

14. Complex fertilizers – manufacturing ammonium phosphates – nitrophosphates and NPK complexes

COMPLEX FERTILIZERS

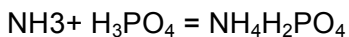
Complex fertilizers is defined as a material containing all three primary, nutrients (N,P and K) and it is also designated as complete complex fertilizers while a fertilizer material containing one or two of the primary nutrient elements (N and P or P and K etc) are known as incomplete complex fertilizers. They are produced by a process of chemical reaction. Most important complex fertilizers are Nitro phosphates & polyphosphate based fertilizers etc

Nitro phosphates

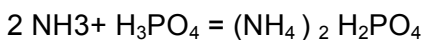
It is a granular fertilizer containing stabilizer which prevents reversion of citrate soluble phosphates to insoluble phosphate. Being granulated it maintains excellent physical condition during storage and handling. Nitrophosphate contains nitrogen and phosphorus in different proportions depending upon the process of manufacture. It also contains easily soluble and readily available $\text{NO}_3\text{-N}$ as well as $\text{NH}_4\text{-N}$. Phosphorus is also present as water soluble as well as citrate soluble forms. All nitrophosphates have less acidic effect on soil compared to other fertilizers.

Ammonium Phosphate

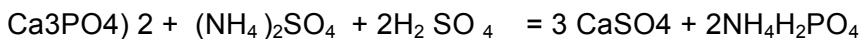
Ammonium phosphate is an incomplete complex fertilizer and both monoammonium and diammonium phosphates are manufactured by the combination of ammonia with H_3PO_4 and also by treating with rock phosphate with H_2SO_4 and $(\text{NH}_4)_2\text{SO}_4$ as follows:



(Mono-ammonium phosphate)



(Diammonium phosphate)



(Rock phosphate)

The resulting solution contains both nitrogen and phosphorus. The liquid is turned into a granular product in the granulator. The granular product is dried and screened. Product that is too small or too large is recycled to the granulator.

In India, different types of nitrophosphates are manufactured with different chemical reactions and mixing process by different fertilizer company. They marketed the complex fertilizers as their different grades and commercial names. Most important grades of nitrophosphate is 20: 20 : 0 and it means that nitrophosphate contains 20 percent nitrogen. 20 per cent phosphorus and no potassium. Besides these there are various other commercially produced complex fertilizers such as of different grades e.g. 15: 15 : 15: 20: 20 : 20 etc.

Polyphosphate based fertilizers

Ammonium polyphosphate. potassium polyphosphate. zincated poly phosphates etc. are the most popular complex fertilizers that have been recently developed.

Ammonium polyphosphate

It is a complex fertilizer. Although it contains N and P but it contains chiefly phosphorus because polyphosphate is a compound derived from the condensation of two or more phosphoric acids.

Ammonium polyphosphates may be granular and liquid. Different grades of polyphosphates are marketed like 15-62-0; 12-53-0, 15-60-0; etc. as solid or granular and 10-54-0, 11-37-0 as liquid. In addition to these there are Sulphated and Zincated ammonium polyphosphates which are also available in the market to supply secondary and micronutrient to the plant along with nitrogen and phosphorus. So the polyphosphate based different micronutrient fertilizers which acts as slow-release micronutrient are going to be developed recently.

Zincated polyphosphates can also be manufactured with the rock-phosphate containing Zn and polyphosphates and that is also soluble in water and available to plants.

A potassium polyphosphate solution of grade 0-26-26 was produced and this was made by reacting superphosphoric acid and potassium hydroxide and contained a mixture of ortho- pyro- and higher polyphosphates. Solid potassium polyphosphates of grades 0-42-42 to 0-47-47 are also available

When polyphosphatic fertilizers are applied to soils, these are hydrolysed step by step either chemically or biologically to form orthophosphate.

Diammonium phosphate (DAP) (chemical formula $(\text{NH}_4)_2\text{HPO}_4$)

It is one of a series of water-soluble ammonium phosphate salts which can be produced when ammonia reacts with phosphoric acid. DAP is used as a fertilizer and a fire retardant. When applied as plant food, it temporarily increases the soil pH (more basic), but over a long term the treated ground becomes more acidic than before upon nitrification of the ammonium. It is incompatible with alkaline chemicals because its ammonium ion is more likely to convert to ammonia in a high-pH environment.

Product containing diammonium phosphate as essential ingredient with small amount of mono ammonium phosphate

Total nitrogen: x (18-21)%

P₂O₅ soluble in neutral ammonium citrate and water: y (45-53)%