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FERTILIZER PRODUCTION & STORAGE

With over half of the world's food supply dependent on fertilizer due to nutrient lacking soil, the importance of fertilizer production, fertilizer storage and transport continues to grow. By supplying crops with essential nutrients, fertilizers facilitate the efficient use of land resources and improve overall crop quality and production yields. The world's leading producers of inorganic fertilizers are China, India, USA, Russia, Canada and Brazil, with the global market estimated to reach $152 billion by 2020[1].

What are fertilizers?

Inorganic fertilizers commonly used in the agricultural sector are NPK; fertilizer that is primarily composed of 3 elements: Nitrogen, Phosphate and Potassium. Different ratios of NPK are combined to produce the optimal fertilizer for each agricultural application.

- Nitrogen is characterized as ammonium, nitrate, ammonium sulfate and other nitrogen solutions. The role of Nitrogen is to improve a plants' ability to photosynthesize, improving growth and crop yields.
- Phosphate consists of MAP (monoammonium phosphate), DAP (diammonium phosphate) and triple superphosphate, and it supports the formation of oils, sugars and starches and the growth of roots.
- Potassium, known as Potash, improves water retention, activates vital plant enzymes, fights disease and improves crop quality.

Fertilizer particles are often coated to control their solubility in soil. By controlling a fertilizer's solubility, a prolonged nutrient release can be achieved, resulting in more uniform plant nutrition. Urea, a fertilizer with the highest N content, is the base material for the majority of the coated fertilizers. Sulfur, resin-based polymers and polyethylene polymers are widely used coating agents for fertilizer granules or prills.

Fertilizer production & fertilizer cooling

For fertilizer production, the varying inorganic components are granulated and blended together. This blending can be achieved through a pipe reactor system or a rotating drum process, resulting in fertilizer prills of an ideal size. The most important step in fertilizer production is cooling, which is required for proper storage and transport. Elevated fertilizer temperatures will result in product caking during storage and transport, leading to breakage and a lower-valued end product.

By nature, fertilizers are hygroscopic, meaning that they attract and absorb moisture from the surrounding air. Moisture transfer between the product and air will cause the humidity of the surrounding air to increase, leading to condensation and product caking. The critical relative humidity (CRH) governs the relationship between dew point and product temperature. For example, when a fertilizer's CRH is lower than the ambient air's relative humidity, the product will absorb moisture from the air which will cause caking. To prevent this reaction, cooling the product to an ideal temperature for storage and transport is extremely important and will lead to a higher quality end product.

Traditional cooling technology

Traditionally, fertilizers are cooled through a direct contact air coolers or fluid bed coolers in granulation and prilling plants. In these instances, cooling capacity is restricted to the height or capacity of the cooling tower.

Rotary Drum drying and cooling machines can cool fertilizer granules from 60°C – 80°C to an end temperature of 40°C and can reduce moisture content to 2 – 3% from 20 – 30%. Hot air first passes through the rotary drum dryer to remove moisture, then the product is transferred to the rotary drum cooling machine by conveyor or bucket elevator. Cooling air passes through the body of the machine to lower the product's final temperature.

New technology

In recent years, an innovative technology has gained momentum in fertilizer production. The Solex fertilizer cooling system uses vertically stacked plates, within a modular design to cool fertilizer granules through conduction. The product passes through the vertical banks of stainless steel plates in mass flow, as cooling water flows through the plates indirectly cooling material through conduction. Air is not used in this process, preventing contamination and degradation of the final product. Understanding the CRH of each fertilizer and customizing water temperatures, prevents caking within the unit. As gravity is the mechanism that slowly moves the product through the indirect cooler, the end result is a product with a stable and uniform final temperature.

This solution is also ideal for capacity increases due to the small footprint, low installation costs and minimal maintenance. Overall, this innovative technology has seen a 90% decrease in energy consumption due to the elimination of air cooling methods and it results in a superior end product.

With a growing demand on the fertilizer industry and increasingly stringent environmental regulations, the need to efficiently increase plant capacity and produce high quality fertilizer is gaining global attention. Inevitability, adequate cooling remains the key factor to the success of fertilizer producers.

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1 "Global Fertilizers Market Worth USD 152 Billion by 2020 - Analysis, Technologies & Forecasts Report 2015-2020 - Key Vendors: Agrium, EUROCHEM, Koch Industries - Research and Markets." Business Wire. Business Wire, 22, Mar. 2016. Web. 9 May, 2016.