Bio-electrochemically assisted recovery of nutrients from urine

Sub-department of Environmental Technology

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Motivation

There is a need for fertilizers in agriculture to ensure sufficient food production. These fertilizers are mainly made from phosphorous (P) and ammonia (NH_3). P is limited and scarce and NH_3 comes from energy-intensive processes, such as the Haber-Bosch process.

Urine is a potential source of the nutrients. It contributes to 80% of the nitrogen (N) and 50% of the P load in conventional domestic wastewater. Its high N and P concentration compared to normal sewer water enables a more effective and energy efficient recovery. Additionally, the nutrient load to the wastewater treatment plants is lowered and the water consumption reduced by the use of separation toilets or water free urinals.

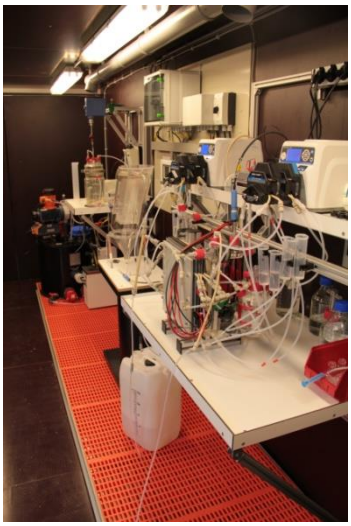

Fig.1 *Pilot*

Technological challenge

The aim is to develop, demonstrate and evaluate an innovative and energy-efficient bio-electrochemical system (BES) that allows for the recovery of valuable nutrients (P and NH_3) from urine while producing chemicals (NaOH, KOH) and, electricity or hydrogen (H_2) (Fig. 2 and 3).

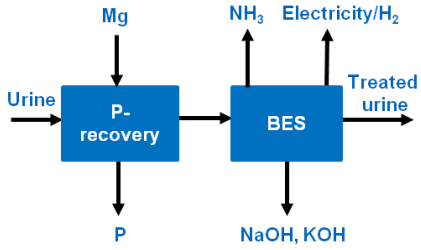

Fig.2 *General process scheme. P is recovered via struvite precipitation.*

The process must be optimized and the material costs lowered in order to make it more economically attractive. For that reason, the research involves:

- Optimization of coulombic efficiency and current density of the anode; NH_3 and alkaline recovery of the cathode
- Testing different configurations of cell stacks to decrease start-up and operation problems and increase current density

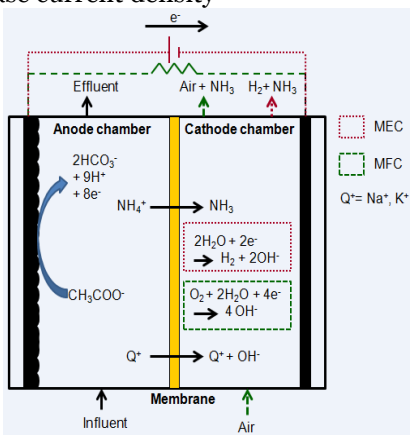

Fig.3 *Working principle of two different BES: microbial fuel cell (MFC) and microbial electrolysis cell (MEC). Biological oxidation of organics drives transport of cations through the membrane.*

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SEVENTH FRAMEWORK PROGRAMME

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