Report on Glyphosate Business Opportunities Worldwide

- Analysis on Upstream Industry Chain

- The Third Edition

August 2016

CCM Data & Business Intelligence

Researched & prepared by:
Kcomber Inc.

Contents

LIST OF TABLES

LIST OF FIGURES

1. Introduction

Global Commercial Opportunities Derived from Glyphosate Industry is an alternative study that doesn't survey a certain product or industry. However, it is anticipated to be an overview of a value chain analyzing all the upstream industries whose development and opportunities are driven or influenced by the glyphosate industry. The whole report is an integrated analysis and professional forecast to guide investments and business movements for the upstream players who pay close attention to glyphosate industry or try to find opportunities in it.

This global survey focuses mainly on:
- Global development trend of glyphosate by three routes;
- Forecast on supply & demand of raw materials and analysis of investment opportunities based on future possible transformation of three production routes;
- Future possible industry transfer of global glyphosate production and analysis of investment opportunities;
- Analysis of potential opportunities for the upstream players for glyphosate industry, including petrochemical enterprises, chlor-alkali players, intermediate producers, raw material processors, etc.;
- Study on global natural resources based on development of glyphosate production and consequences brought to development of upstream industries;

Main products involved in this report include:
- ✓ Glyphosate technical & PMIDA
- ✓ Diethanolamine (DEA)
- ✓ Ethylene oxide (EO)
- ✓ Glycine
- ✓ Paraformaldehyde (PF)
- ✓ Iminodiacetonitrile (IDAN)
- ✓ Yellow phosphorus
- ✓ Phosphorus trichloride
- ✓ Dimethyl phosphite (DMP)
- ✓ Chlor-alkali products
- ✓ Methanol

2. Approach for the report

This report has been drafted by diverse methods which are as follows,

- ✓ **Desk research**

There are various sources of desk research, including published magazines, journals, Through desk research, basic information such as production, producers, trade, supply & demand, and consumption by region/country is collected, mainly from the internet, magazines and

periodicals. Third party data were also purchased to deepen and approve our understanding.

✓ **Telephone interview & questionnaire survey**

Extensive telephone interviews and questionnaire surveys were carried out throughout the world, through which CCM gets expert opinions, including forecast on average growth rate of the global glyphosate demand in 2015-2025, factors influencing the demand, new production routes, comparison of three production routes, possibility of glyphosate industry transfer (from China to overseas, or the domestic transfer) and possible countries/regions involved, factors influencing the transfer, etc. Such information helps us better understand the development trend of glyphosate and possible transfer in the future.

The interviewees include:
- Glyphosate producers
- Researchers
- Suppliers of glyphosate's raw materials
- Traders
- Associations

✓ **Import & export analysis**

Analysis of export data (HIS code 29310000, 38089311 and 38089319) from Chinese Customs helps work out flow chart of Chinese glyphosate (glyphosate technical, glyphosate formulations and PMIDA) by producer, trader and destination, and analysis of the US' export data helps know better the distribution of the US' and Monsanto's glyphosate-based products.

✓ **Report generation**

Logical analysis and scientific ratiocination were conducted to generate the report, such as supply & demand analysis and cross-checking of all data. All the data and findings obtained through the above methods will be presented in the report clearly.

3. Executive summary

- **Supply and demand of glyphosate**

Glyphosate is the world's biggest selling herbicide, seeing a sharp growth in both sales volume and sales value. In 2015, global glyphosate sales decreased to USDXX billion, accompanied with a market demand of about XX tonnes (95% technical equivalent), USDXX billion less than 2014 because of the decreasing price and demand.

Glyphosate-based herbicides are widely used in over 130 countries in the world, but the global supply of glyphosate technical is only concentrated in several countries including China (with easily available raw materials including IDAN and glycine), the US (headquarters of Monsanto,

the global glyphosate giant), Argentina (a large glyphosate user, as well as production base of Monsanto and Atanor), Brazil (a large glyphosate user and production base of Monsanto and Nortox), etc.

Glyphosate is mainly consumed in American countries, especially the US, Brazil and Argentina, the top three biotech crop planting countries. The three countries together consume about XX million liters of glyphosate-based herbicides (equivalent to XX tonnes of glyphosate 95% technical) annually, accounting for about XX% of the global total.

The increasing demand for glyphosate before 2015 mainly from increasing planting areas of herbicide-tolerant crops (including herbicide-tolerant and herbicide/insecticide-resistant crops which are mostly glyphosate-tolerant), development of biofuels, increasing share of no-tillage system, increasing global harvested area and no substitute for glyphosate. The decreasing demand in 2015 was attributed to the decreasing planting area of herbicide-tolerant crops resulting from the decreasing price of corn, cotton and rapeseed. It is estimated that the global demand for glyphosate in the next ten years will stop declining and keep increasing along with the rising price of corn, cotton and rapeseed, but the growth rate will be much lower than before. The global production of glyphosate technical will grow stably correspondingly, and the three production routes will still coexist but the share of the DEA route will keep declining in the coming few years.

- **Industrial transfer**

Global glyphosate production is relatively concentrated in only some countries especially China and the US. Some new glyphosate projects have been launched outside China since 2014, which will further aggravate the overcapacity of the product in the world but optimize the global supply distribution.

Two approaches have been adopted to study the possibility of glyphosate technical's capacity transfer from China to overseas countries or within China: professional consultancy (questionnaire and face-to-face interview) and state-of-the-art analysis, as well as step by step exclusion and comprehensive evaluation. Results are as follow:
1. It is of little possibility to launch new production lines of glyphosate technical using DEA (or glycine, IDAN) as original starting material beyond China in the future 5~10 years. In other words, it's inadvisable to invest in such production lines.
2. It is possible to launch glyphosate production line using PMIDA as starting raw material beyond China in the future 5~10 years, but the possibility is relatively low.

New projects in China may be distributed in less developed regions or those holding rich phosphorus ore and gas resources including Hubei Province, Sichuan Province, Yunnan Province, Inner Mongolia Autonomous Region or Xinjiang Uygur Autonomous Region. The possibility of industry transfer to Inner Mongolia and Xinjiang is relatively low because of high cost in transportation and incomplete facilities there.

- **Overview of iminodiacetonitrile (IDAN)**

Over XX% of IDAN's total output is used for glyphosate production worldwide currently. Therefore, the development of IDAN industry is tightly banded with that of glyphosate industry. Most global IDAN capacity and output come from China mainly, in which there are large-scale producers like Chongqing Unisplendour Chemical Co., Ltd. Total consumption volume of IDAN is expected to see a stable increase at a CAGR of XX% during 2016 and 2025.

Currently, IDAN still has the advantage of low production cost for glyphosate production. However, it will face the biggest challenge from rise of natural gas price in the future. The complete marketization of natural gas price in China will not be realized in the short term, and the natural gas price will still be determined by administrative departments. In China, natural gas is mainly supplied directly to producers of IDAN, so its price (well-head price + pipe transport cost) has hardly changed in the past few years. The well-head price will not change in the short term. However, the Chinese government issued regulations in Feb. 2015 that the price for direct-supplying customers will be reformed and set by both parties involved, meaning that the price of natural gas supplied for IDAN production will increase (the date and the increment are undetermined).

Opportunities for IDAN industry include good chance to join in integration of whole industrial chain of glyphosate to strengthen its total industrial competitiveness, etc.

- **Overview of diethanolamine (DEA)**

The global output of DEA was XX tonnes in 2015, accounting for XX% of ethanolamine's total. There are many petrochemical giants who produce DEA scattered in the US, Europe, and South and East Asia, selling DEA around the world at competitive prices. The sale would be profitable to them because of their enormous scales, advanced technologies and global deployments. It is hard for new entrants to compete with existing players. For example, although China has launched large production capacity of DEA, the sale is unprofitable. On the contrary, possibility for enterprises in the Middle East, particularly Saudi Arabia, to penetrate in this market is high because of their enormous local raw material of DEA and cooperation with international players.

Global glyphosate industry consumed about XX tonnes of DEA in 2010, and the amount declined to about XX tonnes in 2015, as a result of the fast development of other two glyphosate production routes.

- **Overview of glycine**

Global glycine production has developed rapidly since 2005. Glycine production is mainly concentrated in China, Japan, the US, the Netherlands, India and Belgium. China ranks top in terms of both output and consumption, producing industrial grade glycine mainly, and the total

capacity and output came to XX t/a and about XX tonnes in 2015. Production and consumption of glycine beyond China focus on food grade, feed grade and pharmaceutical grade.

Global glycine consumption, reaching about XX tonnes in 2015, is expected to keep growing in the coming years; yet, the growth rate will be smaller. It is estimated that about XX tonnes of glycine will be consumed in 2025, posting a XX% CAGR in 2016-2025.

- **Overview of paraformaldehyde (PF)**

Stimulated by an increasing demand from downstream industries and producers' expanding formaldehyde industrial chain to gain higher profits, the world's production scale of PF has been enlarging–the capacity and output presented a respective CAGR of XX% and XX% from 2008 to 2015.

In the past decade, the world's paraformaldehyde capacity kept growing, especially in 2007-2010, 2013 and 2015, due to the fast expansion in China.

Global consumption of PF in glyphosate production was about XX tonnes in 2015, accounting for about XX% of its total consumption in agrochemical production and about XX% of its global total consumption.

4. What's in this report?

Table 1.1-1 Key players of glyphosate technical in the world, 2015

Glyphosate producer	Capacity '15, '000 t/a	Output, '000 t					
		2010	2011	2012	2013	2014	2015
Chinese (about 32 producers)	XXX	320	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
XXXXXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Total	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Source: CCM

Figure 1.1-3 Output share of glyphosate technical by province in China, 2015

Source: CCM

1.2 Demand

Glyphosate is mainly consumed in American countries, especially the US, Brazil and Argentina, who are the top three biotech crop planting countries worldwide, growing 70.9 million hectares, XX million hectares and XX million hectares of biotech crops in 2015 respectively. The three countries consume over XX million liters, XX million liters and XX million liters glyphosate-based herbicides annually with their total glyphosate demand accounting for about 50% of the global total.

Figure 1.2-2 Global consumption of glyphosate by region, 2015

Source: CCM

1.3 Forecast on global glyphosate industry for 10 years

1.3.1 Drivers and barriers

Table 1.3.1-2 Production of bioethanol and corresponding corn consumption in the US and Brazil, 2005-2015

Year	The US				Brazil			
	Bio-ethanol production, billion liters	Corn used for bio-ethanol, million tonnes	Corn production, million tonnes	Share of corn used for bio-ethanol, %	Bio-ethanol production, billion liters	Sugarcane used for bio-ethanol, million tonnes	Sugarcane production, million tonnes	Share of sugarcane used for bio-ethanol, %
2005	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2006	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2007	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2008	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2009	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2010	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2011	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2012	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2013	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2014	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX
2015	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX

Source: The United States Department of Agriculture; the Brazilian Sugarcane Industry Association

2.3 Analysis on factors influencing glyphosate capacity redistribution and industrial transfer

2.3.1 Influencing factors

Generally, the determinant of a new investment decision is the expected profitability of the investment in the future years (usually 5~10 years). Therefore, investors should take expected profitability as the most important factor for investment in new production lines of glyphosate technical.

Figure 2.3.1-1 Factors impacting profitability of glyphosate business

Source: CCM

2.3.2 Rating of factor importance

Table 2.3.2-1 Factors impacting profitability of glyphosate business

Factor	Importance
Environmental protection expenditure	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX
XXXXXX	XXX

Note: The importance is graded into 1-5.

5 means the most important and 1 means the least.

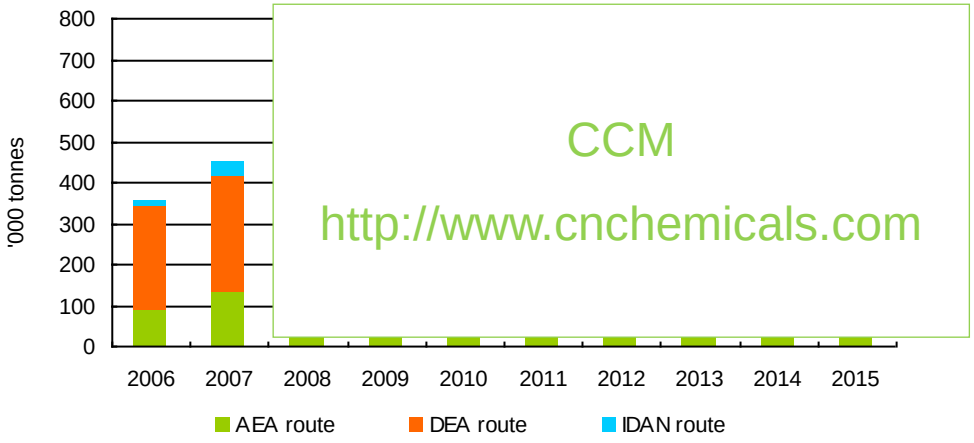
Source: CCM

3.1 Current situation and market share of three major production routes

There are three production routes of glyphosate technical in the world, namely the AEA route, the IDAN route and the DEA route. The former two routes are available in China only, and only the DEA route is adopted by overseas glyphosate technical producers including Monsanto, Cheminova and Atanor (the last two have started to purchase China's PMIDA to produce glyphosate technical) in recent years.

The DEA route is facing intense competition from the other two routes. Market share of glyphosate made by this route has decreased from over XX% before 2006 to XX% in 2013 and XX% in 2015.

Figure 3.1-1 Output of glyphosate technical by different routes in the world, 2006-2015



Note: 95% technical equivalent

Source: CCM

3.3.2 Influence of stricter environmental protection policies

Table 3.3.2-4 Comparison of membrane method and selective transformation and burning method for disposal of glyphosate mother liquid

Item	Membrane method	Selective transformation and burning method
Phosphorus utilization rate	XXXXX	XXXXX
Salt disposal	XXXXX	XXXXX
Water consumption	XXXXX	XXXXX
Solid waste	XXXXX	XXXXX
Waste gas	XXXXX	XXXXX
Initial investment	XXXXX	XXXXX
Operation cost* (USD/t glyphosate)	XXXXX	XXXXX
Side product	XXXXX	XXXXX

*Note: * Revenue of side products excluded.*

Source: CCM & Changjiang Securities

Table 3.3.2-5 Investment of 100,000 t/a organophosphorus wastewater treating project by Zhejiang Wynca Chemical Group Co., Ltd.

Item	Content	Amount, USD	Amount, RMB
Pretreatment to concentration	Equipment	XXX	XXX
	Civil work	XXX	XXX
	Installment	XXX	XXX
	Others	XXX	XXX
	Sub-total	XXX	XXX
Burning to deep processing	Equipment	XXX	XXX
	Civil work	XXX	XXX
	Installment & auxiliary	XXX	XXX
	Flow capital	XXX	XXX
	Others	XXX	XXX
	Sub-total	XXX	XXX
Total		XXX	XXX

Source: CCM

3.3.3 Cost of glyphosate technical by route

Table 3.3.3-1 Cost comparison of three different routes for glyphosate technical production in China, Jun. 2016, USD/t glyphosate

Item	AEA	DEA	IDAN
Raw material cost	XXX	XXX	XXX
Production cost	XXX	XXX	XXX
Waste water treatment fee	XXX	XXX	XXX
By-product recovery income	XXX	XXX	XXX
Real cost	XXX	XXX	XXX

Source: CCM

Table 3.3.3-2 Raw material cost of AEA route for glyphosate technical production in China, Jun. 2016

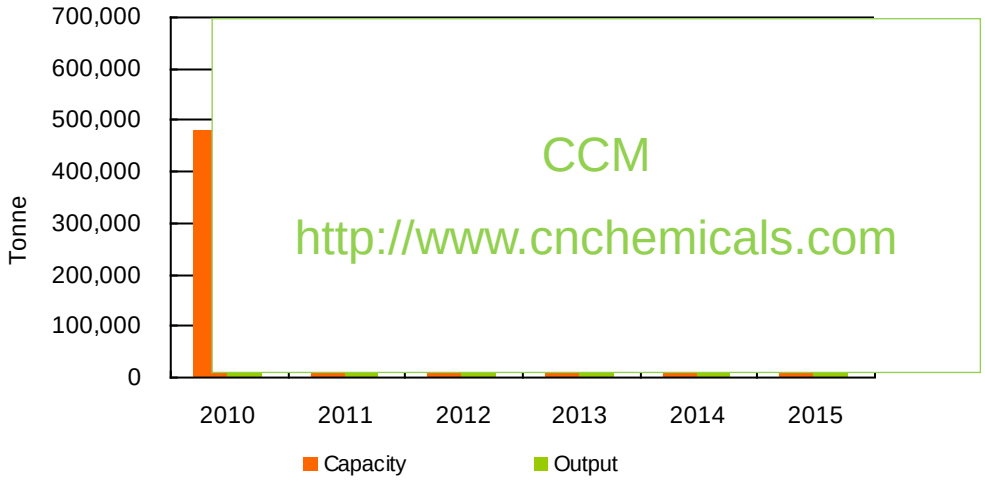
Raw material	Unit consumption, t/t	Unit price*, USD/t	Unit cost, USD/t
Glycine (Industrial grade)	XXX	XXX	XXX
Paraformaldehyde (37%)	XXX	XXX	XXX
Triethylamine (99.5%)	XXX	XXX	XXX
Methanol (95%)	XXX	XXX	XXX
DMP	XXX	XXX	XXX
Hydrochloric acid (30%)	XXX	XXX	XXX
Total			XXX

Note: The unit price is not only based on the ordinary market price but also the degree of economic scale, operating rate and backward integration of glyphosate manufacturers.

Source: CCM

4.2.2 Glycine

Figure 4.2.2-1 Global capacity and output of glycine, 2010-2015



Source: CCM

Figure 4.2.2-4 Global consumption of glycine by downstream segment, 2015

Source: CCM

If you want more information, please feel free to contact us

Tel: +86-20-37616606 Fax: +86-20-37616968

Email:econtact@cnchemicals.com