



**Phosphorus recovery from sewage sludge
Implications of incineration and enrichment potential of produced ashes**

av

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Abstract

Sewage sludge is a promising source for phosphorus recovery, but it also contains contaminants (organics, metals) which must be removed. The most commonly used practice is incineration, where organic contaminants are decomposed. This treatment entirely alters the chemical profile of the material, and information regarding this transformation is crucial for development of durable handling and recovery processes. The aims of this project were to; ¹study the chemical speciation of phosphorus and metals in sewage sludge and their ashes after incineration; ²evaluate the impact of iron and aluminium on the phosphorus redistribution following incineration, and ³investigate the potential for sewage sludge ashes to function as sorbents for phosphorus and metals. Sludge and ashes from 10 municipal wastewater treatment plants in Sweden were sampled and characterized for their elemental composition, mineral components, leachability and chemical speciation. Major elements were Fe and Al (added in the wastewater treatment process), Ca, Mg, Na and K. Phosphorus was predominantly associated with aluminium and iron in the sludge, but after incineration there was a shift to calcium associated species, which is preferred for phosphorus recovery. This alteration was hampered by high concentrations of aluminium, why its concentration should be kept at a minimum. The incineration caused changes in speciation, where more ordered mineral phases were created, hematite being the major component. The ashes were successfully used as sorbents for both metals and phosphorus. Adsorption isotherms and inter particle-diffusion modelling indicated that the sorption takes place in two stages, where the first is a rapid process on the surfaces, while the second is slower and includes interactions with the pores of the material.

Keywords: Wastewater, sewage sludge, ashes, phosphorus, metal, speciation, adsorption, recovery, sustainability