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Transforming ash to resources by electrodialytic separation – Sewage sludge ash as an example

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Ashes from incineration are often considered as residual waste, i.e. waste which is removed from the overall material cycle. The ashes should instead be considered as secondary resources; however, to recover the resources it is necessary to develop separation technologies. This work focuses on one such technology, namely electrodialytic separation. In this technology, the ash is suspended in water and an electric DC field is applied. Hereby ions are transported towards the electrode of opposite polarity. During treatment, pH and redox conditions are optimized for desorption of target elements, and ion exchange membranes are used to separate unwanted ions from the suspension. This work gives an example of electrodialytic separation of sewage sludge ash. A two-compartment electrodialytic cell was used, where the anode was placed directly in the ash suspension and the cathode in a second compartment, separated from the suspension by a cation exchange membrane. Electrodialytic separation simultaneously desorbed phosphorous and heavy metals into the liquid phase of the suspension. The desorbed heavy metals were transported into the cathode compartment in the applied field. Phosphorous rich crystals were produced (about 25 wt.% P) by evaporation of the filtrate. The ratio of heavy metals to phosphorous in the crystals was comparable to the very low end in phosphorous fertilizers at the market today. The mineral fraction of the SSA after recovery of phosphorous was tested as cement replacement in concrete. The resulting concrete had an interesting aesthetical expression because of a warm red colour, and the material properties were highly encouraging.

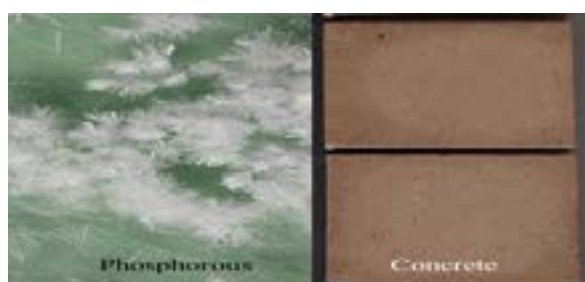


Figure 1: Phosphorous rich crystals and concrete produced with the treated ash

Recent Publications

1. Ottosen L M, Jensen P E and Kirkelund G M (2016) Phosphorous recovery from sewage sludge ash suspended in water in a two-compartment electrodialytic cell. *Waste Management* 51:142-148.
2. Kappel A, Viader R P, Kowalski K P, Kirkelund G M and Ottosen L M (2018) Utilization of electrodialytically treated sewage sludge ash in mortar. *Waste and Biomass Valorization* DOI: 10.1007/s12649-018-0215-z.

Biography

Ottosen L M has MSc and PhD degrees from the Technical University of Denmark. She has more than 140 Web of Science journal papers. She is leading the research group ZeroWaste Byg. She is a Section Leader of the Section for Construction Materials and Durability at Department of Civil Engineering, Technical University of Denmark.

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