

# Hydrometallurgy to solve phosphate processing

The phosphate fertiliser industry is at present based mainly on the use of sulphuric acid. The problems of this technology are the following:

- generation of large amounts of radioactive gypsum that represents a storage and environmental problems.
- the use of expensive reactors for acidification that necessitates the frequent replacing the damaged agitators.
- extensive material handling problems, and in the case of Florida, large losses of  $P_2O_5$  values in the circuit.

Applying hydrometallurgical techniques to phosphate processing could solve these problems. For example, using in situ, heap, or vat leaching solves the problem of the reactor, but nitric acid must be used in this case instead of sulphuric. It is more expensive but this solves the disposal problem due to gypsum. The acid concentration must be 20%  $HNO_3$  so that the leach solution is monocalcium phosphate and calcium nitrate [4]:



Instead of evaporating the leach solution of monocalcium phosphate, limestone is added to precipitate finely divided dicalcium phosphate:



The product (40%  $P_2O_5$ ) is insoluble in water but soluble in citric acid and is an excellent fertiliser. Because it is neutral it can be mixed with other nitrogen containing fertilisers. An option also exists: instead of filtering off the dicalcium phosphate, the slurry is evaporated under

vacuum to produce dicalcium phosphate - calcium nitrate fertiliser mixture.

In this technology, less nitric acid is used as compared with the nitrophosphate process which is based on the following reactions:



After crystallising a portion of calcium nitrate, the solution is then treated with ammonia:



Under the mild leaching conditions used in this process, HF in solution reacts with silica to form fluosilicic acid:



which can be recovered from the leach solution by precipitation with sodium nitrate to form sodium hexafluorosilicate:



Dicalcium phosphate produced by this process can be used also as animal feed.

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