

Note: Key data/information in these pages is hidden, while it is not in the report.

1 Overview of phosphorus ore

1.1 Reserves and exploitation

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► Characteristics and quality of phosphate ore in major countries

The top phosphate ore reserve countries, namely Morocco, Iraq, China and the US, have different characteristics of their phosphate ore.

Table 1.1-1 Characteristics of phosphate ore in top reserves countries

Item/ Country	China	Morocco	The US
Content(counted by P2O5)	Low content (mostly lower than 30%)	Basically above 30%	Basically lower than 30%
Mining	Hard	Easy	Easy
Location	Mainly in inland plateau provinces-Yunnan, Guizhou, Hunan	West Sahara area (more than 70% reserves)	Florida (more than 50% reserves)
Transportation	Inconvenient	Convenient	Convenient
Developers	Decentralized	Centralized, only one developer	Decentralized, seven developers

Source: CCM International

Compared with Morocco and the US, phosphate ore exploitation in China is much tougher and more waste is generated.

Table 1.1-2 Typical analysis of commercial phosphate ore in major countries

Country	Distribution of ore deposit	P2O5	As	Cd	Cr	Hg	U	V
		(wt %)	(ppm)	(ppm)	(ppm)	(ppb)	(ppm)	(ppm)
China	Distributed all over the country	31.0	26.0	2.5	33	4,990	22.8	80
Morocco	Bu Craa	35.1	-	37.5	-	-	75.0	-
	Louribga	32.6	13.3	15.1	200	855	88.0	106
	Youssoufia	31.2	9.2	29.2	255	120	97.0	200
The US	Florida	31.9	11.3	9.1	60	199	141.0	108
	Idaho	31.7	23.7	92.3	290	107	107.0	769
	North Carolina	29.9	11.2	38.2	158	233	65.0	26
Jordan	Distributed all over the country	32.0	8.0	5.0	92	48	78.0	70
South Africa	Distributed all over the country	39.5	11.0	2.0	-	-	9.0	17
Australia	Distributed all over the country	28.9	14.0	4.0	35	75	84.0	63

Source: Albright & Wilson internal data, CCM International

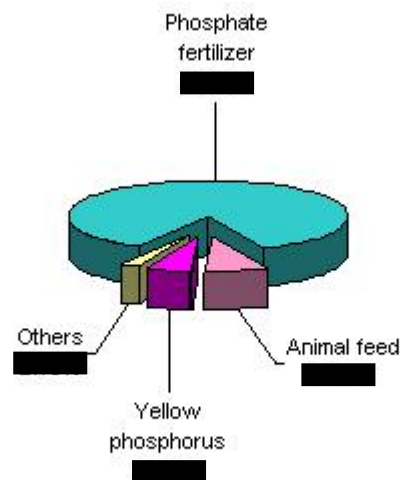
The above table shows that South Africa has the best quality phosphate ore in the world with the highest phosphorus content and relatively low impurity content.

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► Consumption

Phosphate ore is mainly used to produce phosphate fertilizer, animal feed and element phosphorus in the world, or is directly used in farmland.

Figure 1.1-3 Consumption pattern of phosphate ore in the world, 2008



Source: CCM International

Fertilizer is the largest consumer of phosphate ore. However, some developing countries, such as China, use phosphate ore mainly to produce low analysis fertilizer, while developed countries, such as the US, use it to produce high analysis fertilizer like monoammonium phosphate (MAP), diammonium phosphate (DAP) and triple superphosphate (TSP).

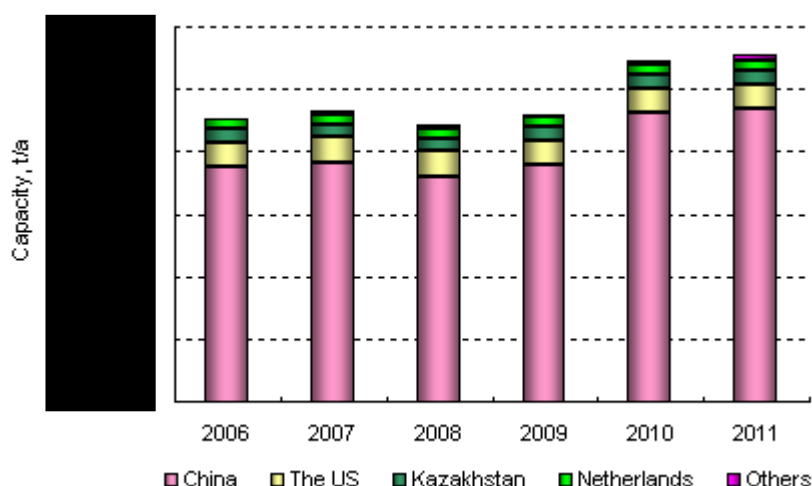
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2 Production and supply of yellow phosphorus

2.1 Overview

The total capacity of yellow phosphorus in the world has not increased a lot in the past five years, growing from XXXt/a in 2006 to XXXt/a in 2011 and most of the newly added capacity comes from China. The fast expansion from 2009 to 2010 in China can be considered as a result of the implementation of yellow phosphorus industry admittance, because some small enterprises had raised their capacity to meet the new criteria.

Figure 2.1-1 Capacity of yellow phosphorus in the world, 2006-2011



Source: CCM International

Many developed countries such as the US have reduced output of yellow phosphorus for three main reasons. Firstly, their governments are restraining the development of yellow phosphorus industry, hoping to preserve their own phosphorus resources.

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In order to enhance the competitiveness in global market under current sluggish market, most yellow phosphorus production countries have paid attention to optimizing industrial structure and developing high value-added phosphate chemicals. Production in major suppliers such as the US, China and Kazakhstan will keep relatively stable, while that in other countries lacking phosphorus ore or electric power will decrease in the future.

The total volume of yellow phosphorus transaction among countries is only XXX tonnes in 2010, accounting for just about XX% of the total output. If re-export is considered, the real transaction volume may be even lower and may account less than XX% of the total output, because yellow phosphorus is mostly used as raw materials to produce other products. Thus, yellow phosphorus is exported through downstream products to some extent. Besides, the two developing countries, Kazakhstan and Vietnam, are trying to develop downstream industry of yellow phosphorus and reduce the proportion of their exports of yellow phosphorus.

Table 2.1-1 Output and export of yellow phosphorus of main suppliers in the world, 2010

Country	Output, tonne	Export, tonne	Ratio of export
China	XXXXXX	35,557	XX%
The US	XXXXXX	18,269	XX%
Netherlands	XXXXXX	11,852	XX%
Kazakhstan	XXXXXX	28,189	XX%
Vietnam	XXXXXX	XXXXXX	XX%

Source: CCM International

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2.2 China

2.2.1 Introduction

The capacity of yellow phosphorus in China keeps expanding in recent years, from XXXt/a in 2006 to XXXt/a in 2011. Chinese enterprises have been increasing their yellow phosphorus capacity while many foreign enterprises have been cutting production in recent years. As the largest supplier of yellow phosphorus in the world, China's capacity reaches XXXt/a in 2011, constituting over 80% of the world's total, and its output of yellow phosphorus is XXX tonnes in 2011. However, China's export volume is only 15,838 tonnes in 2011, which is less than XX% of the output. In order to protect domestic phosphorus resources, the Chinese government is trying to restrain the production of yellow phosphorus and reduce the export volume, and yellow phosphorus output and export data show that the government's policy begins to take effect.

- Resource supply

► Electricity

The electricity supply is still dramatically tight in China during summer months, the peak demand season for electricity. In order to restrict electricity consumption in high energy-consuming industries, the Chinese government has abolished the former preferential price policy and executed discriminative price policy for the yellow phosphorus industry since 2007. In 2011, the local governments have temporarily stopped the production of high energy-consuming products including yellow phosphorus in order to fulfill the goal of energy saving and emission reducing.

Since the electricity cost constitutes over.....

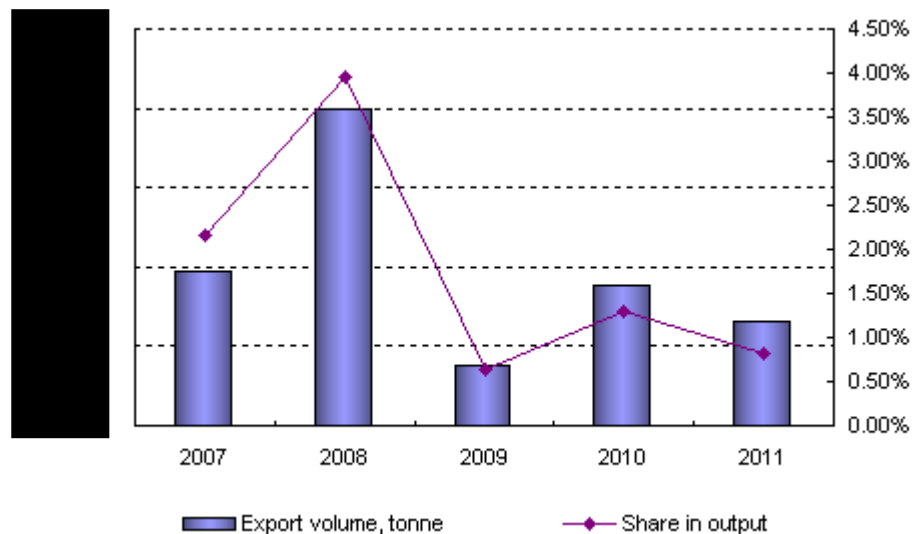
As yellow phosphorus production mostly depends on hydropower, most manufacturers arrange their production only in wet seasons, from June to Nov. The price of electricity in wet seasons is about USD0.07/kWh in Southwest China where the hydropower is abundant.

► Phosphate ore

Chinese phosphate ore resources are abundant, but are not rich. The grade of phosphate ore in China is low in general, with average grade (content of phosphorus pentoxide) of only about 17%. China has only XXX billion tonnes of high-grade phosphate ore reserves, accounting for approximately XX% of its total phosphorus reserves. In addition, XX% of phosphate ore in China is high-Mg phosphorite which needs to be ground into 200 mesh powder for monomer dissociation.

China's phosphorus resources are mainly distributed in.....

Figure 2.2.1-1 Export volume of phosphate ore in China, 2007-2011



Source: China Customer, CCM International

Since China has the second largest phosphorus resource reserves in the world, it needn't to import phosphate ore. In fact, China's imported phosphate ore was very limited in the past 20 years, with the volume less than 100 tonnes per year.

The export volume in China has declined a lot in the past ten years, from over XXX million tonnes in 2001 to about XXX million tonnes in 2011. As China's policy tends to protect domestic phosphorus resources and the domestic demand from fertilizer and phosphorus chemical industries keeps increasing, the export volume of phosphate ore will further decline in the future.

- Policy

► Restriction on electricity use

The Chinese Central Government first released differential power price policy for six high energy-consuming industries, excluding yellow phosphorus industry in 2004, but the yellow phosphorus industry has been included since 2006. Although some local governments, such as Yunnan and Sichuan provinces, had executed preferential price policies in 2008 because of the financial crisis, these policies were soon prohibited by the Chinese Central Government. What's more, higher differential price policy has been executed since June 1, 2010. It is worth mentioning that, whether a company belongs to eliminated ones, restricted ones or not depends on the Catalog of Guidance of Industrial Structural Adjustment.

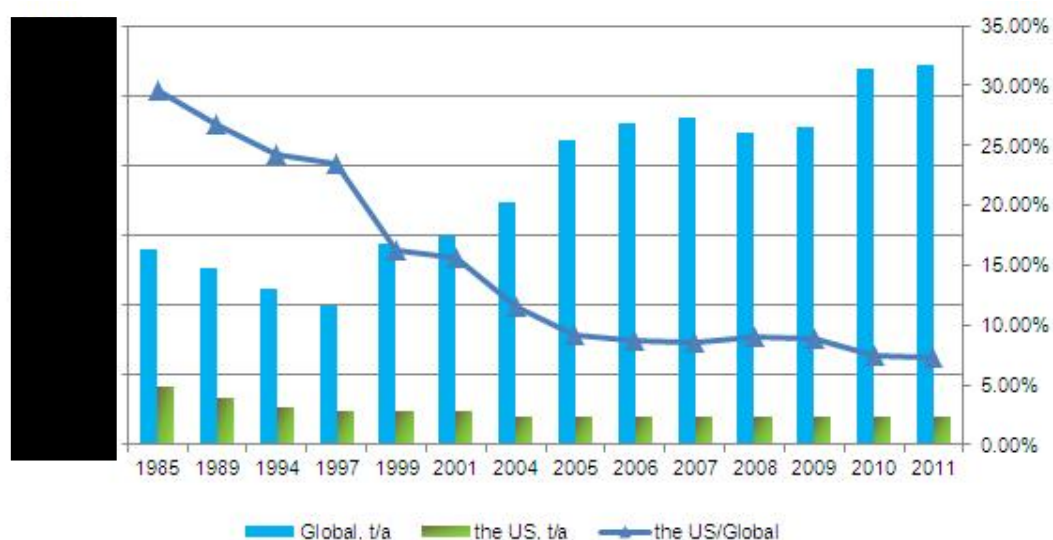
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2.3.2 Production situation

- Capacity and output

Due to the weak demand and high production cost, Astaris L.L.C. closed its yellow phosphorus plant in Dec. 2001. Since then, Monsanto become the unique yellow phosphorus producer in the US and the US's yellow phosphorus capacity has kept stable at about XXXt/a, ranking the second in the world. The US's yellow phosphorus output is about XXX tonnes in 2011, slightly down from XXX tonnes in 2010.

Figure 2.3.2-1 Yellow phosphorus capacity of the US, 1985-2011



Source: CCM International

- Producer

Currently, there is only one producer in the US, namely Monsanto Company, with total capacity of 200,000t/a in 2011. The company uses yellow phosphorus primarily to manufacture phosphorus trichloride, the raw material for the production of glyphosate-based herbicides.

Table 2.3.2-1 Main producer of yellow phosphorus in the US, 2009-2011

Main Producer	2009		2010		2011	
	Capacity, t/a	Output, tonne	Capacity, t/a	Output, tonne	Capacity, t/a	Output, tonne
Monsanto Company	XXX	XXX	XXX	XXX	XXX	XXX

Source: CCM International

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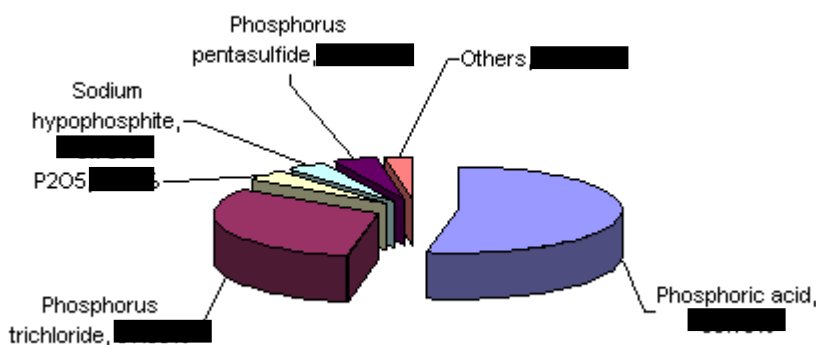
3 Demand from end use market

3.1 Overview

The global yellow phosphorus consumption reaches XXX tonnes in 2010. On the whole, the consumption of yellow phosphorus is increasing slowly in the past five years, with fast development in developing countries. There are five major products using yellow phosphorus as raw materials, including phosphoric acid, phosphorus trichloride, phosphorus pentasulfide, sodium hypophosphite and phosphorus pentoxide.

Phosphoric acid is still the biggest user of yellow phosphorus, but its proportion keeps decreasing in the past five years. The consumption by phosphorus trichloride is growing continuously, accounting for XX% of the total consumption of yellow phosphorus in 2011. The consumption in other fields remains stable.

Figure 3.1-1 Consumption of yellow phosphorus in downstream areas in the world, 2010



Source: CCM International

Table 3.1-1 Apparent consumption of yellow phosphorus by country, 2010

Country	Apparent consumption, tonne
China	XXX,XXX
The US	XXX,XXX
Kazakhstan	XXX,XXX
Netherlands	XXX,XXX
Japan	XXX,XXX
Germany	XXX,XXX
Brazil	XXX,XXX
India	XXX,XXX
Poland	XXX,XXX
Italy	XXX,XXX
Vietnam	XXX,XXX
France	XXX,XXX
Others	XXX,XXX
Total	XXX,XXX

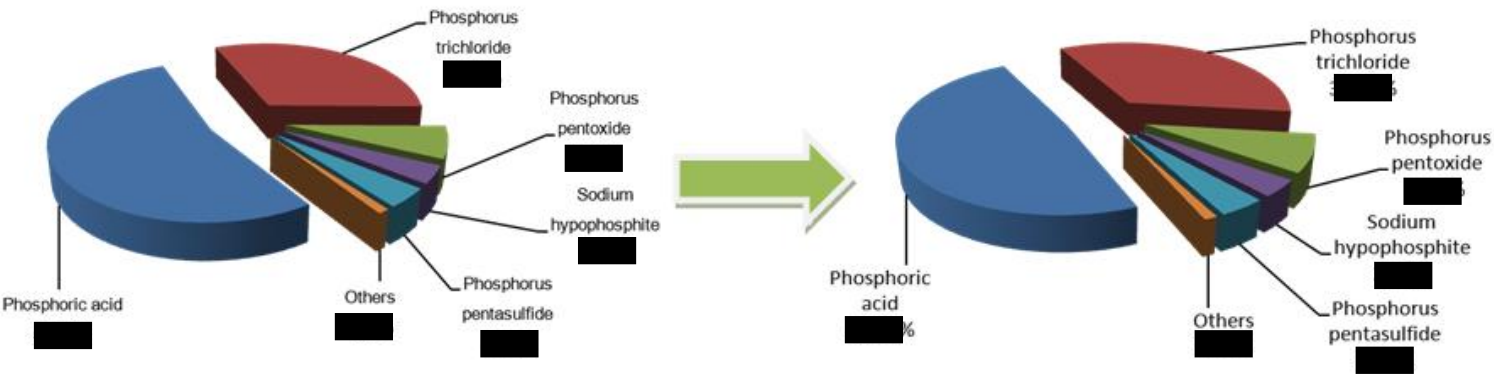
Source: CCM International

In the past five years, global consumption evolution of yellow phosphorus can be concluded as follows.

Firstly, consumption of yellow phosphorus has been centralizing in production countries.

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Figure 3.1-2 Forecast on yellow phosphorus consumption by application fields in the world, 2010 VS 2016



Source: CCM International