

Sustainable recovery and reuse of phosphorus

Why recycle and reuse?

Phosphorus is one of the vital building blocks for life, as it is an essential nutrient for plants, animals and humans. There is no substitute for phosphorus and in its natural form it only exists as phosphate rock. Local supplies of phosphorus rock in Europe is almost non-existent, therefore approximately 95% is imported, mainly from Morocco and Russia, where it is extracted by mining.

Phosphate rock is finite and non-renewable and was added in May 2014 by the European Commission to the revised list of critical raw materials. At the same time, phosphorus is also wasted e.g. through runoff from agricultural land to waterways and inadequate capture from water treatment since not all wastewater treatment plants fulfil the EU phosphorus removal requirements.

INCOPA does support incentives for sustainable recycle and reuse of phosphorus from sewage and waste water treatment.

Sludge – a valuable resource

To be able to recycle phosphorus it is necessary to remove it as much as possible from waste water and then recover it from the sludge. Approximately 30 different processes to separate and concentrate phosphorus are under development. Their performance, applicability and economy still have to be scrutinized in detail. Nevertheless, the current costs of recycling phosphorus, possibly with the exception of sludge spread directly on fields, are higher than using rock phosphate.

Irrespective of whether sludge is recycled directly or after an upgrading process, it is essential to avoid that pathogens and toxic elements end up in agriculture. It must also be of a comparable quality to mineral fertilisers.

The recovery of phosphorus should be encouraged and we support the development of processes that can use wastewater sludge for phosphorus recycling. Full implementation of the wastewater directive and the sludge directive would enable more phosphorus to be captured and recovered, resulting in an improved water environment and more phosphorus available for recycling.

To encourage increased reuse, there is also a need to apply appropriate quality standards for sludge and biodegradable waste to ensure commercial acceptance and generate confidence in the product.

Coagulants – a sustainable solution

Coagulants consist of iron or aluminium salts and have been used for more than hundred years to treat water. Today they are the most frequently used chemical in water treatment. Coagulants are traditionally used to remove impurities which give the water colour, taste and smell. Today, they are also used in many wastewater plants as a highly effective and cost-efficient solution to capture and remove phosphorus from wastewater.

The environmental impact of the coagulant production has been quantified in a recent LCA study performed by Karlsruhe Institute. The mean carbon footprint value for coagulants is extremely low (0.106 kg CO₂-eq/mole Fe₃₊ or Al₃₊). Most coagulants are produced using by-products from other industrial processes thereby optimising resource efficiency, creating environmental benefit and avoiding potential waste generation.

The removal of phosphorus from wastewater is an essential stage of the recovery process and that the recovered phosphorus is in a form that can be reused. It has been suggested that the low solubility of phosphorus complexes formed with coagulants can restrict the availability to plants. We would like to challenge this and emphasise that instead such complexes may offer the ideal scenario: a slow phosphorus release material which could supply the necessary plant nutrient whilst avoiding excessive losses and resultant eutrophication problems.^{1, 2, 3, 4}

In conclusion, coagulants represent a sustainable wastewater treatment solution and an efficient phosphorus removal option which can help secure Europe's supply of phosphorus by operating as an essential part of the recovery schemes.

INCOPA (the European Inorganic Coagulants Producers Association) is a Sector Group of Cefic, the European Chemical Industry Council. INCOPA's membership includes 31 producers of inorganic coagulants with about 80 production units representing more than 85% of the European production capacity. The member companies produce either aluminium or iron salts which are used for water treatment, paper manufacturing, in the cement industry and fertiliser production. The carbon footprint of the industry is very low. One reason is that the raw materials used in coagulant manufacturing are generally recycled materials from other industries.

For further information:

INCOPA Secretariat

C Andersson (e-mail: can@cefic.be; Tel +32 2 676 7248)

¹ Phosphorus in Manure and Sewage Sludge More Recyclable than in Soluble Inorganic Fertilizer, H. Kahiluoto, M. Kuisma, E. Ketoja, T. Salo, and J. Heikkinen, January 2015.

² The effectiveness of different precipitated phosphates as sources of phosphorus for plants, Report on work undertaken for CEEP, EFMA Anglian Water UK, Thames Water UK and Berlin Wasser Betriebe, I R Richards and A E Johnston, December 2001

³ Phytoavailability of Biosolids Phosphorus; G. A. O'Connor, * D. Sarkar, S. R. Brinton, H. A. Elliott, and F. G. Martin Published in J. Environ. Qual. 33:703-712 (2004).

⁴ Plant-availability of iron phosphate recovered from one chemically precipitated sewage sludge. Kvarnström, E., C. Morel and A. Guivarch (2001), Second International Conference of Phosphate from Sewage Sludge and Animal Wastes, Noordwijkerhout, Holland, March 12-14 2001.