Electrodialytic recovery of phosphorus from chemically precipitated sewage sludge ashes

Parés Viader, Raimon; Jensen, Pernille Erland; Ottosen, Lisbeth M.; Ahrenfeldt, Jesper; Hauggaard-Nielsen, Henrik

Publication date: 2016

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Aim: Phosphorus

- Phosphorous is a limited resource and an essential nutrient.
- Phosphate rock (P-rock) reserves are foreseen to be depleted in 300-400 years [1].
- In the last decade, the EU imported around 90% of the P-rock that it consumed (IFA).
- In the EU there is a flow of 182,000 t of non-recycled P yearly in sewage sludge, around 20% of the EU P-rock consumption (Van Dijk et al. (submitted)).
- A common practice in some countries (AT, BE, CH, DE, DK, NL, US, JP, HK) is incineration of sewage sludge. In recent years, gasification has gained attention.

Electrodialysis: a technology to recover P from sewage sludge ashes

- A patent has been filed from DTU (WO 2015/032903) for the 2-compartment Electrodialytic (ED) cell.

![Electrodialytic cell diagram](image1)

- With this setup (Figure 1), it is possible to recover up to 90% of P from incineration sewage sludge ashes, in the anolyte liquid with low content in heavy metals (Cd, Cr, Cu, Ni, Pb, Zn) [2].
- Only 26% of P was recovered with the same setup at the same conditions (liquid-to-solid ratio, current density and experimental time) with gasification sewage sludge ashes [3]. Most likely, due to the presence of Fe-P bindings (Figure 2). Poor results were previously observed for ashes with high Al content [4].
- Up to 70% of P was eventually recovered for the same ashes with an innovative ED setup. The recovered P-liquid has a content in heavy metals comparable to the one of wet phosphoric acid (Figure 3). The new setup is currently being drafted for a patent filing.
- Further work will focus on sewage sludge ashes containing both high content of both Fe and Al.

Low-temperature gasification technology

- Due to the low temperature it is possible to use high alkaline fuels. Examples: straw, sewage sludge, etc.
- The resulting ashes, might have a high content in heavy metals or have a poor P-plant availability.

Figure 1. Two-compartment ED cell

Figure 2. Solubility of Al-P, Ca-P and Fe-P compounds

Figure 3. Heavy metal to P ratio of the ash, anolyte liquid (final product) and wet phosphoric acid

Figure 4. Different sewage sludge ashes

References


*Corresponding author. Tel.: + 45 45 25 21 63 E-mail address: rapv@byg.dtu.dk