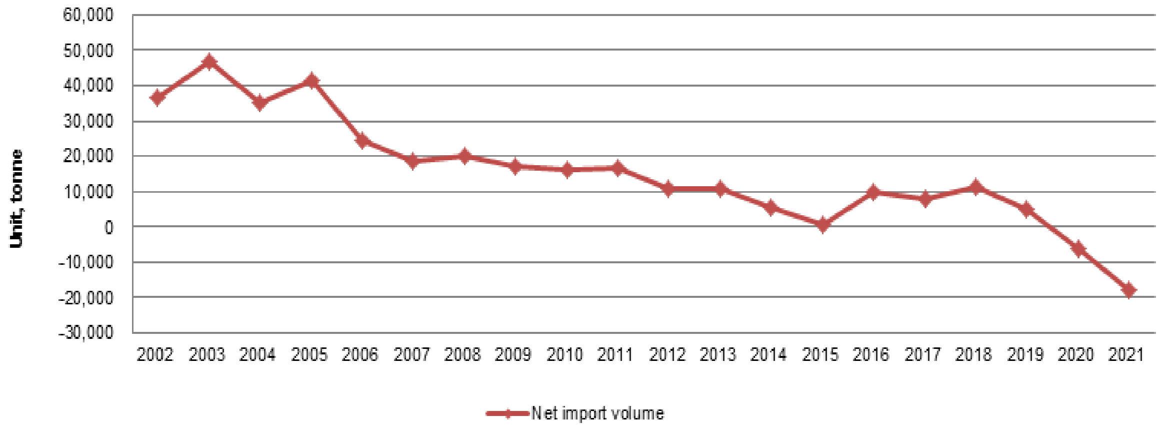
In 2021, both import and export volumes of PF in China increased, up by 10.9% and 49.5% respectively compared with those in 2020.

Table 3.1-1 China's imports and exports of PF, 2002–2021

Year	Import			Export		
	Volume, tonne	**Value, USD**	**Average price, USD/t**	**Volume, tonne**	**Value, USD**	**Average price, USD/t**
2002	36,627	16,453,333	449	93	114,373	1,230
2003	47,281	22,150,080	468	223	257,952	1,157
2004	36,418	17,413,685	478	1,035	519,427	502
2005	41,963	24,355,821	580	287	364,806	1,271
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

Source: China Customs & CCM

Figure 3.1-1 Net import volume of PF in China, 2002–2021



Source: China Customs & CCM

3.2 Import analysis of PF 2021

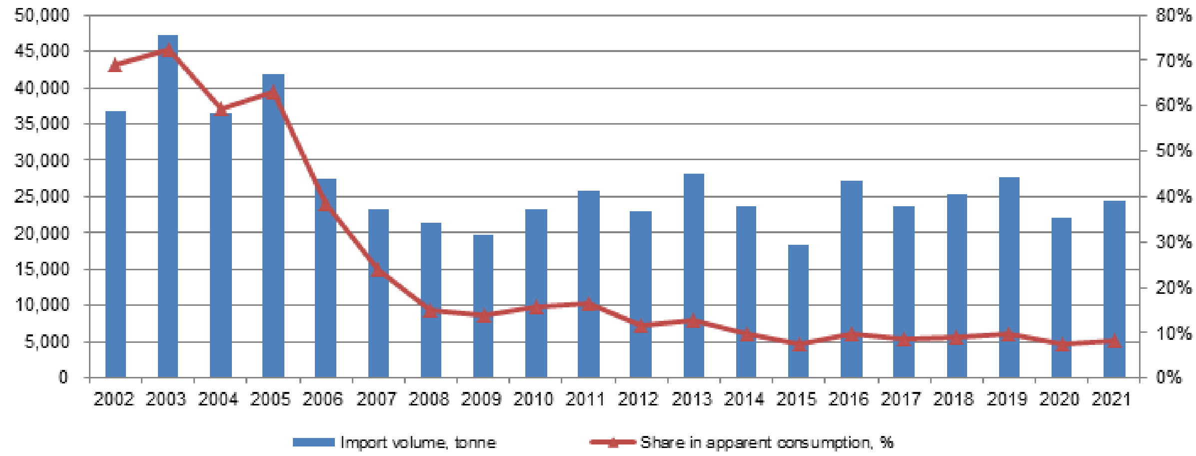
- Import volume

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.

Figure 3.2-1 Import volume of PF and its share in PF apparent consumption in China, 2002–2021



Source: China Customs & CCM

- Import origin

Spain, Taiwan Province and the US have been 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.

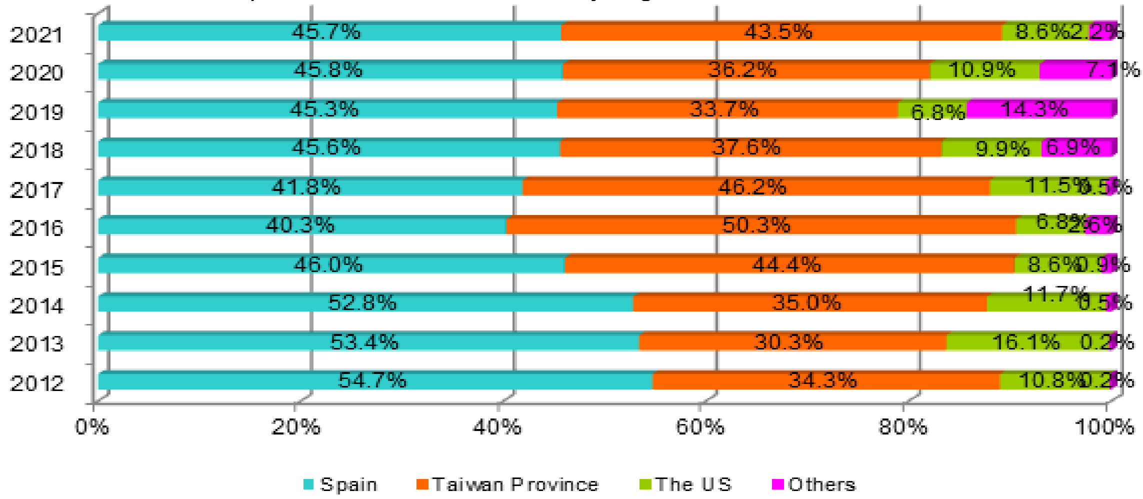
In 2018, Spain won back the No. 1 position, and China imported 1,620 tonnes of PF from Indonesia, a new but vigorous comer.

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. The top three PF producers were still Spain, Taiwan Province and the US, accounting for 92.9% of the total.

In 2021, the top three PF origions remianed the same: Spain, Taiwan Province and the US, the three taking up 97.8% of the total import volume. Indonesia stood in fourth place with 532 tonnes, and its volume and share shrank greatly from those in 2019.

Figure 3.2-2 Share of imported PF volume to China by origin, 2012–2021



Source: China Customs & CCM

Table 3.2-1 Origins of China's imported PF, 2017–2021

Country/origin	2017			2018			2019			2020			2021		
	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	9,910	6,813,317	687	11,495	8,931,597	777	12,560	9,260,199	737	10,064	6,266,063	623	11,121	9,251,155	832
Taiwan Province	10,934	7,012,333	641	9,482	6,987,824	737	9,345	6,161,531	659	7,947	4,604,826	579	10,589	8,453,506	798
The US	2,717	2,231,157	821	2,496	2,220,797	890	1,877	1,671,151	890	2,384	1,984,230	832	2,096	2,024,950	966
Indonesia	/	/	/	1,620	1,133,453	700	3,460	2,242,081	648	1,540	875,320	568	532	479,220	901
Others	121	112,406	929	123	122,398	995	505	386,187	765	17	54,818	3,322	1	45,909	41,547
Total	**23,682**	**16,169,213**	**683**	**25,216**	**19,396,069**	**769**	**27,747**	**19,721,149**	**711**	**21,952**	**13,785,257**	**628**	**24,339**	**20,254,740**	**832**

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 has kept an uptrend since Dec. 2009, reaching USD965/t in April 2014, a peak after the global financial crisis.

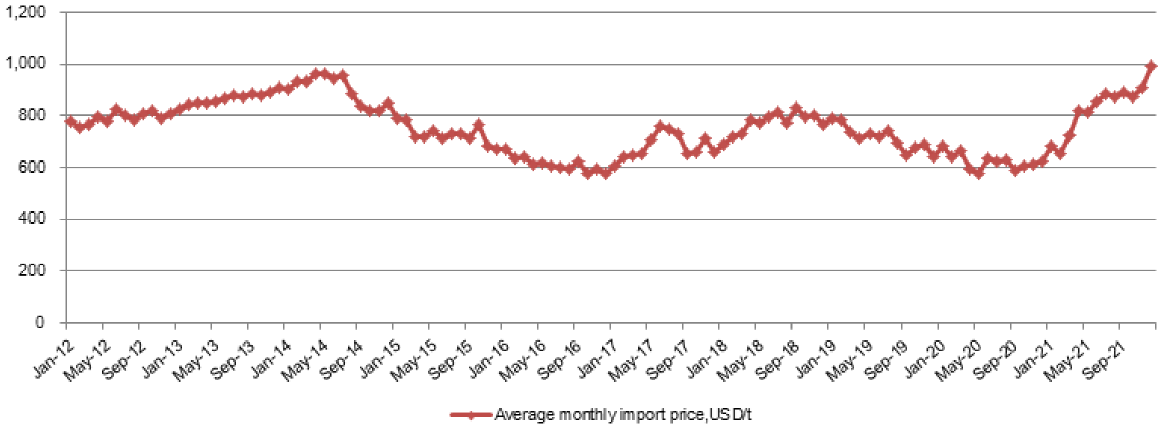
Crude oil was in overcapacity and its price still kept decreasing in 2015. The overcapacity and low price of crude oil almost affected the global macroeconomic environment. The import price of PF had much to do with the crude oil price. The import price of PF in China was down to USD673/t in Dec. 2015 from USD853/t at the end of 2014. In 2016, the overall import price was lower than that in 2015, 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 at USD711/t, down some 7% year on year. In 2020, the annual average price continued to decrease, down about 12% over the previous year.

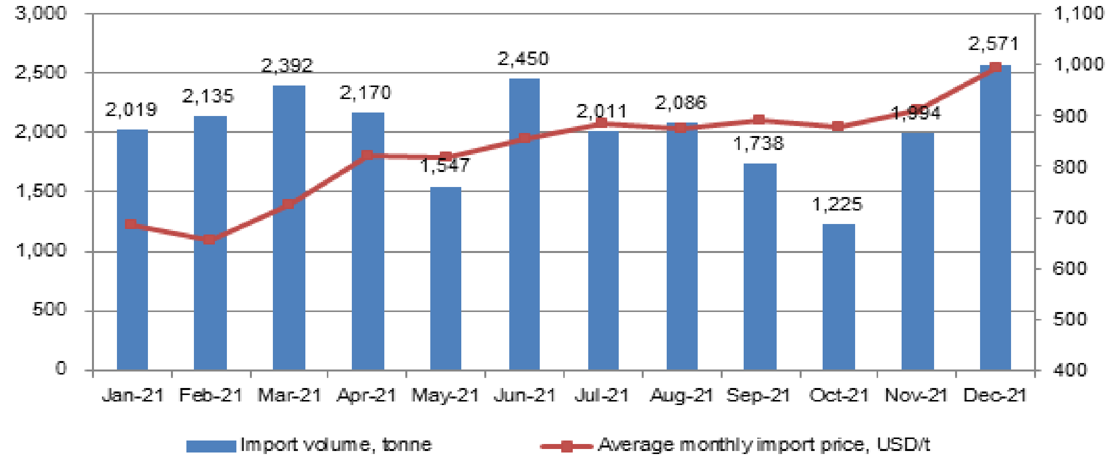
The annual average import price of PF jumped to USD832/t in 2021 from USD628/t in 2020, up by 32.5% year on year.

Figure 3.2-3 China's import price of PF by month, 2012–2021



Source: China Customs & CCM

Figure 3.2-4 China's imports of PF by month, 2021



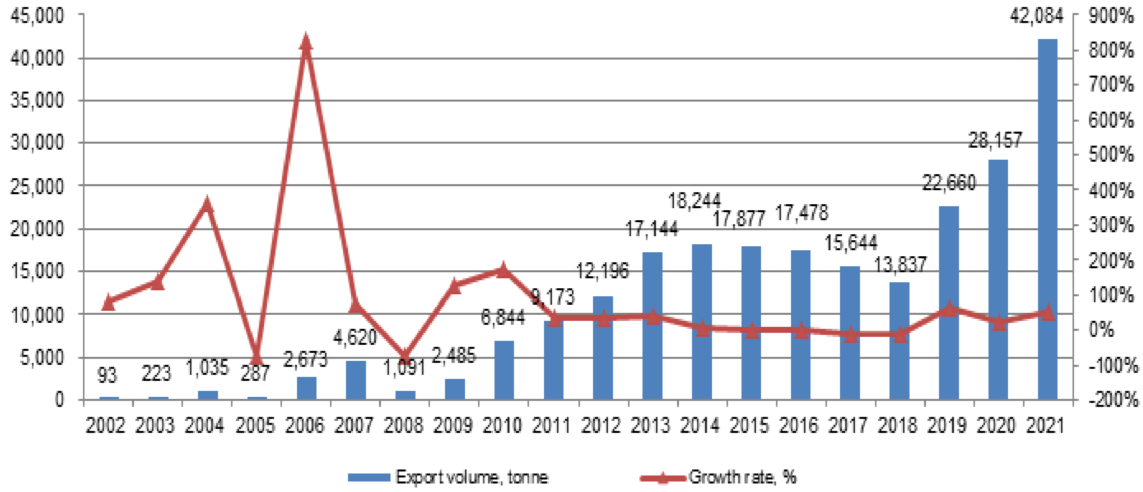
Source: China Customs & CCM

3.3 Export analysis of PF 2021

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. From 2019 to 2021, PF export from China saw big year-on-year increases; the volume in 2021 reached 42,084 tonnes.

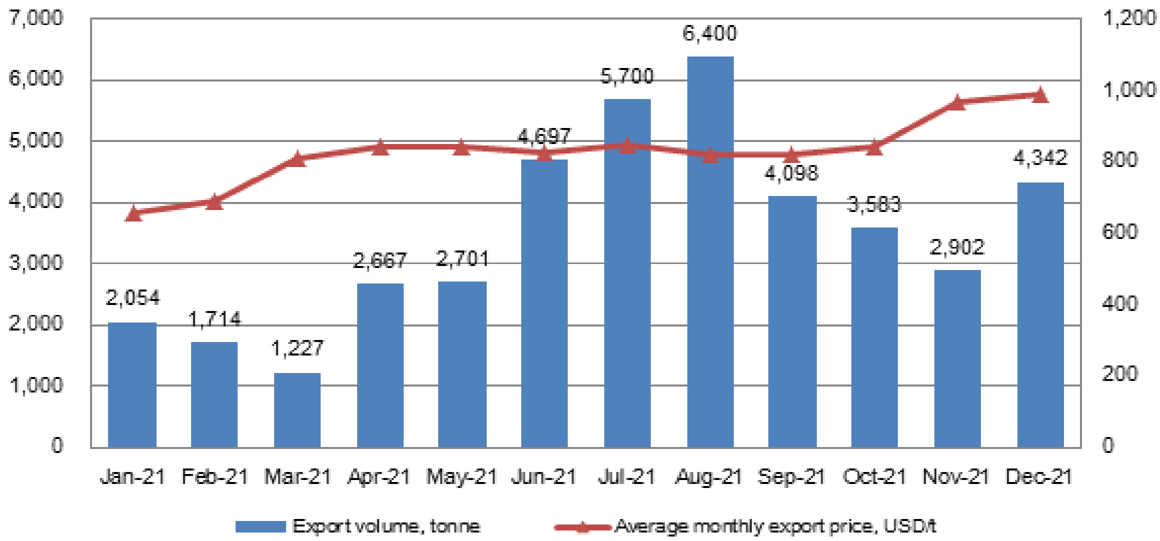
In 2021, the top five export destinations of China's PF with a volume over 3,000 tonnes were Djibouti, South Korea, Nigeria, Kenya and Myanmar.

Figure 3.3-1 China's export volume of PF, 2002–2021



Source: China Customs & CCM

Figure 3.3-2 China's exports of PF by month, 2021



Source: China Customs & CCM

Table 3.3-1 Export destinations of China's PF, 2017–2021

No.	2017			2018			2019			2020			2021		
	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	4,191	627	South Korea	3,683	783	South Korea	7,632	711	South Korea	6,711	586	Djibouti	7,965	798
2	Bangladesh	2,145	620	Thailand	1,669	793	Ethiopia	1,995	686	Djibouti	3,797	541	South Korea	7,654	836
3	Taiwan Province	1,233	782	Ethiopia	1,448	901	Kenya	1,789	757	Ethiopia	3,758	577	Nigeria	7,464	876
4	Singapore	975	707	Djibouti	1,408	887	Djibouti	1,563	762	Nigeria	3,248	579	Kenya	4,077	854
5	India	943	593	Angola	917	951	Angola	1,363	752	Kenya	2,300	613	Myanmar	3,968	865
6	Djibouti	910	762	Kenya	848	899	Tanzania	1,258	747	Tanzania	1,588	643	Bangladesh	2,482	779
7	Angola	760	705	Tanzania	695	910	Thailand	959	750	Bangladesh	1,513	440	Tanzania	2,020	850
8	Thailand	726	650	Cameroon	568	806	Myanmar	945	683	Taiwan Province	1,391	631	Angola	1,257	871
9	Kenya	677	737	Myanmar	551	914	Taiwan Province	913	693	Angola	581	560	Thailand	1,135	882
10	Sri Lanka	467	723	Taiwan Province	624	875	Nigeria	866	729	Cameroon	570	578	Taiwan Province	1,123	828
11	Nigeria	364	882	India	484	728	Bangladesh	789	649	Thailand	529	592	Ethiopia	725	862
Sub-total		**13,390**	**627**	**Sub-total**	**12,894**	**844**	**Sub-total**	**20,072**	**709**	**Sub-total**	**25,986**	**576**	**Sub-total**	**39,868**	**841**
Others		2,254	627	Others	943	919	Others	2,588	728	Others	2,171	596	Others	2,216	892
Total		**15,644**	**684**	**Total**	**13,837**	**849**	**Total**	**22,660**	**711**	**Total**	**28,157**	**578**	**Total**	**42,084**	**843**

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, %	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

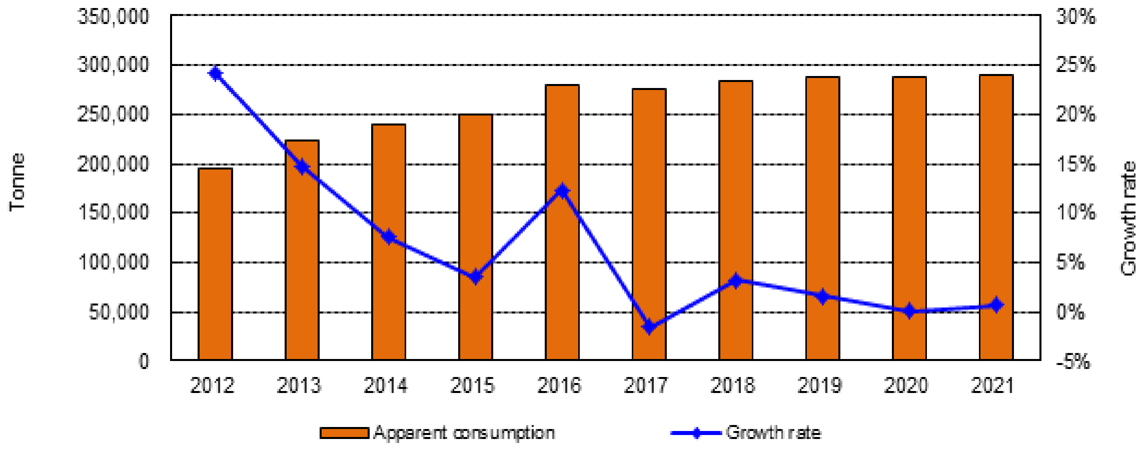
Note: 1. Export rebate refers to refunds of the value-added tax (VAT) and consumption tax (CT) actually paid by the exporting enterprises on exported goods during the production and circulation process. 2. VAT is a consumption tax on goods and services that is levied at each stage of the supply chain where value is added, from initial production to the point of sale.

Source: China Customs

4 End use segments of PF in China

On the whole, the apparent consumption of PF in China is increasing steadily, at a CAGR of 4.6% during 2012–2021.

Figure 4-1 Apparent consumption of PF and its growth rate in China, 2012–2021



Source: CCM

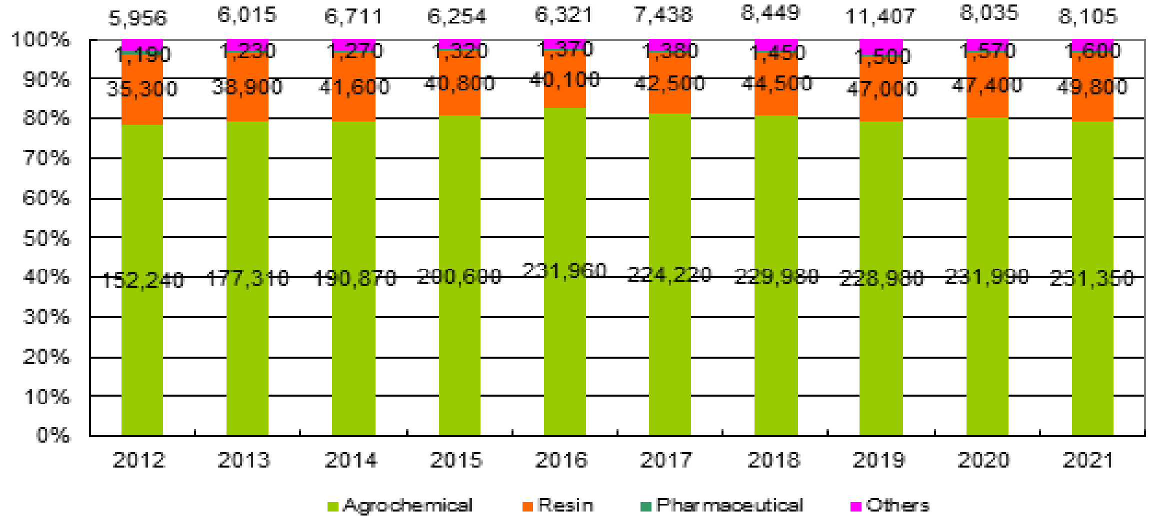
Agrochemical has kept being the largest end use segment for PF in China, whose consumption of PF took up 79.5% of the national total in 2021, dropped slightly by 0.8 percentage points year on year. In this segment, PF is mainly consumed in glyphosate and amide herbicides, including acetochlor, butachlor, alachlor, propisochlor.

The second largest downstream industry of PF is resin, including phenolic resin, urea-formaldehyde resin, melamine resin. At present, most resin is still made from formaldehyde solution (37%), and only a small portion of resin, mainly used in automobile coatings/paints and inks, is made from PF. The PF applied in resin is limited because the technology adopted by domestic companies is not advanced enough and the companies also need to reduce their production cost. Resin producers using PF as the raw material are mostly foreign enterprises or Sino-foreign joint ventures. But with the increasing concern on environmental protection and the excellent characteristics of PF (easily shipped and stored), PF would substitute more formaldehyde solution (37%) for resin production, which accounts for quite a large portion of the overall demand for formaldehyde solution.

The apparent consumption volume of PF in resin and pharmaceutical reached 49,800 tonnes and 1,600 tonnes in 2021, up by about 5.1% and 1.9% year on year respectively.

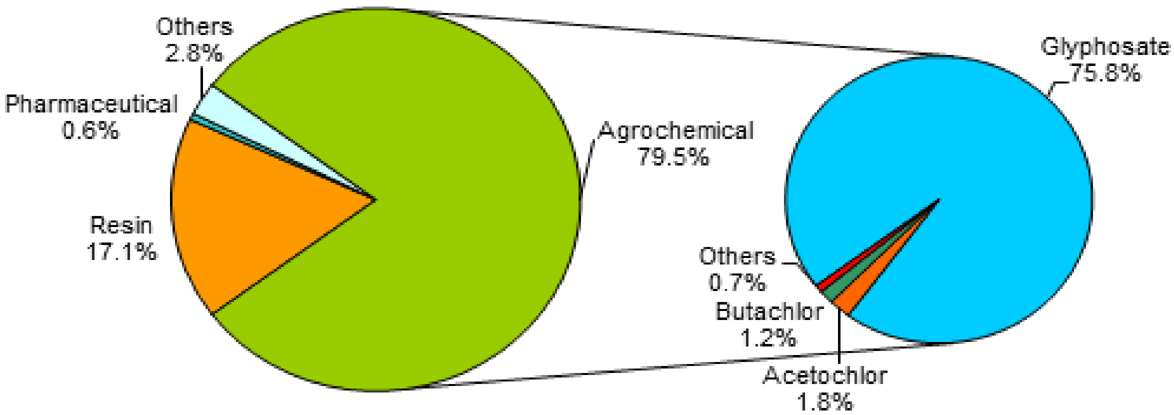
PF can be used in other applications such as organic ingredients, additive and so on. The apparent consumption volume of PF in other applications in China was about 8,105 tonnes in 2021, taking up around 2.8% of the national total.

Figure 4-2 Consumption pattern of PF in China by downstream industry, 2012–2021



Source: CCM

Figure 4-3 PF consumption breakdown by end use segment in China, 2021



Source: CCM

4.1 Consumption of PF in glyphosate

Glyphosate is the largest PF consumption sector in China. Glyphosate production (AEA pathway) uses PF with the content of 95%–97% as raw material, and about 0.49 tonne of PF is needed to produce one tonne of glyphosate technical. PF consumption in glyphosate has accounted for over three quarters of the total PF consumption during the past five years.

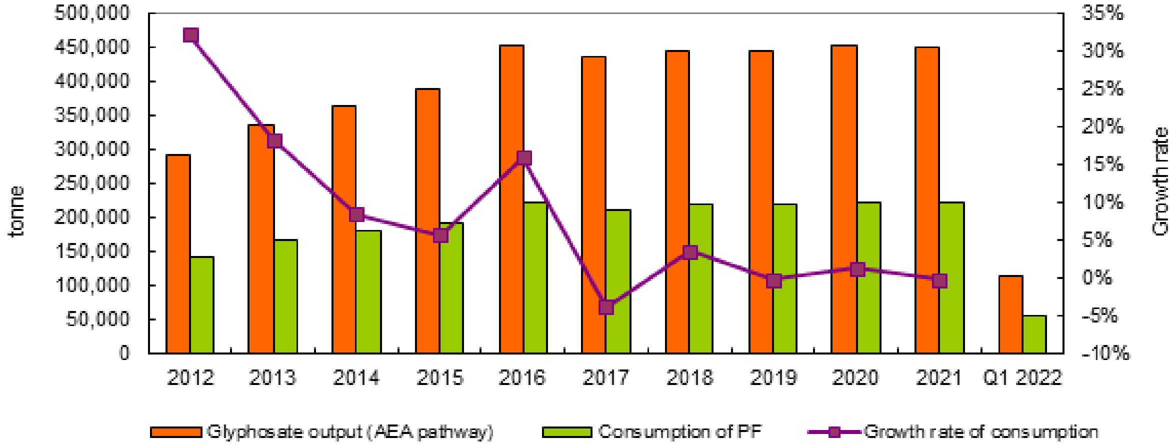
In China, PF consumption volume in glyphosate increased fast from 2009 to 2016, with a CAGR of about 12.0%, mainly driven by the increasing output of glyphosate technical (AEA pathway) in China.

In 2017, PF consumption volume in glyphosate decreased, because Zhejiang Wynca Chemical Group Co., Ltd.'s output of glyphosate technical decreased a lot from 30,000 tonnes in 2016 to only 5,000 tonnes in 2017 caused by production line removal.

From 2018 to 2020, PF consumption volume in glyphosate increased because of the increasing output of glyphosate technical (AEA pathway) in China.

In 2021, China's PF consumption volume in glyphosate declined slightly to 220,500 tonnes as the operating rate of glyphosate technical (AEA pathway) decreased a bit.

Figure 4.1-1 Consumption of PF in glyphosate production (AEA pathway) in China, 2012–Q1 2022



Source: CCM

4.1.1 Dynamic of glyphosate development in China

Stimulated by the fat profit and large demand for glyphosate at the end of 2007 and H1 2008, domestic companies competing with each other by expanding their capacity of glyphosate or constructing new production lines of glyphosate technical, thus the capacity of China's glyphosate technical (statistical results from the companies whose status were active or idle) kept increasing fast from 202,800 t/a in 2006 to 826,900 t/a in 2010. Along with the sluggish market, poor profit, stricter requirements for waste treatment, etc., some small- and medium-sized producers have been eliminated or have stopped the production of glyphosate technical, and the domestic capacity declined to 777,500 t/a in 2011. Along with the expansion of some key producers such as Hubei Trisun Chemical Co., Ltd. (Hubei Trisun), Jiangsu Good Harvest-Weien Agrochemical Co., Ltd. (Jiangsu Good Harvest-Weien), Inner Mongolia Tenglong Fine Chemical Co., Ltd. (Inner Mongolia Tenglong), Henan HDF Chemical Co., Ltd. (Henan HDF) and Sichuan Hebang Corporation Limited (Sichuan Hebang), the capacity of glyphosate technical in China increased to 906,500 t/a in 2013, 909,500 t/a in 2014 and 998,500 t/a in 2015.

The oversupply of glyphosate since 2008 resulted in stable production of glyphosate technical in China, and from 2008 to 2011, the domestic output of glyphosate technical fluctuated between 320,000 tonnes and 340,000 tonnes (glyphosate technical 95% equivalent, similarly hereinafter). From 2009 to 2011, the operating rate of glyphosate technical was kept below 50%. Stimulated by the increasing overseas demand, the domestic output of glyphosate technical increased rapidly to 430,000 tonnes and 512,000 tonnes in 2012 and 2013 respectively, and it kept increasing in 2014 with an output of 534,000 tonnes.

As the crude oil price stayed at low level, which affected the macroeconomy, the agricultural industry ran weak in 2015. The glyphosate market was sluggish afterwards. Although the capacity of glyphosate technical increased, the output decreased to 520,000 tonnes in 2015.

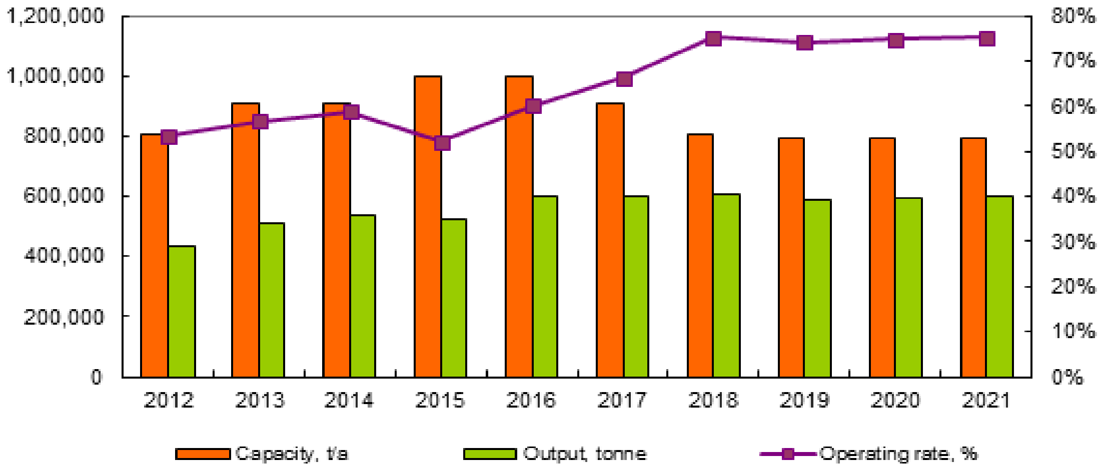
In 2016, the capacity of glyphosate technical was 999,000 t/a; the output was 600,000 tonnes, up by 15.4% year on year.

In 2017, glyphosate was in short supply and demand for glyphosate in China was still on the rise. However, due to the nationwide centralised environmental inspection and the inspection of production safety, the production of glyphosate had been restricted and its output kept stable.

In 2018, the capacity of glyphosate in China decreased to 805,000 t/a because of stricter environmental protection policies, while the output increased to 605,000 tonnes driven by increasing demand at home and abroad.

The capacity of glyphosate technical decreased in 2019 and remained unchanged at 795,000 t/a till 2021, while the output increased from 590,000 tonnes in 2019 to 598,000 tonnes in 2021, with an operating rate of about 75% in the past three years.

Figure 4.1.1-1 Capacity and output of glyphosate technical in China, 2012–2021



Source: CCM

The controversy on glyphosate's carcinogenicity

In late March 2015, the World Health Organization (WHO) stated that the glyphosate contained in Roundup, one of Monsanto's herbicide, may be linked to cancer, which drew high attention and controversy in the scientific field.

Besides, in Feb. 2019, researchers from the University of Washington evaluated existing studies into the chemical found in glyphosate-based herbicides and concluded that it significantly increased the risk of non-Hodgkin's lymphoma (NHL), a cancer of the immune system.

However, the conclusion is quite different from those made by other mainstream authorities that participated in the risk assessment of glyphosate:

- In Jan. 2014, the Federal Institute for Risk Assessment (BfR) concluded in the glyphosate assessment that glyphosate is unlikely to pose a carcinogenic risk to humans.
- In Nov. 2015, the European Food Safety Authority (EFSA) and the EU member states finalized the reassessment of glyphosate and released a report stating that glyphosate is unlikely to pose a carcinogenic threat to humans.
- From 9 to 13 May, 2016, the Joint FAO/WHO Meeting on Pesticide Residues (JMPR) confirmed that glyphosate is unlikely to pose a carcinogenic risk to humans from exposure through the diet.
- In Aug. 2016, independent toxicologists commissioned by the New Zealand Environmental Protection Agency (EPA) assessed the evidence of glyphosate's carcinogenicity. And the result showed that glyphosate is unlikely to cause cancer.
- In November 2017, a large study in the Journal of the National Cancer Institute looked at nearly 45,000 glyphosate users. That study concluded that no association was apparent between glyphosate and any solid tumors or lymphoid malignancies overall, including non-Hodgkin lymphoma (NHL).
- In 2018, the Agricultural Health Study, which followed more than 50,000 people in the US for over ten years, was published. This world study in the population with the highest exposure to glyphosate showed that if there was any risk of cancer from glyphosate preparations, it was exceedingly small.

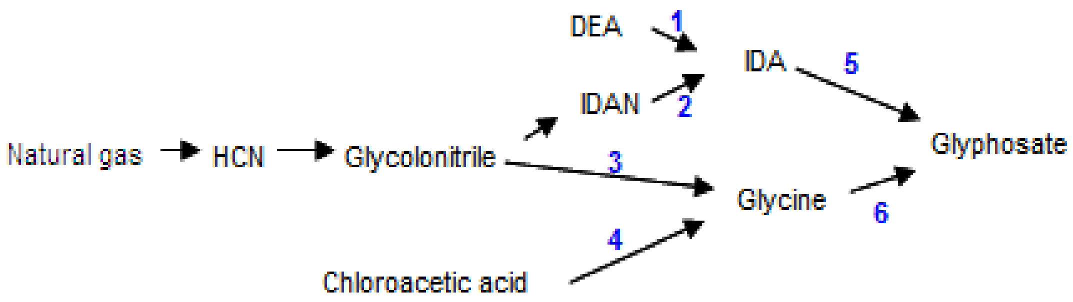
To sum up, CCM believes that the performance of glyphosate in the market won't be greatly influenced in the short term, given that no substantial scientific evidence relating to the carcinogenicity of glyphosate has been introduced.

As one of the main raw materials of glyphosate, the paraformaldehyde market is directly related to the glyphosate market. Currently, glyphosate is the premier pesticide variety in China, ranking first among all varieties in terms of output, consumption, output value and sales. It's estimated that the Chinese government will keep an eye on the potential carcinogenicity of glyphosate for a long time, but won't issue related policies to ban its use domestically in the short run. Accordingly, the paraformaldehyde business won't be affected.

However, the main process route of glyphosate (glycine route) has generated more wastewater and stricter environmental policies have been implemented in China in recent years. If the glyphosate producers limit or even suspend their production due to environmental pressure, domestic paraformaldehyde market is likely to face oversupply, leading to an increase in market risks.

4.1.2 Routes for glyphosate production

Figure 4.1.2-1 Production pathways of glyphosate technical in China



Note: 1) DEA route 2) IDAN route 3) HCN route (No enterprise in China adopted this route since 2010) 4) Glycine route 5) IDA pathway 6) AEA pathway
Source: CCM

Currently, there are two production pathways of glyphosate technical in China, namely aminoethanoic acid (AEA) pathway (also named glycine route) and iminodiacetic acid (IDA) pathway. The latter includes two routes: DEA (diethanolamine) route and IDAN (iminodiacetonitrile) route.

IDA pathway is popular in western countries, while most domestic glyphosate producers in China adopt AEA pathway due to its mature technology, low cost, sufficient supply of raw materials and complete industrial chain, etc.

During the last few years, the Chinese government has taken a series of measures to strengthen environmental protection, such as the ban on glyphosate SL with a content less than 30% and the launch of environmental protection verification (EPV) by the Ministry of Environmental Protection of the People's Republic of China in 2013. The stricter environmental protection policies have driven up the cost of disposing glyphosate mother liquor dramatically. As the impurity of mother liquor waste generated from AEA pathway is most difficult to be disposed of among three routes, the treatment cost for AEA pathway is also the highest. However, the cost of AEA pathway has advantage over IDAN route and DEA route if by-product recovery is included.

Table 4.1.2-1 Comparison of three production routes of glyphosate technical in China, 2021

Item		AEA	DEA	IDAN
Strength		Simple process, mature technology, easily available raw materials, small investment, low technology barrier	High yield, good product quality, relatively safe production process, mature technology	High yield, good product quality, easily available raw materials, low production cost
Shortcoming		Low quality and severe pollution to the environment	High dependence on imported DEA, high investment resulted from high requirement on equipment	High technology barrier, high equipment cost, high investment resulted from high requirement on equipment, raw material cost may rise sharply if the price of natural gas catches up with the international level
Raw material supply		Sufficient	High dependence on imported DEA	Sufficient
Wastewater		There are nearly saturated inorganic salt, organophosphorus (OP) compounds of high concentration and glyphosate isomer in the wastewater.	PMIDA wastewater from condensation process: There are OP compounds of high concentration in the wastewater; 3% formaldehyde contained in wastewater becomes a biological inhibitor; the intermediate, DEA or IDAN, and its derivatives are refractory; it contains 18%–22% NaCl which is nearly saturated saline solution.	
			PMIDA oxidation: There are OP compounds of high concentration in the wastewater; the wastewater contains 3% formaldehyde, 2.5% glyphosate products, unspent PMIDA and other by-products.	
Major recyclable by-products		Chloromethane, HCl, methanol, methylal, triethylamine, NaCl, etc.	Urotropine, methylal, PMIDA, etc.	Urotropine, methylal, PMIDA, etc.
Initial application time in China		1986	1995	2005
Production situation in 2021	Capacity, t/a	548,000	55,000	192,000
	Capacity share	68.9%	6.9%	24.2%
	Output, tonne	449,000	30,000	119,000
	Operating rate	81.9%	54.5%	62.0%
	Number of producer	11	2	6
Typical company		Hubei Trisun Chemical Co., Ltd.; Fuhua Tongda Agro-chemical Technology Co., Ltd.	Jiangsu Yangnong Chemical Co., Ltd.	Nantong Jiangshan Agrochemical & Chemical Co., Ltd.; Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.

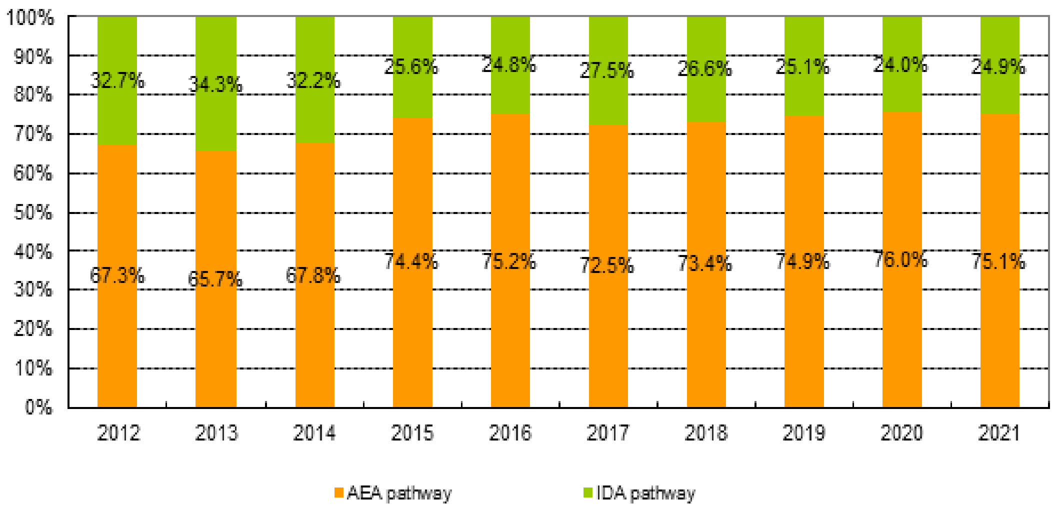
Source: CCM

Table 4.1.2-2 Capacity and output of glyphosate technical by pathway in China, 2012–2021

Pathway		2021	2020	2019	2018	2017	2016	2015	2014	2013	2012
AEA	Capacity, t/a	548,000	548,000	548,000	558,000	603,000	648,000	645,000	550,000	552,000	477,000
	Output, tonne	449,000	452,000	442,000	444,000	434,900	451,000	387,100	361,800	336,300	289,500
	Growth rate of output	-0.7%	2.3%	-0.5%	2.1%	-3.6%	16.5%	7.0%	7.6%	16.2%	33.6%
	Operating rate	81.9%	82.5%	80.7%	79.6%	72.1%	69.6%	60.0%	65.8%	60.9%	60.7%
IDA	Capacity, t/a	247,000	247,000	247,000	247,000	302,000	351,000	353,500	359,500	354,500	329,500
	Output, tonne	149,000	143,000	148,000	161,000	165,100	149,000	132,900	172,200	175,700	140,500
	Growth rate of output	4.2%	-3.4%	-8.1%	-2.5%	10.8%	12.1%	-22.8%	-2.0%	25.1%	13.9%
	Operating rate	60.3%	57.9%	59.9%	65.2%	54.7%	42.5%	37.6%	47.9%	49.6%	42.6%
Total	Capacity, t/a	795,000	795,000	795,000	805,000	905,000	999,000	998,500	909,500	906,500	806,500
	Output, tonne	598,000	595,000	590,000	605,000	600,000	600,000	520,000	534,000	512,000	430,000
	Growth rate of output	0.5%	0.8%	-2.5%	0.8%	0.0%	15.4%	-2.6%	4.3%	19.1%	26.5%
	Operating rate	75.2%	74.8%	74.2%	75.2%	66.3%	60.1%	52.1%	58.7%	56.5%	53.3%

Note: Total capacity (output) = Capacity (output) of AEA pathway + Capacity (output) of IDA pathway; Total growth rate of output = (Total output this year / Total output last year) - 1; Total operating rate = Total output / Total capacity
Source: CCM

Figure 4.1.2-2 Output share of glyphosate technical in China by pathway, 2012–2021



Source: CCM

Table 4.1.2-3 Glyphosate technical (AEA pathway) producers in China, 2021

No.	Producer	Abbreviation	Location	Pathway	Status	Capacity, t/a	Output, tonne
1	Fuhua Tongda Agro-chemical Technology Co., Ltd.	Fuhua Tongda	Sichuan Province	AEA	Active	153,000	126,000
	Nantong Jiangshan Agrochemical & Chemical Co., Ltd.	Nantong Jiangshan	Jiangsu Province	AEA	Active	30,000	29,000
2	Hubei Trisun Chemicals Co., Ltd.	Hubei Trisun	Hubei Province	AEA	Active	130,000	122,000
	Inner Mongolia Xingfa Technology Co., Ltd.	Inner Mongolia Xingfa	Inner Mongolia Autonomous Region	AEA	Active	50,000	28,000
3	Zhejiang Wynca Chemical Group Co., Ltd.	Zhejiang Wynca	Zhejiang Province	AEA	Active	30,000	30,000
	Zhenjiang Jiangnan Chemical Co., Ltd.	Zhenjiang Jiangnan	Jiangsu Province	AEA	Active	50,000	50,000
4	Henan HDF Chemical Co., Ltd.	Henan HDF	Henan Province	AEA	Active	30,000	25,000
5	Jiangxi Jinlong Chemical Co., Ltd.	Jiangxi Jinlong	Jiangxi Province	AEA	Active	20,000	20,000
6	Anhui Dongzhi Guangxin Agrochemical Co., Ltd.	Anhui Guangxin	Anhui Province	AEA	Active	20,000	19,000
7	CAC Nantong Chemical Co., Ltd.	Nantong CAC	Jiangsu Province	AEA	Idle	20,000	0
8	Shandong Weifang Rainbow Chemical Co., Ltd.	Shandong Rainbow	Shandong Province	AEA	Idle	15,000	0
Total						**548,000**	**449,000**

Source: CCM

4.1.3 Anti-dumping issues

Glyphosate, invented by Monsanto and first introduced to the market in 1974, now is the most widely used herbicide in the world. Roundup, Monsanto's flagship herbicide, has made the company a leader in the global glyphosate market. Following the expiry of Monsanto's patent in the early 1990s, competition from other glyphosate producers has made herbicide market virtually unrecognizable. To maintain its original leading position, Monsanto once intended to seek for cooperation with Chinese glyphosate producers, but failed ultimately. In October 1995, Monsanto launched the first anti-dumping charge in Europe against glyphosate originated from China. After that, Monsanto launched nine similar charges either by itself or in alliance with the EU, Brazil, Australia and Argentina. Except Monsanto, some other overseas glyphosate players, including Albaugh, LLC and Nufarm Limited, have also launched anti-dumping investigation into China glyphosate products.

Overall, Chinese glyphosate industry has basically overcome obstacles from anti-dumping tax, and Chinese-made glyphosate will maintain competitive in the global glyphosate market in the future.

- The EU

Monsanto lodged a charge to the European Union (EU) in October 1995 about the dumping of glyphosate originated from China. The EU regarded China as a non-market economy and treated China with Brazil as referential country. The final ruling was made in Feb. 1998 and Monsanto won the case. The EU imposed a 24% anti-dumping tax on glyphosate originated from China.

In Aug. 1998, Monsanto again facilitated the anti-absorption procedures in Europe. The final ruling was made in Feb. 2002, which was still in favor of Monsanto. The anti-dumping tax was increased from 24% to 48%.

In May 2001, Monsanto raised the anti-evading procedure for the third time in Europe against glyphosate exported from Taiwan and Malaysia, and the final ruling was made in Nov. 2001. A 48% anti-dumping tax was therefore extended to glyphosate export companies in Taiwan and Malaysia. Glyphosate became the only product exported by China to the EU market that suffered from anti-dumping, anti-absorption and anti-evading verdicts at the same time.

On 15 Feb., 2003, upon the application of Glyphosate Association of Europe, the EU started the investigation of sunset review and expiry review on glyphosate originated from China. During this investigation, the European Committee chose Brazil as the substitute country to evaluate the actual value of Chinese glyphosate. At that time, Zhejiang Wynca appealed to the EU alone. On 30 Sept., 2004, the European Committee proclaimed the final verdict of sunset review and expiry review. As a result of the investigation, all glyphosate producers of China were levied an anti-dumping tax of 29.9%, and the effective period was extended to 2008.

The EU once cancelled anti-dumping duties on Chinese glyphosate for a period of nine months from May 2009, mainly because the glyphosate market in the EU undergone a change in 2009, especially the high market price resulting in fat profits.

In order to enter the EU market, Chinese glyphosate producers, such as Zhejiang Wynca, have kept fighting with Monsanto and other companies in the EU, and finally won the case in June 2009. The EU then cancelled the 29.9% anti-dumping duty on Zhejiang Wynca's glyphosate. Zhejiang Wynca has become the only winner among all Chinese producers since 1995 when the EU started an anti-dumping investigation into Chinese glyphosate.

On 16 Dec., 2010, the EU announced that European Commission had decided to terminate the anti-dumping measures on glyphosate originated from China since 13 Dec., 2010.

On 19 July, 2012, the EU Court of Justice (ECJ) released its final judgment on the glyphosate anti-dumping case against Zhejiang Wynca. The ECJ ruled that the EU's anti-dumping measure on Zhejiang Wynca was invalid, and dismissed the EU Council's appeal entirely. Zhejiang Wynca got the final victory of the case.

- Australia

In March 1996, Monsanto lodged an anti-dumping charge in 1996 against glyphosate exported by China. 13 Chinese enterprises responded to the suit. The Australian government treated China as a country in economic transition. The final ruling was made on 12 March, 1997 and Chinese enterprises won the case. The Chinese glyphosate was not levied any addition tariff.

On 14 May, 2001, the subsidiary of Monsanto in Australia again raised the dumping charge and the amount involved was RMB23 million. The Australian Customs launched investigation into the dumping case on 12 June, 2001. After losing the markets in the EU and Brazil, pesticide producers in China already realized the risk and therefore reached agreement on protecting the market in Australia. Seven major glyphosate producers including Zhejiang Wynca, Zhenjiang Jiangnan Chemical Co., Ltd., Sinochem Hebei Import & Export Co., Ltd., Hebei Golhil Chemicals Co., Ltd., Nantong Jiangshan Agrochemical & Chemical Co., Ltd., Jiangsu Weien and Suzhou Jiahui made a collective response. On 26 Feb., 2002, the Australian Customs decided not to adopt any antidumping measures to glyphosate from China to Australia. Nevertheless, after the completion of the case, Monsanto and other Australian companies successfully persuaded the Australian Government to revise the anti-dumping provisions in the new law.

On 6 Feb., 2012, two Australian glyphosate formulators, Nufarm Limited and Accensi Pty, applied for anti-dumping investigation against Chinese-made glyphosate formulations, and the Australian Customs and Border Protection Service (ACBPS) had initiated this investigation. The investigation was concerned with imported glyphosate based herbicides including 360g/L IPA, 450g/L IPA, 570g/L IPA and 680g/L WSG. The goods was classified to the tariff code of 38089300. The current rate of duty applicable to the goods imported from China is 5%.

The investigation period is from 1 Jan., 2011 to 31 Dec., 2011. In 2011, Chinese-made glyphosate based herbicides exported to Australia took up about 5% (glyphosate 95% technical equivalent) of total Chinese-made glyphosate export number, thus, this investigation has limited effect on Chinese glyphosate industry.

On 2 Aug., 2012, ACBPS issued Notice No. 2012/37 that it decided to terminate the anti-dumping investigation against glyphosate based herbicides exported from China on the grounds that no dumping evidence is shown in the investigation results.

On 28 Aug., 2012, Nufarm Limited lodged an application with the Review Officer for a review of the decision on terminating the investigation. On 23 Oct., 2012, the Review Officer revoked the decision that to terminate the dumping investigation. On 16 Nov., 2012, ACBPS announced the resumption of anti-dumping investigation in relation to glyphosate based herbicides exported to Australia from China.

On 24 June, 2013, ACBPS released Notice No. 2013/51, saying that the three companies, namely Jiangsu Weien, Shandong Rainbow and Zhejiang Wynca, were judged that they had not dumped formulated glyphosate products into Australia, and ACBPS decided to terminate the resumed investigation.

- Brazil

Brazil launched an anti-dumping investigation on glyphosate originated from China in Aug. 2001. The main accuser was the subsidiary of Monsanto in Brazil. Ten glyphosate producing and exporting companies in China responded to the charge. On 7 Feb., 2003, the Brazilian Foreign Trade Commission (CAMEX) issued the No. 5 Notice to levy a 35.8% anti-dumping duty on glyphosate originated from China since 12 Feb., 2003, which lasted for 5 years.

The 35.8% anti-dumping duty on glyphosate originated from China expired in Feb. 2008. Brazil started a sunset review investigation and decided to reduce the anti-dumping duty from 35.8% to 11.7% for one year.

In July 2008, the CAMEX decided to reduce the anti-dumping duty from 11.7% to 2.9% for eight months.

In Feb. 2009, the CAMEX reduced the anti-dumping duty further to 2.1%, which would be valid in the following five years.

On 19 May, 2011, Monsanto renewed a request for an anti-dumping investigation on glyphosate originated from China, and in Aug. 2011 the company withdrew its anti-dumping petition with the CAMEX in term of the uncertainty and unpredictability under the international economic situation.

- Argentina

In Nov. 2001, the subsidiary of Monsanto in Argentina lodged an anti-dumping charge against glyphosate originated from China. The Argentine government launched an investigation in April 2002. Duration of the investigation was one year and seven months from 1 Aug., 2000 to 31 March, 2002 and the value involved was USD58 million. Argentina is the second country in South America after Brazil who launched an anti-dumping investigation on glyphosate originated from China. Zhenjiang Jiangnan, Zhejiang Wynca and Sinochem Shanghai Import & Export Co., Ltd. responded to the investigation. With the support from various parties in Argentina including farm owners, Chinese companies finally won the dumping case. The Argentine government made a final judgment on 4 Feb., 2004, deciding to terminate the anti-dumping investigation on glyphosate originated from China (tariff code 29310032, 29310039, 38083023, and 38083029) and not to impose anti-dumping tax. The case was finally in Chinese glyphosate producers' favor.

- The US

On 31 March, 2010, US-based Albaugh Inc. appealed to the US Department of Commerce (USDC) and United States International Trade Commission (USITC) to open an anti-dumping investigation on glyphosate originated in China, but the investigation had never been started since the company withdrew its anti-dumping petition on 29 April, 2010 when the case hadn't been filed yet.

4.1.4 Technology trend and its influence to PF utilization

Technologies of the three production routes of glyphosate technical are mature in China, and the three routes will coexist in China in the near future. Competitiveness of the three routes is determined by production cost, raw material accessibility, waste treatment cost, etc., along with the keen competition and stricter environmental protection policy.

It is estimated that the AEA pathway will maintain its dominant position in China in the coming few years because of abundant supply of raw materials, complete industrial layout, and huge market of by-products.

- The supply of key raw materials, including glycine, dimethyl phosphite and PF, is abundant in China. Meanwhile, China has rich reserves of coal (the raw material of glycine and PF) and phosphorus ore (the raw material of dimethyl phosphite).
- Glyphosate producers adopting AEA pathway have made great progress in increasing the yield rate, recycling by-products and raw materials, and cutting down production cost, which help promote this pathway in China.
- The future domestic glyphosate production will become more and more concentrated on those large companies who own comprehensive industrial chains, or strong R&D capability and some of them have already taken AEA pathway, such as Zhejiang Wynca, Hubei Trisun, Fuhua Tongda and Nantong Jiangshan (who takes both AEA pathway and IDA pathway). Among these companies, Fuhua Tongda and Hubei Trisun have built comprehensive industrial chains from upstream to downstream (chlor-alkali, hydrogen chloride, caustic soda, electricity, coal, phosphorus ore, yellow phosphorus, phosphorus trichloride, DMP, glycine, and chloromethane recycling), and their glyphosate technical capacity was 153,000 t/a and 130,000 t/a respectively in 2021.

The IDAN route also has obvious advantages in environmental protection, product quality, production cost, etc., and it will also remain competitive in the future in China.

The DEA route will be less advantageous in the future competition, because of high cost and weak accessibility of raw materials compared with other two routes. Some producers have purchased homemade PMIDA to produce glyphosate technical instead of using DEA as starting material.

As stated above, glyphosate technical (AEA pathway) output in China will keep increasing in the future, corresponding to stably increasing consumption of PF.

4.2 Consumption of PF in other pesticides

Besides used in glyphosate production, PF is also consumed in production of amide herbicides including acetochlor, butachlor, alachlor, propisochlor, and insecticides such as tricyclazole.

- Acetochlor

Acetochlor, a traditional herbicide, had witnessed severe oversupply for many years, resulting in the low operating rate, seldom surpassing 30% since 2012.

It's worth mentioning that acetochlor has been included in the restricted list in the European Union (the EU) since 2012, as its metabolite is harmful to human. As a result, China's export volume of acetochlor technical to the Eurozone has decreased. If other overseas countries and regions follow suit, the export volume of acetochlor technical would further decline.

In 2016–2019, the domestic output of acetochlor technical kept decreasing, because of the decreasing demand at home and abroad. However, the consumption of PF in the acetochlor technical production in 2020 increased slightly to 5,700 tonnes, accounting for about 2.0% of the total PF consumption.

In 2021, due to the high cost of raw materials, the operating rate of acetochlor technical dropped and the output decreased to 26,700 tonnes. Accordingly, the consumption volume of PF declined to about 5,340 tonnes, 1.8% of the total PF consumption.

Table 4.2-1 Capacity and output of acetochlor technical and consumption of PF in China, 2012–2021

Year	Capacity, t/a	Output, tonne	Consumption of PF, tonne
2012	142,000	40,100	8,020
2013	144,000	37,000	7,400
2014	144,000	35,300	7,060
2015	136,000	31,600	6,320
2016	136,000	36,000	7,200
2017	136,000	35,700	7,140
2018	101,000	30,400	6,080
2019	101,000	26,900	5,380
2020	95,000	28,500	5,700
2021	95,000	26,700	5,340

Source: CCM

- Butachlor

Similar to acetochlor, butachlor is also a traditional herbicide. Due to its toxicity, butachlor has been forbidden for use and sale in the EU since 1 Jan., 2004, according to the law of EU/2076/2002. However, the demand of butachlor from other regions including Asia, South America and Africa increased stably in 2015–2017, echoing the increasing output of butachlor in China during the same period.

In 2018, demand for butachlor beyond China decreased, and China's output of butachlor decreased correspondingly.

Since 2019, both the demand for butachlor beyond China and domestic output of butachlor rebounded.

Table 4.2-2 Capacity and output of butachlor technical and consumption of PF in China, 2012–2021

Year	Capacity, t/a	Output, tonne	Consumption of PF, tonne
2012	39,600	13,300	2,660
2013	39,600	13,600	2,720
2014	38,500	13,800	2,760
2015	38,500	15,900	3,180
2016	38,500	17,700	3,540
2017	38,500	21,500	4,300
2018	38,500	17,000	3,400
2019	38,500	17,500	3,500
2020	29,500	17,700	3,540
2021	29,500	17,800	3,560

Source: CCM

- Tricyclazole

The production of tricyclazole in China also uses PF as its raw material, and about 200 kg of PF is consumed to produce one tonne of tricyclazole.

The consumption volume of PF in tricyclazole technical witnessed a downward trend in 2013–2016, as the output of tricyclazole technical slipped because of shrinking demand. PF consumption in this pesticide picked up in 2017, and saw growths in 2019–2021.

Table 4.2-3 Capacity and output of tricyclazole technical and consumption of PF in China, 2012–2021

Year	Capacity, t/a	Output, tonne	Consumption of PF, tonne
2012	9,600	3,955	791
2013	11,900	4,350	870
2014	11,900	4,155	831
2015	12,400	4,050	810
2016	12,400	4,000	800
2017	12,400	4,100	820
2018	12,400	4,000	800
2019	12,400	4,200	840
2020	12,400	4,300	850
2021	12,400	4,650	930

Source: CCM

- 1-Naphthylacetic acid

In China, 1-naphthylacetic acid is not produced by PF, but obtained by the reaction of naphthalene and chloroacetic acid.

As a plant growth regulator, the current capacity of 1-naphthylacetic acid in China is relatively small. There are few 1-naphthylacetic acid producers in China, with an annual output of 1,000 tonnes–1,500 tonnes.

- List of some end users in agrochemical industry

- **Nantong Jiangshan Agrochemical & Chemicals Co., Ltd. (Nantong Jiangshan)**

Nantong Jiangshan uses domestic PF to produce acetochlor and butachlor with the capacity of 22,000 t/a and 15,000 t/a respectively. Its output of acetochlor technical and butachlor technical in 2021 was about 9,500 tonnes and 16,000 tonnes respectively.

- **Jiangsu Changlong Agrochemical Co., Ltd. (Jiangsu Changlong)**

Jiangsu Changlong has capacity of 10,000 t/a acetochlor technical and 3,000 t/a butachlor technical. Its output of these two products in 2021 was about 7,400 tonnes and about 2,200 tonnes respectively.

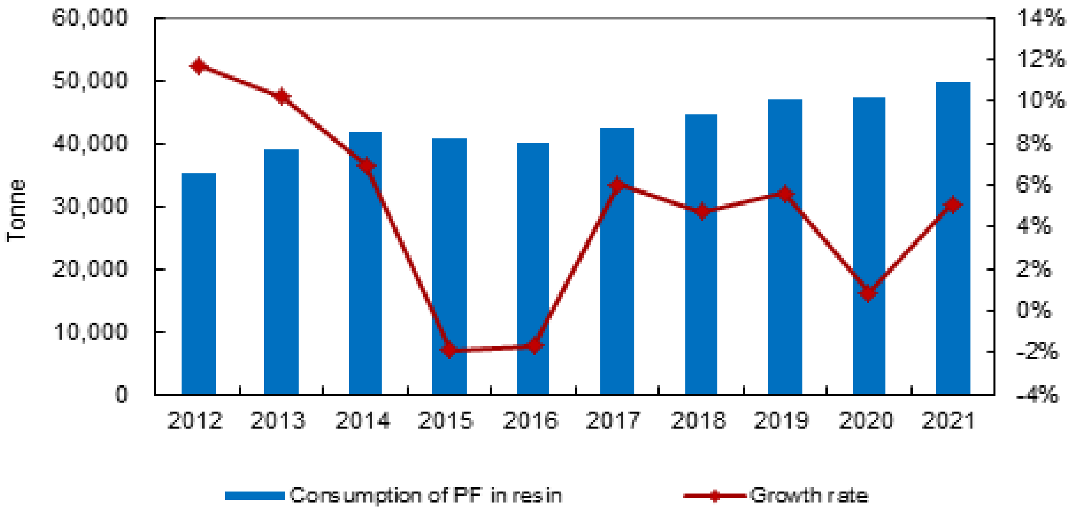
Previously, Jiangsu Changlong chose the cheaper one between domestic and imported PF as its raw material. Now the company consumes homemade PF only.

- **Shandong Binnong Technology Co., Ltd. (Shandong Binnong)**

Shandong Binnong is a major amide herbicide producer in China with capacity of 9,000 t/a in 2021; its amide herbicide technical mainly includes acetochlor, metolachlor, butachlor, alachlor. The output of acetochlor technical and butachlor technical in 2021 was about 1,600 tonnes and 1,000 tonnes respectively.

4.3 Consumption situation of PF in resin industry

Figure 4.3-1 Consumption of PF in resin industry in China, 2012–2021



Source: CCM

PF can be a substitute for formaldehyde solution (37%) to produce resins, including phenolic resins, urea-formaldehyde resins and melamine resins. The advantages of using PF as the raw material are listed as follows:
- Shortening reaction time;
- Improving the reaction yield and decreasing the consumption of formaldehyde by 7%–17%;
- Significantly reducing wastewater discharge.

Producers possessing advanced technologies for producing urea-formaldehyde resins, phenolic resins, melamine resins, etc. tend to take PF as the raw material, which is beneficial to product quality improvement and cost reduction.

At present, resins taking PF as the raw material are mainly used in inks and coatings, and the producers using PF are mostly foreign enterprises and Sino-foreign joint ventures, who generally master advanced production technologies and have high requirements on their raw materials in order to produce high-quality products. More and more domestic private producers use PF to produce resins for high quality.

Such production usually demands PF with good water solubility. Therefore, most resin producers purchase PF produced by spray drying method.

China's PF consumption in resin industry was about 49,800 tonnes in 2021 with a year-on-year growth rate of 5.1%, taking up about 17.1% of the total domestic PF consumption.

Drivers of PF application in resins

The growth of PF application in resins is mainly driven by stricter environmental protection requirements. China is paying more and more attention to environmental protection, and resin production using PF instead of formaldehyde can reduce pollution to a great extent. Now, in Jiangsu Province, most of the resin manufacturers use PF to produce resins instead of formaldehyde.

The constant development of automobile industry in China is driving up output of resins, thereby promoting demand for PF in resin production. And it is estimated that the demand for phenolic resins will increase in the next few years in automobile market.

Barriers of PF application in resins

- The price of PF is commonly higher than that of formaldehyde, resin manufacturers chasing low production cost and ignoring environment problems would prefer formaldehyde.
- Some production technologies of resins in China are traditional, which mainly use formaldehyde as the raw material. Therefore, advanced technologies adopted in resin production with PF as the raw material are needed and resin manufacturers need to improve their technologies.

Considering the drivers and barriers, as well as the development of PF, PF's consumption volume in resin industry is expected to grow steadily in China in the future.

Table 4.3-1 List of some key end users of PF in resin industry in China, 2021

No.	End user	Location	PF consumption, tonne	Product consuming PF	Ownership	Telephone
1	Chang Chun Chemical (Jiangsu) Co., Ltd.	Jiangsu	5,800	Epoxy resin	Taiwan-funded	+86-512-52648000
2	Shandong Shengquan New Materials Co., Ltd.	Shandong	3,300	Phenolic resin, cold box resin	Private	+86-531-83511608
3	Sumitomo Bakelite (Nantong) Co., Ltd.	Jiangsu	1,600	Phenolic resin	Japan-funded	+86-513-85927822
4	Asahi Organic Chemicals (Nantong) Co., Ltd.	Jiangsu	1,500	Phenolic resin	Japan-funded	+86-513-83592400
5	Sino Legend (China) Chemical Co., Ltd.	Jiangsu	1,500	Phenolic resin	Hong Kong-funded	+86-512-58326999
6	Cardolite Chemical (Zhuhai) Co., Ltd.	Guangdong	1,300	Epoxy resin hardener	The US-funded	+86-756-7269567, 7269115
7	Rianlon Corporation	Tianjin	1,200	Antioxidant 1520/1726/3114	Listed	+86-22-83718817
8	Eternal Chemical (China) Co., Ltd.	Jiangsu	1,000	Urea-formaldehyde resin	Taiwan-funded	+86-512-57626927
9	Liaoning Jincheng Chemical Refractory Co., Ltd.	Liaoning	1,000	Phenolic resin	Private	+86-417-6957257
10	Allnex Resins (China) Co., Ltd.	Jiangsu	700	Urea-formaldehyde resin	Germany-funded	+86-512-66655355
11	Fujian Nanping Lawter Chemical Co., Ltd.	Fujian	600	Phenolic resin	Japan-funded	+86-599-8469500
12	Baling Branch of Sinopec	Hunan	600	Epoxy resin	Listed	+86-730-8492355
13	Jiangsu Senbo New Materials Co., Ltd.	Jiangsu	600	Phenolic resin	Private	+86-513-69925888
14	Laton Rosin Nanning Co., Ltd.	Guangxi	300	Disproportion rosin	South Korea-funded	+86-771-4518960
15	Changle Hengchang Chemical Co., Ltd.	Shandong	300	Phenolic resin	Private	+86-536-6731165
16	Xinyi Rihong Plastic Chemical Co., Ltd.	Guangdong	300	Rosin modified phenolic resin	Japan-funded	+86-668-8887766-808
17	Nanning Lawter Chemical Co., Ltd.	Guangxi	200	Rosin modified phenolic resin	Japan-funded	+86-771-5752172
Total			**21,800**	**/**	**/**	**/**

Source: CCM

- Chang Chun Chemical (Jiangsu) Co., Ltd. (Chang Chun Chemical)

Chang Chun Chemical produces epoxy resins from PF, with capacity of 100,000 t/a, and it consumed about 5,800 tonnes of PF in 2021, which was mainly purchased from its parent company, Chang Chun Plastics Co., Ltd.

- Shandong Shengquan New Materials Co., Ltd. (Shandong Shengquan)

Shandong Shengquan uses PF as the raw material to produce phenolic resins. The consumption of PF in this company was about 3,300 tonnes in 2021.

It uses domestic or imported PF as raw material, and chooses the one with lower price. If the price of PF becomes high, it will switch to formaldehyde instead. The company mainly purchases PF from Zhenjiang LCY Performance Materials Co., Ltd. and Jiangsu Sanmu Group Co., Ltd.

- Sumitomo Bakelite (Nantong) Co., Ltd. (Sumitomo Bakelite)

Sumitomo Bakelite mainly uses PF imported from Spain to produce phenolic resins, and it can produce 29,000 tonnes of phenolic resins annually.

Its PF consumption was about 1,600 tonnes in 2021.

- Eternal Chemical (China) Co., Ltd. (Eternal Chemical)

Eternal Chemical uses PF to produce urea-formaldehyde resins. This company used to purchase imported PF before 2017, but now the domestic ones. It prefers PF produced by Taiwan-funded companies because of the high quality and relatively lower price. It consumed 1,000 tonnes of PF in 2021.

- Fujian Nanping Lawter Chemical Co., Ltd. (Nanping Lawter)

Nanping Lawter uses PF as the raw material to produce phenolic resins. It can produce 10,000 tonnes of resins annually, and its PF consumption was about 600 tonnes in 2021.

It uses either domestic or imported PF as the raw material and chooses the one with lower price.

- Liaoning Jincheng Chemical Refractory Co., Ltd. (Liaoning Jincheng)

Liaoning Jincheng uses PF as the raw material to produce phenolic resins, with capacity of 12,000 t/a. Its PF consumption volume was about 1,000 tonnes in 2021.

- Jiangsu Senbo New Materials Co., Ltd. (Jiangsu Senbo)

Jiangsu Senbo uses domestic PF to produce phenolic resins. Its Phase I phenolic resin production line was put into production in 2020, and its PF consumption volume was about 600 tonnes in 2021. According to the company's previous assessment, after the completion of the Phase II phenolic resin production line, its annual PF consumption will reach about 2,500 tonnes.

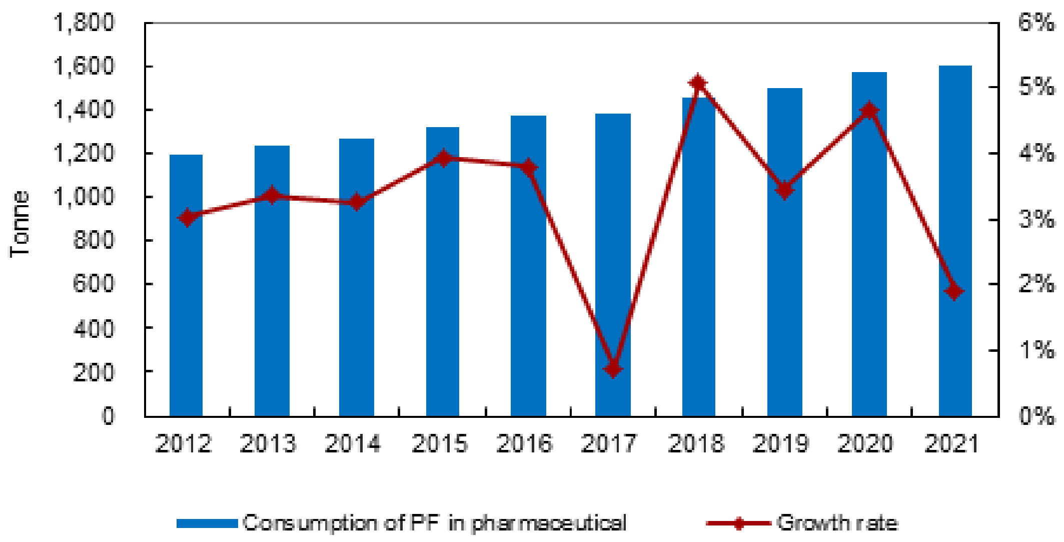
4.4 Consumption situation of PF in pharmaceutical industry

The consumption volume of PF in pharmaceutical industry in China is small. In 2012–2021, the PF consumption in pharmaceutical industry displayed a slight upward trend, with a CAGR of 3.3%. In 2021, the PF consumption in this field increased by 1.9% year on year to about 1,600 tonnes, accounting for only 0.6% of the total PF consumption.

PF is used to produce disinfectant, pharmaceutical intermediates and some medicines like stomach medicines.

PF consumers from this industry prefer to purchase imported PF because of its high quality and stability. For example, Wenzhou Opal Chemical Industry Co., Ltd. purchased about 10 tonnes of imported PF to produce glycerol formal every year.

Figure 4.4-1 Consumption of PF in pharmaceutical industry in China, 2012–2021



Source: CCM

4.5 Consumption situation of PF in other industries

Apart from agrochemicals, resins and pharmaceuticals, PF can also be used in organic ingredients, textiles, castings as parting medium and adhesives, livestock breeding as disinfectants, etc., the consumption in which took up around 2.8% of its total in 2021.

Table 4.5-1 List of some PF end users in other industries in China, 2021

No.	End user	Category	Application	PF consumption, tonne	Telephone
1	Anhui Jinpeng Flavours & Fragrances Co., Ltd.	Additives	Salicylaldehyde (spice)	1,500	+86-18912958995
2	Zibo Zhangdian Oriental Chemical Co., Ltd.	Intermediates	2-(2-Hydroxyethyl)pyridine	1,200	+86-533-2081494
3	Zhejiang NHU Co., Ltd.	Additives	Methyl dihydrojasmonate & linalol	900	+86-575-85211969
4	Jilin Zhongxin Chemical Group Co., Ltd.	Chemicals	Isopentenyl alcohol	900	+86-432-65119664
5	Yingyang (China) Aroma Chemical Group	Additives	Salicylaldehyde (spice)	800	+86-22-58399303-832

Source: CCM

5 Forecast on PF industry in China

5.1 Factors influencing future development of PF

5.1.1 Driving forces

Growing demand from the domestic downstream industries

- Glyphosate

The glyphosate industry, sharing the majority of PF's consumption by 75.8% in 2021, is decisive to the demand trend for PF.

Global glyphosate market is greatly influenced by the planting of genetically modified (GM) crops, which has been steadily increasing in the past 20 years. Driven by the constant development of GM crops in the world along with increasing planting areas, the demand for glyphosate will keep increasing in the next few years.

China's glyphosate industry is expected to play an increasingly important role in the global market. China's output of glyphosate technical (AEA pathway) is estimated to keep increasing at a CAGR of about 0.3% during 2022–2026. Therefore, its demand for PF will grow accordingly.

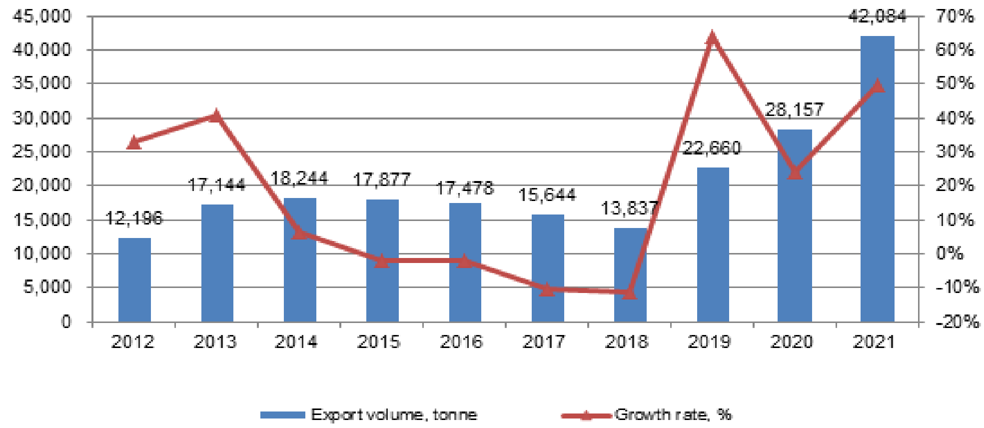
- Resin

Resin, the second largest consumption field of PF by consumption volume, took up 17.1% of domestic PF consumption in 2021. In China, the demand for PF from resin industry is estimated to increase stably in the next few years. For one thing, automobile needs to use phenolic resins to improve fire safety and strengthen fuel efficiency. Urea-formaldehyde resins are widely used in fiber boards and molding compounds and the demand for urea-formaldehyde resins will increase in the next few years. For another, related environmental departments limit the emission from formaldehyde production, so more resin producers use PF instead of liquid formaldehyde.

Growing demand from the overseas market

China's PF industry becomes more and more competitive in the world, and China's export volume of PF increased greatly, reaching 18,244 tonnes in 2014, with a CAGR of 27.8% from 2010 to 2014. Although the export showed a downward trend in 2015–2018, it rebounded since 2019 owing to the scale competitiveness. Affected by COVID-19 in the past two years, operation in overseas PF manufacturers has been limited, resulting in an increase in the export of China's PF. The export volume totalled 42,084 tonnes in 2021, up by 49.5% year on year.

Figure 5.1.1-1 Export volume of PF in China, 2012–2021



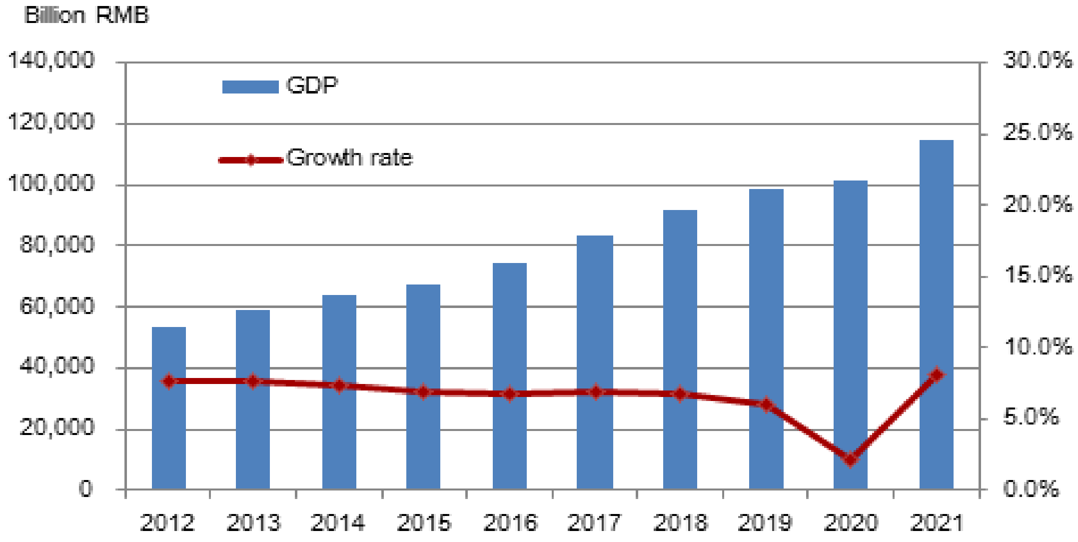
Source: China Customs

Stable macro-economic environment

The focus of GDP growth in China has shifted from high speed to high quality. In recent years, China has maintained a relatively stable economic growth, with a GDP growth rate of 6% or above, except in 2020, at 2.2%. And according to the *Report on the Work of Government* delivered at the Fifth Session of the 13th National People's Congress of the People's Republic of China on March 5, 2022, the GDP growth target for the year 2022 is set around 5.5%.

CCM believes that the fundamentals for China's long-term and high-quality economic growth will not change. Growth target maintained at this level is conducive to guiding people in all sectors to focus on accelerating transformation of the economic development mode and adjustment of economic structure, and improving quality and performance of economic growth, so as to promote a sustainable and healthy economic development.

Figure 5.1.1-2 China's GDP growth, 2012–2021



Note: Data for 2021 is preliminarily calculated.
Source: National Bureau of Statistics of the People's Republic of China

Good product performance of PF

PF is convenient for shipping and storage because of its granular form. PF contains high content of formaldehyde. It is a good substitute for formaldehyde, because formaldehyde is hard to transport and store. Furthermore, using PF to substitute formaldehyde solution will reduce the volume of wastewater during the production process.

The excellent properties of PF decide that it can be used in various fields in which formaldehyde can't be applied in.

5.1.2 Barriers

Production technology needed to be improved

PF products produced by rake drying method have poor water solubility, which inhibits their application in resins. Meanwhile, a large quantity of wastewater is discharged from PF production.

In 2021, there were 21 PF producers adopting rake drying method in PF production in China, with a total capacity of 467,000 t/a, accounting for 70.0% of the national total.

Challenge from the COVID-19

The COVID-19 pandemic is still raging, and the world is still facing many uncertain challenges. In this context, PF production and sales, as well as the upstream and downstream sectors will be more or less influenced.

Challenge from glyphosate development

Demand for natural gas and crude oil recovered fast in 2021; prices of these two have soared and affected markets of other commodities. As a result, glyphosate price has also risen along with increased cost.

And more rigorous environmental inspections also forced some glyphosate enterprises to suspend production, thus reducing the capacity of glyphosate in 2016–2019. The trend continued in 2021 and will not stop here.

There are some other barriers for glyphosate development as well, including the increasing presence of glyphosate-tolerant weeds, prohibition of glyphosate in some countries, policies on GM crops, and so on. More varieties of GM crops will be developed and the demand for glyphosate will also decrease afterwards.

Overcapacity of PF

In general, China's PF capacity expanded in 2012–2021, with a CAGR of 5.5%. However, the operating rate of PF industry kept at a low level. Meanwhile, there are still some potential PF production lines under construction, even though the estimated demand grows not so fast as capacity enlarges in China.

5.2 Supply and demand forecast on PF 2022–2026

Demand forecast to 2026

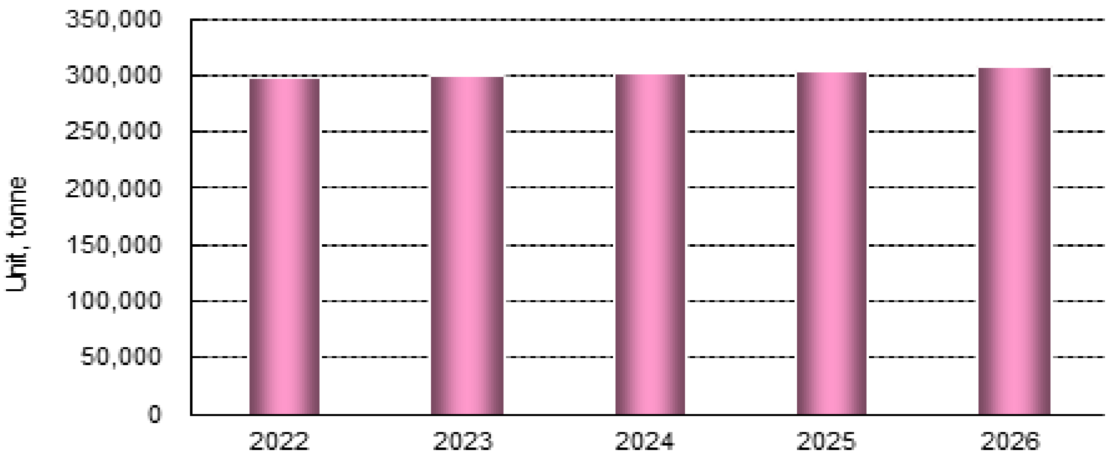
In 2021, domestic glyphosate industry contributed to about 75.8% of the domestic demand for PF. The future trend of PF demand in China will be similar with the development trend of domestic production of glyphosate technical.

Demand for PF in China is expected to keep increasing from 2022 to 2026. It's predicted that demand for PF will be 308,400 tonnes in China in 2026, at a CAGR of 0.8% in 2022–2026.

It is estimated that the PF consumption in glyphosate will be about 232,500 tonnes in 2026. Moreover, as production technology of resin improves in China, the PF consumption in resin is expected to rise at a CAGR of 2.2% in 2022–2026, with an estimated volume of 55,000 tonnes in 2026.

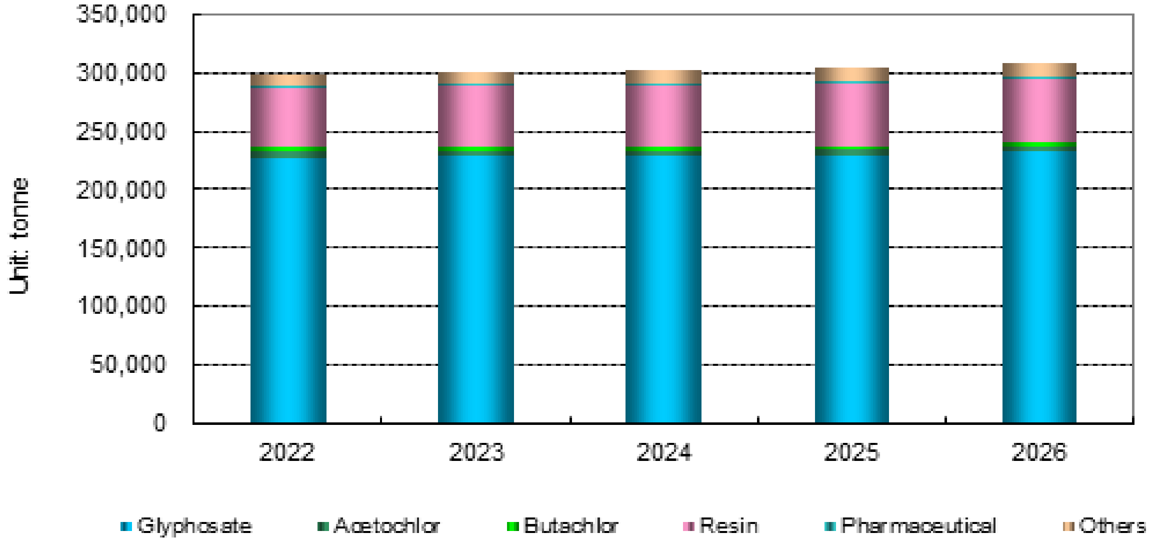
With improved production technology, the quality of Chinese-made PF gets better, which enables more and more domestic PF to be applied in other industries, especially in resin and pharmaceutical. Besides, it is expected that an increasing volume of PF will be exported.

Figure 5.2-1 Forecast on demand for PF in China, 2022–2026



Source: CCM

Figure 5.2-2 Forecast on PF consumption by product in China, 2022–2026



Source: CCM

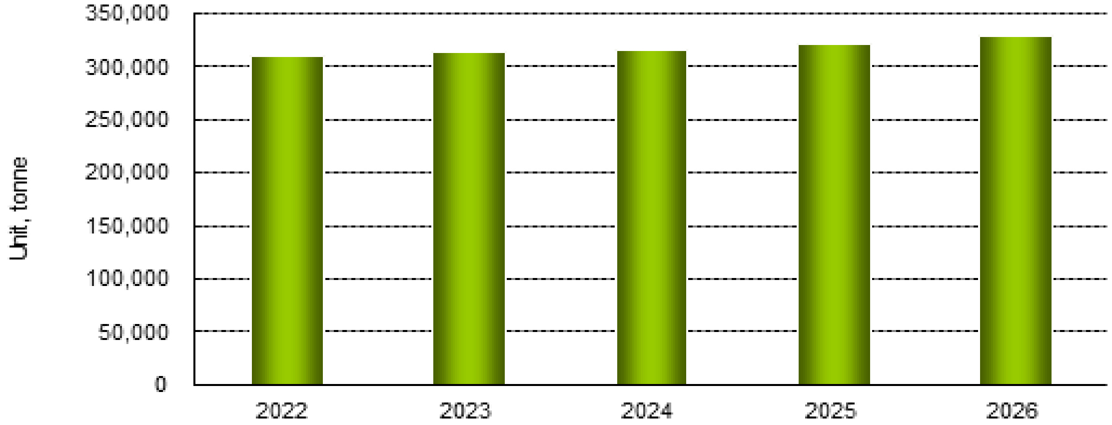
Supply forecast to 2026

The future trend of PF production in China is almost the same as the development trend of the domestic demand for PF. Both the increasing domestic demand and the overseas demand (export) for PF will be the drivers for PF production in China.

In 2022–2026, the output of PF in China will keep a slow growth, and it is predicted to reach 330,400 tonnes in China in 2026, with a CAGR of 1.5% in 2022–2026.

For 2022, PF output in China is predicted at 311,200 tonnes, and import and export volume may decline to about 23,000 tonnes and 35,000 tonnes respectively.

Figure 5.2-3 Forecast on PF output in China, 2022–2026



Source: CCM

Table 5.2-1 New/expansion projects of PF in China, as of March 2022

No.	Producer	Location	Technology source	Technology	Capacity	Remark
1	Hubei Trisun Chemicals Co., Ltd. (Hubei Xingxin Materials Co., Ltd.)	Hubei	Domestic	Rake drying	30,000	2nd phase: 30,000 t/a PF and 85,400 t/a formaldehyde
2	Qinyang Yongrun Technology Development Co., Ltd.	Henan	N/A	N/A	30,000	Under equipment installation as of March 2022, and may be put into production at the end of 2022.
3	Anhui Quansheng Chemical Co., Ltd.	Anhui	N/A	Spray drying	30,000	/
4	Anhui Dafeng Chemical Co., Ltd.	Anhui	N/A	N/A	30,000	Proposal
5	Jining Huiquan Chemical Co., Ltd.	Shandong	N/A	Spray drying	30,000	1st phase: 100,000 t/a formaldehyde, 50,000 t/a adhesive; 2nd phase: 100,000 t/a formaldehyde, 30,000 t/a PF.
6	Dingyuan County Linxing Chemical Co., Ltd.	Anhui	N/A	N/A	10,000	1st phase: 70,000 t/a modified urea-formaldehyde resin; 2nd phase: 10,000 t/a PF.
7	Juancheng County Zhanbang Chemical Co., Ltd.	Shandong	Domestic	Rake drying	10,000	1st phase: 240,000 t/a formaldehyde, 10,000 t/a PF.

No.	Producer	Location	Technology source	Technology	Capacity	Remark
8	Ningxia Ningshun New Material Co., Ltd.	Ningxia	N/A	Rake drying	20,000	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.
9	Xinjiang Shunyuan Chemical Technology Co., Ltd.	Xinjiang	N/A	N/A	50,000	1st phase: 200,000 t/a formaldehyde, 200,000 t/a urea-formaldehyde resin, 50,000 t/a PF; 2nd phase:50,000 t/a urotropine and 300,000 t/a formaldehyde.
10	Qinzhou Juli New Energy Technology Co., Ltd.	Guangxi	N/A	N/A	20,000	1st phase: 80,000 t/a formaldehyde, 20,000 t/a methylal, 20,000 t/a PF, 30,000 t/a DMMn; 2nd phase: 30,000 t/a polymethoxy dimethyl ether
11	Hutubi Ruiyuantong Chemical Co., Ltd.	Xinjiang	Domestic	Spray drying	30,000	/
12	Anhui Hehong Chemical Co., Ltd.	Anhui	N/A	Spray drying	90,000	1st phase: 60,000 t/a PF, etc.; 3rd phase: 30,000 t/a PF, etc.
13	Wen'an County Decheng New Material Technology Co., Ltd.	Hebei	N/A	N/A	60,000	1st phase: 960,000 t/a formaldehyde; 2nd phase: 960,000 t/a formaldehyde, 60,000 t/a PF, 500,000 t/a melamine-formaldehyde resin, 600,000 t/a urea-formaldehyde resin, and 200,000 t/a phenolic resin.
14	Yake Technology (Anqing) Co., Ltd.	Anhui	Domestic	Spray drying	60,000	1st phase: 60,000 t/a PF, etc.
15	Shandong Linfeng New Material Technology Co., Ltd.	Shandong	N/A	N/A	60,000	2nd phase: 60,000 t/a PF, etc.
16	Guangxi Guifulin Technology Co., Ltd.	Guangxi	N/A	Rake drying	100,000	/
17	Anhui Ruibai New Materical Co., Ltd.	Anhui	N/A	Spray drying	60,000	/

Source: CCM

Figure 5.2-4 Overview of paraformaldehyde report 2022

Categories 2021		2017 act.			2018 act.			2019 act.			2020 act.			2021 act.			2022 est.			2023 est.		
		Quantity	Share	Growth	Quantity	Share	Growth	Quantity	Share	Growth	Quantity	Share	Growth	Quantity	Share	Growth	Quantity	Share	Growth	Quantity	Share	Growth
Manufacturers	27																					
Capacity		**589,000**			**541,000**			**560,000**			**637,000**			**667,000**			**697,000**			**756,000**		
Production		**267,500**	/	-1%	**273,000**	/	2%	**283,800**	/	4%	**295,200**	/	4%	**308,600**	/	5%	**311,200**	/	1%	**314,000**	/	1%
DEMAND																						
Glyphosate	11	211,500	77%	-4%	219,000	77%	4%	218,400	76%	0%	221,000	76%	1%	220,500	76%	0%	228,000	76%	3%	228,500	76%	0%
Acetochlor	12	7,140	3%	-1%	6,080	2%	-15%	5,380	2%	-12%	5,700	2%	6%	5,340	2%	-6%	5,400	2%	1%	5,300	2%	-2%
Butachlor	9	4,300	2%	21%	3,400	1%	-21%	3,500	1%	3%	3,540	1%	1%	3,560	1%	1%	3,500	1%	-2%	3,440	1%	-2%
Other agrochemicals	>10	1,280	0%	14%	1,500	1%	17%	1,700	1%	13%	1,750	1%	3%	1,950	1%	11%	2,020	1%	4%	2,100	1%	4%
Resin	>20	42,500	15%	6%	44,500	16%	5%	47,000	16%	6%	47,400	16%	1%	49,800	17%	5%	50,500	17%	1%	51,700	17%	2%
Pharmaceutical	>6	1,380	1%	1%	1,450	1%	5%	1,500	1%	3%	1,570	1%	5%	1,600	1%	2%	1,700	1%	6%	1,800	1%	6%
Other Applications	>100	7,438	3%	18%	8,449	3%	14%	11,407	4%	35%	8,035	3%	-30%	8,105	3%	1%	8,080	3%	0%	8,160	3%	1%
Total		**275,538**	**100%**	**-2%**	**284,379**	**100%**	**3%**	**288,887**	**100%**	**2%**	**288,995**	**100%**	**0%**	**290,855**	**100%**	**1%**	**299,200**	**100%**	**3%**	**301,000**	**100%**	**1%**
IMPORT																						
Spain		9,910	42%	-10%	11,495	45%	16%	12,560	45%	9%	10,064	46%	-20%	11,121	46%	11%	11,000	48%	-1%	10,200	46%	-7%
Taiwan Province		10,934	46%	-20%	9,482	38%	-13%	9,345	34%	-1%	7,947	36%	-15%	10,589	44%	33%	9,000	39%	-15%	9,000	41%	0%
The US		2,717	11%	46%	2,496	10%	-8%	1,877	7%	-25%	2,384	11%	27%	2,096	9%	-12%	2,000	9%	-5%	1,800	8%	-10%
Indonesia		/	/	/	1,620	6%	/	3,460	12%	114%	1,540	7%	-55%	532	2%	-65%	900	4%	69%	900	4%	0%
Others		121	1%	-83%	123	0%	2%	505	2%	311%	17	0%	-97%	1	0%	-93%	100	0%	8339%	100	0%	0%
Total		**23,682**	**100%**	**-13%**	**25,216**	**100%**	**6%**	**27,747**	**100%**	**10%**	**21,952**	**100%**	-21%	**24,339**	**100%**	11%	**23,000**	**100%**	-6%	**22,000**	**100%**	-4%
EXPORT		**15,644**	/	**-10%**	**13,837**	/	**-12%**	**22,660**	/	**64%**	**28,157**	/	**24%**	**42,084**	/	**49%**	**35,000**	/	**-17%**	**35,000**	/	**0%**

Source: CCM

Table 5.2-2 Forecast on PF consumption by product in China, 2022–2026, tonne

Year	Agrochemical					Resin	Pharmaceutical	Others	Total
	Glyphosate	Acetochlor	Butachlor	Others	Total				
2022	228,000	5,400	3,500	2,020	238,920	50,500	1,700	8,080	299,200
2023	228,500	5,300	3,440	2,100	239,340	51,700	1,800	8,160	301,000
2024	228,500	5,200	3,400	2,200	239,300	52,500	1,860	8,140	301,800
2025	229,000	5,100	3,360	2,350	239,810	54,000	1,920	8,170	303,900
2026	232,500	5,000	3,300	2,400	243,200	55,000	2,000	8,200	308,400

Source: CCM

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