

PRODUCING COMPANIES

In 2000, two processes were used to produce DMF in China; the direct process and the indirect process. In the direct or one-step process, dimethylamine is reacted with carbon monoxide (CO) in the presence of sodium methoxide catalyst. Three of the largest producers – Anhui Huaihua Fine Chemical Co., Ltd., Shandong Zibo Organic Amine Plant of Shandong Dacheng Pesticides Co., Ltd. and Zhejiang Jiangshan Chemical Co., Ltd., all use one-step technology from the United States. In the indirect process, methyl formate is isolated, and then reacted with dimethylamine to form DMF. To obtain methyl formate, two methods have been adopted in China – dehydrogenation of methanol and esterification of formic acid. Sichuan Tianyi Science & Technology Co., Ltd. (formerly Southwest Research & Design Institute of the Chemical Industry) is the major DMF institute that develops and licenses DMF technology based on methanol dehydrogenation or carbonylation technology in China.

China once had over twenty plants producing DMF. Since the mid-1990s, many small plants have left the business because of low cost-efficiency. Of the total DMF capacity of 126 thousand metric tons in 2001, 73% was based on one-step carbonylation of dimethylamine and 27% on the indirect process via methyl formate. As much as 96% of the methyl formate intermediate was sourced from methanol dehydrogenation, with the remaining 4% from esterification of formic acid. The following producers of DMF represented about 97% of the total capacity in 2001:

Major Producers of Dimethylformamide
(thousands of metric tons)

Company and Plant Location	Annual Capacity as of Year-end		Process/Remarks
	2001	2002	
Anhui Huaihua Fine Chemical Co., Ltd. Huainan, Anhui	18	38	Dimethylamine/CO one-step process; started up in 1997. Following debottlenecking from 12 thousand to 18 thousand metric tons in 2000, the company brought another new 20 thousand metric ton-per-year DMF plant on stream in late 2002. Captive dimethylamine.
Guangdong Kaiping Nitrogenous Fertilizer Factory Kaiping, Guangdong	2	2	Indirect process via methyl formate from methanol dehydrogenation. Start-up in 1995.
Jiangsu Xinya Chemical Group Co. Changzhou, Jiangsu	15	15	Indirect process via methyl formate from methanol dehydrogenation. Started up in 1994. Debottlenecking brought the capacity up to 15 thousand from 10 thousand metric tons in 1998. Captive dimethylamine.
Laoting Fengze Organic Chemical Co., Ltd. ^a Tangshan, Hebei	6	6	Indirect process via methyl formate from methanol dehydrogenation. Start-up in 1995.
Lianyungang Shuguang Chemical Plant Lianyungang, Jiangsu	3.7	3.7	Two sets of DMF facilities with total annual capacity of 3.7 thousand metric tons, both by indirect process via methyl formate, from esterification of formic acid for the 0.7 thousand metric ton-per-year unit and from methanol dehydrogenation for the 3 thousand metric ton-per-year unit. The latter unit started up in 1996.
Panjin Xinxing Chemical Co., Ltd. Panjin, Liaoning	3.5	3.5	Indirect process via methyl formate from methanol dehydrogenation. Start-up in 2001.
Shandong Dacheng Pesticides Co., Ltd. ^b Shandong Zibo Organic Amine Plant Zibo, Shandong	8	8	Dimethylamine/CO one-step process. Started up in 1994.

Major Producers of Dimethylformamide (continued)
(thousands of metric tons)

Company and Plant Location	Annual Capacity as of Year-end		Process/Remarks
	2001	2002	
Shandong Hualu Hengsheng Chemical Co., Ltd. ^c Dezhou, Shandong	16	20	Dimethylamine/CO one-step process; start-up in late 2000 with designed capacity of 10 thousand metric tons per year. Successive debottlenecks in 2001 and 2002 to raise total DMF capacity to 20 thousand metric tons in 2002. Captive dimethylamine.
Zhejiang Jiangshan Chemical Co., Ltd. ^d Jiangshan, Zhejiang	50	50	Dimethylamine/CO one-step process; started up in 1994. Process improvements expanded capacity from the initial 8 thousand metric tons to 16 thousand metric tons in 1997. In late 2000, further debottlenecking brought the capacity up to 30 thousand metric tons. In 2001, a new 20 thousand metric ton unit came on stream. Captive dimethylamine.
Total	122.2	146.2	

a. Formerly known as Laoting County Chemical General Plant.

b. Formerly known as Shandong Pesticides Industry Co., Ltd.

c. Formerly known as Shandong Hengsheng Chemical Co., which was originally reorganized based on Dezhou Chemical Fertilizer Plant.

d. Formerly known as Zhejiang Jiangshan General Chemical Plant.

In the next decade, the major DMF capacity expansions will occur at two existing producers—Shandong Hualu Hengsheng Chemical Co., Ltd. is undertaking further debottlenecking and capacity there is likely to be increased by 30 thousand metric tons to 50 thousand metric tons per year by 2003; Zhejiang Jiangshan Chemical Co., Ltd. plans to open another 30 thousand metric ton-per-year methylamines/DMF plant by 2004.

In addition, three new players will participate in the DMF industry within the next five years. A Sino-German joint venture (BASF-YPC Company Limited) between Yangzi Petrochemical Company and BASF AG (each holds a 50% stake) will build a new 30 thousand metric ton-per-year DMF plant based on BASF's one-step technology. As one part of the integrated cracker complex, the DMF project is expected to be completed by 2005. The complex will also involve a facility to produce associated methylamines, with an annual nameplate capacity of 30 thousand metric tons. In 2002, another 10 thousand metric ton-per-year methylamines/DMF plant was announced, to be built at Anyang, Henan, by Henan Anyang Chemical Industry (Group) Co., Ltd. This project is scheduled to come on stream by

2003. Mitsubishi Rayon of Japan and Jiangsu Xinya Chemical will jointly build a new 25 thousand metric ton-per-year methylamine unit and a new 30 thousand metric ton-per-year DMF plant (based on Mitsubishi's one-step technology) by 2004.

The following table lists the significant capacity additions in the foreseeable future:

Dimethylformamide Plants Approved or Under Construction (thousands of metric tons)		
Company and Plant Location	Annual Capacity (announced)	Start-up Date/Remarks
BASF-YPC Company Limited Nanjing, Jiangsu	30	Start up in 2005; dimethylamine/ CO one-step process.
Henan Anyang Chemical Industry (Group) Co., Ltd. Anyang, Henan	10	Start up in 2003.
Mitsubishi Rayon-Jiangsu Xinya Chemical Methylamines/DMF Project Changzhou, Jiangsu	30	Start up in 2004; dimethylamine/ CO one-step process.
Shandong Hualu Hengsheng Chemical Co., Ltd. Dezhou, Shandong	30	Start up in 2003.
Zhejiang Jiangshan Chemical Co., Ltd. Jiangshan, Zhejiang	30	Start up in 2004.
Total	130	