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Phosphate and NPK Fertilizers

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Report Abstract
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Nexant

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INTRODUCTION

Phosphate has been used as a fertilizer for centuries. Europeans and Chinese farmers applied phosphates in the form of bones, whereas the Peruvians used guano, which is a word derived from Quechua – Inca's language - which refers to birds droppings.

Nonetheless, it was not until the 18th century, when it was discovered that calcium dihydrogenphosphate or superphosphate as it was named, is the main component of bones. Not long after that discovery, it was concluded that phosphate and not the organic matter of bones, is the substance that has the fertilizing property.

In the 19th century, the production of soluble phosphates by treating a substrate containing insoluble phosphates with acid was a major breakthrough, and together with findings of large deposits of mineral phosphates triggered the fast development of the commercial phosphate fertilizer industry. Phosphate fertilizer derived from mineral phosphate or phosphate rock, displaced phosphate sources from guano and bones which are less economical as a result of a lower content of phosphate per ton of fertilizer. Phosphate rock refers to rock that contains apatite which is mainly calcium phosphate. Phosphate rock may contain other metal phosphates and halogens which can have an impact in fertilizer production.

In the late 1800s, superphosphates derived from phosphate rock were dominating the fertilizer industry. Then, around 1920, ammonization of phosphoric acid gave rise to the production of multi-nutrient fertilizers. In the 1930s, the nitrophosphate process, which involves the acidulation of phosphate rock with nitric acid, was commercialized in Norway.

While phosphoric acid is a large commodity this is largely due to its consumption in fertilizers production. This is illustrated by the fact that, currently, over 80 percent of global phosphoric acid production is transformed into phosphate fertilizers. The major phosphate fertilizers are ammonium phosphates and triple superphosphate, which represent about 65 percent of phosphate fertilizers produced.

Phosphorus, together with nitrogen and potassium, is a key nutrient to sustain life, being present in molecules in cells. Although, phosphorus can be present in soil, to be useful it has to be in a form that is easily absorbed by the plant.

Phosphate fertilizers provide phosphorus in the monovalent or divalent phosphate form which is soluble or is convertible into a soluble phosphate depending on soil conditions. Type of cations present and pH are some of the main soil characteristics influencing the phosphorus uptake.

TECHNOLOGY

This section includes an overview of the chemistry and the chemical processes involved in the production of the major (mononutrient) phosphate fertilizers. The overview covers also the production of multi-nutrient fertilizers such as ammonium phosphate and NPKs.

- Triple superphosphate (TSP)
- Single superphosphate
- Ammonium phosphates
- Nitrophosphate fertilizers
- Fertilizer granulation

COMMERCIAL TECHNOLOGY

This report provides an overview of the general technology for the production of phosphate fertilizers. Phosphate technology is quite mature and while there are arguably no "major" differences in the commercial technologies employed, Nexant has analyzed the different technology configurations employed by key producers and/or licensor providers in the industry. Specifically, configurations by the companies listed below have been reviewed:

- Incro
- ESPINDESA
- GPN
- Jacobs Engineering
- Yara

TECHNOLOGY DEVELOPMENTS

Technology for phosphate fertilizer production is quite mature and the chemistry of the process has not changed for many years. Nonetheless, a number of patents have been awarded and applied for, which Nexant has reviewed. A summary is given and intended to highlight novel processes that involve the production of fertilizers with other nutrients, the utilization of a different feedstock other than phosphate rock and the production of a fertilizer with a different form of phosphate.

PROCESS ECONOMICS

Diammonium phosphate (DAP) is the most consumed phosphate fertilizer globally and therefore the report includes a comparison of costs of production of (DAP) in major producing and consuming regions. i.e., on China, Middle East, U.S., West Europe bases.

In addition, costs of production comparison between two different routes to produce NPK fertilizers, i.e., the sulfur (slurry granulation) route and the nitrophosphate route), is given on a China and West Europe bases.

The costs of production tables given in this report include a breakdown of the cost of production in terms of raw materials, utilities consumed (electrical energy, cooling water, fuel etc.), direct and allocated fixed costs, by unit consumption and per metric ton and annually, as well as contribution of depreciation to arrive at a cost estimate. Capital costs are broken down according

to inside battery limits (ISBL), outside battery limits (OSBL), other project costs, and working capital.

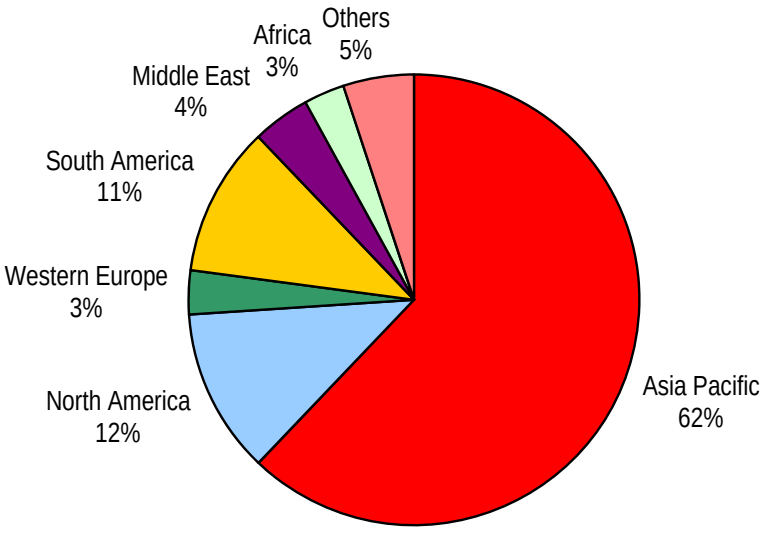
COMMERCIAL MARKET REVIEW

A brief overview of commercial applications of ammonium phosphates, superphosphates, and NPK fertilizers is given.

Global consumption of ammonium phosphates (MAP and DAP) and TSP is given for 2010 and forecast to 2016.

The figure below shows the global consumption of phosphate fertilizers (MAP, DAP and TSP) by regional breakdown. Asia Pacific, the largest fertilizer consumer, accounted for 62 percent of global consumption.

Figure 1 Global Total DAP, MAP, and TSP Consumption by Region



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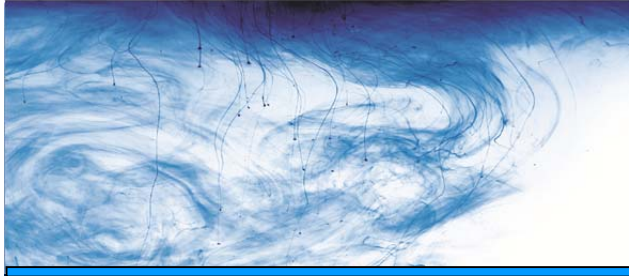
- A regional market (supply, demand, trade) review for phosphate fertilizers, namely monoammonium phosphate (MAP), diammonium phosphate (DAP) and triple superphosphate (TSP) for North America, Western Europe, and Asia Pacific regions is given, including a forecast timeframe to 2016.



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