

# NPK VIA PHOSPHORIC ACID

## PROCESS FEATURES

- The same plant, with no modifications, can alternatively manufacture a wide range of NPK formulations as well as granular DAP or MAP.
- The granulator has no other internal than the pipe reactor.
- Low recycle ratio (1.5 to 2.1 depending on the NPK formulations)
- The neutralization of phosphoric acid can reach N/P ratios as high as 2.0, then maximizing the use of ammonia (the cheapest source of nitrogen).
- Easy operation (no pre-neutralizers needed, only one ammonia feed to the Plant, no need of granulator internals, etc.).
- It copes with strict pollution regulations
- Many different solid raw materials can be used, such as urea, ammonium sulphate, ammonium nitrate, superphosphates, MAP, MOP, SOP, etc.
- NPK via steam granulation instead of phosphoric acid addition is also feasible.
- Different Nutrients can be added.



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## PROCESS DESCRIPTION

### Pipe reactor and granulation

Phosphoric acid and ammonia react in a pipe reactor located inside the rotary granulator. The ammonia/acid ratio is automatically adjusted to produce an ammonium phosphate melt of N/P ratios ranging 1.0 to 2.0 depending on the NPK formulation being manufactured.

Inside of the granulator the ammonium phosphate melt crystallizes over the bed of solids and leads to the manufacture of round and hard granules which are discharged to the drier to reduce its moisture content below 1%.

### Solid handling

The granulated NPK falls into the rotary Drier where it dries in contact with a co-current flow of hot air coming from the Drier Burner.

Product leaving the Drier is sent, through the Ex-Drier Elevator, to the top of the Screens, where is divided into three streams: the oversize, the on-size and the fines.

The oversize (and some on-size if required) pass into the Oversize Pulverizers. Crushed materials, fines and the dust collected by the Drier Cyclones, FBC Cyclones, and Dedust Cyclones, are discharged on the Recycle Conveyor.

The on-size solids are cooled and coated before being sent to the storage, while the oversize granules are crushed, mixed with the undersize particles and recycled to the granulator.

### Ammonia recovery

The neutralization of phosphoric acid leads to some losses of ammonia, the amount depending of the specific NPK formulation being manufactured.

Unreacted ammonia from the pipe reactor together with the steam discharged from the same are entrained by a stream of air and sent to a proprietary design multiventuri scrubber which recovers all the ammonia.

Those gases are finally sent to a Drier scrubber before being exhausted to the atmosphere.

### Acid preparations section

Fresh phosphoric acid is sent to Scrubber Circulation Tank. The Scrubber Pumps send the scrubber liquor to the Granulator and Drier Scrubber.

In the Granulator Scrubber the acid fixes most of ammonia lost from the Granulator. The scrubber liquor results partially neutralized and falls by gravity into the Scrubber Circulation Tank.

In the Drier Scrubber the acid fixes the ammonia evolved in the Drier and also dissolves the dust of NPK entrained from the Drier Cyclones. The acid is pumped to the Scrubber Circulation Tank where it is mixed with the acid coming from the Granulator Scrubber.

### Raw Materials Consumptions

The efficiency of recovery of solid raw materials, measured as stack losses is as high as 99.5% while the recovery of ammonia and phosphoric acid reaches values of 99.0%.

### Typical utilities consumption (per metric ton of NPK)

Electricity	30	kWh
Coating oil	5	kg

### PROCESS FLOW DIAGRAM

