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The reuse of Phosphorus

1 Background

Phosphorus is one of the major macronutrients, fundamental to essential processes in all living cells, and as a component of DNA. Although being the 11th most abundant element in the earth's crust, continued exploitation rate of phosphorus, for fertilizer or other industrial purposes, is not fully in accord with the principles of sustainability. This is due both to the decline in quality and reduced accessibility. The global fertilizer market accounts for approximately 80% of all phosphate rock production.

2 Available resources

Estimates of world phosphate reserves and availability of exploitable deposits vary greatly and assessments of how long it will take until these reserves are exhausted also vary considerably. Furthermore, it is commonly recognized that the high quality reserves are being depleted expeditiously and that the prevailing management of phosphate, a finite non-renewable source, is not fully in accord with the principles of sustainability. A 50% population increase over the next 50 years would point towards an increase in global food needs by at least a proportionate figure, assuming roughly constant per capita cereal consumption. As demand for food increases, this may result in bringing into agricultural use more land, but certainly will bring a requirement for increased yields, thus increasing fertilizer demand. Hence, agricultural phosphate use may increase faster than world population.

3 Lifetime of reserves

Depletion of current economically exploitable reserves are estimated at somewhere from 60 to 130 years. Using the median reserves estimates and under reasonable predictions, it appears that phosphate reserves would last for at least 100+ years. Increasing demand and increasing prices will make more reserves economically exploitable.

4 Other sources of phosphorus

All organic waste contains amounts of phosphorus, with animal manure being the most important. Animal excreta in Western Europe are estimated to contain yearly around 1,600,000 t P. The sewage sludge resulting from the treatment of wastewater contains nutrients and organic matter. With a full implementation of the UWWTD, the European Commission expects total amounts in 2005 of at least 9.4 million tons of dry solids every

year within the EU. The potential total phosphorus from sludge could amount to about 300.000 tons of P/A. The annual P consumption in the EU derived from phosphate rock is about 1,340,000 t/a as phosphatic mineral fertilizers, 250,000 t/a as animal feed supplements and 110,000 t/a for the manufacturing of detergents. Current policy within the EU is to promote the recycling of this resource. Several studies support recycling as the most sustainable route for the use of this resource. Sludge utilization in agriculture is regarded a safe and energy-efficient way to ensure phosphorus reuse. New, advanced techniques, where phosphorus is extracted from sludge prior to incineration, or extracted from ashes produced from incineration, have so far shown to be very energy-demanding, and have not yet proven to be political or economical feasible.

5 Conclusion

In order to reduce the depletion of global phosphorus reserves, focus should be on more effective exploitation of phosphates, especially in commercial fertilizers. In addition, a more efficient recycling of phosphates should be encouraged, concerning phosphorus present in animal excreta, in wastes from abattoirs (chemically treated bone), wastes and phosphorus in sewage sludge. New techniques for extracting phosphates from sewage sludge have not yet proven to be political or economical feasible.

Sources: I. Steen, Kemira Agro, in Phosphorus and Potassium, Issue no: 217, 1998 Proceedings from JRC Workshop on problems around sludge, Stresa 1999. T.D. Evans and A.E. Johnston in E. Valsami-Jones (ed.), Phosphorus in environmental technologies, IWA Publishing 2004 Eureau page 2 of 2 21/02/2005