

CH1019 Chemical Process Technology

Lecture 4b

Chapter 3 Fertilizer Industries

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Overview of topics

Chapter 3 FERTILIZER INDUSTRIES

- 1 Nitrogen industries
- 2 Phosphorous industries
- 3 Potassium industries



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Fertilizer industries – Phosphorous

Phosphorous in elemental form and in its many products is derived from commercial deposits of phosphate rock in the mineral form Fluorapatite $[\text{Ca}_{10}(\text{PO}_4)_6\text{F}_2]$.



Fertilizer industries – Phosphorous

Major products of phosphate industry are:

- Phosphorous
- Phosphoric acid
- Ammonium phosphate
- Nitrophosphate
- Calcium phosphate
- Sodium phosphate
- Triple superphosphate



Fertilizer industries – Phosphorous

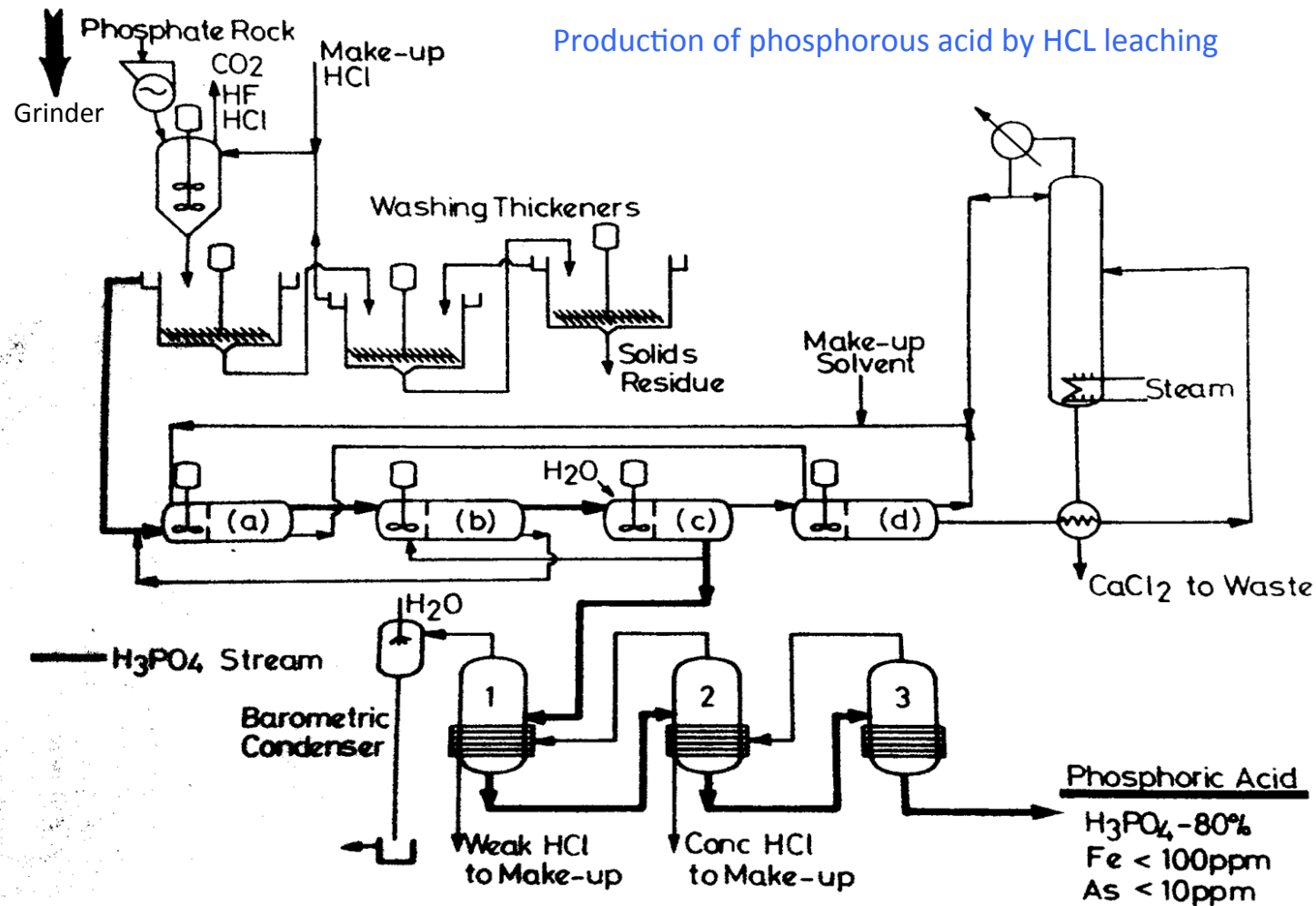
Phosphorous content of rock is expressed as percentage P_2O_5

Manufacturing methods:

- Production of elemental phosphorous, phosphorous pentoxide, and phosphoric acid by electric furnace method.
- Production of phosphoric acid and chemical fertilizer from phosphate rock by strong acid process.
- Production of phosphorous acid by HCL leaching

Fertilizer industries – Phosphorous

Phosphorous content of rock is expressed as percentage P_2O_5





Fertilizer industries – Phosphorous

Major steps in the process

- Grinding the phosphate rock
- Dissolving powdered phosphate rock in HCl
- Removal (or washing) of fumes of CO_2 , HF and HCl in series of mixer/thickener.
- Extraction of H_3PO_4 and recovery of HCl in series of evaporators (Multiple effect evaporators)
- Concentration of H_3PO_4
- Removal of CaCl_2 as waste after extraction



Fertilizer industries – Phosphorous

Manufacture of Superphosphate and Triple super phosphate

Super phosphate – made by reacting phosphate rock with sulfuric acid

Triple super phosphate - made by reacting phosphate rock with phosphoric acid.

The phosphorus content of triple superphosphate (17 - 23% P; 44 to 52% P_2O_5) is therefore greater than that of superphosphate (7 - 9.5% P; 16 to 22% P_2O_5). It is produced in granular and nongranular form and is used both in fertilizer blends (with potassium and nitrogen fertilizers) and by itself.



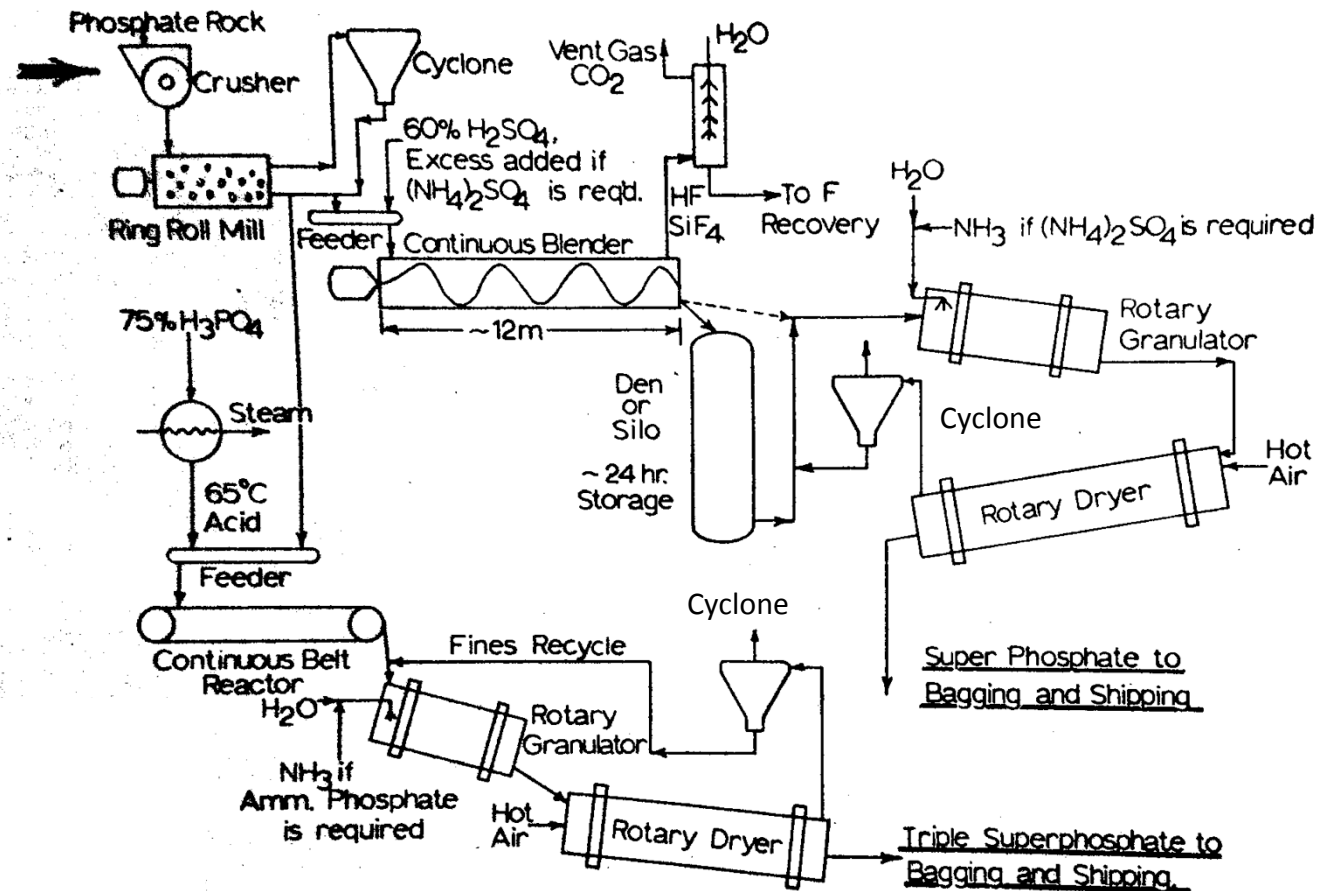
Fertilizer industries – Phosphorous

Manufacture of Superphosphate and Triple super phosphate

A major use of TSP is in situations where several solid fertilizers are blended together for broadcasting on the soil surface or for application in a concentrated band beneath the surface. It is also desirable for fertilization of leguminous crops, such as alfalfa or beans, where no additional N fertilization is needed to supplement biological N fixation.

Fertilizer industries – Phosphorous

Manufacture of Superphosphate and Triple super phosphate





Sulfur Industries

References

1. Dryden C. E, *Outlines of Chemical technology – for the 21st Century*, 3rd edition, East-West Press (2004)
2. Austin G. T, *Shreve's Chemical Process Industries*, 5th edition, Mc Graw Hill International editions (1984)