# Optimization and upscaling of electrochemical ammonia recovery

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## Motivation

The intensive use of fertilizers in EU regions is degrading sensitive water bodies. When these nutrients make their way into rivers, they considerably disturb aquatic ecosystems. Recycling the reactive nitrogen could reduce the energy needed to both produce fertilizers and dispose of nutrients, cutting greenhouse gas emissions on both ends of their production chain.

Electrochemical systems (ES) can be the new solution for this nitrogen issue, as they are capable to both remove and recover nitrogen. Earlier results using ES to treat urine showed an effluent with a lowered TAN (total ammonia nitrogen) concentration and a product with potential use as a fertilizer (ammonium sulphate).

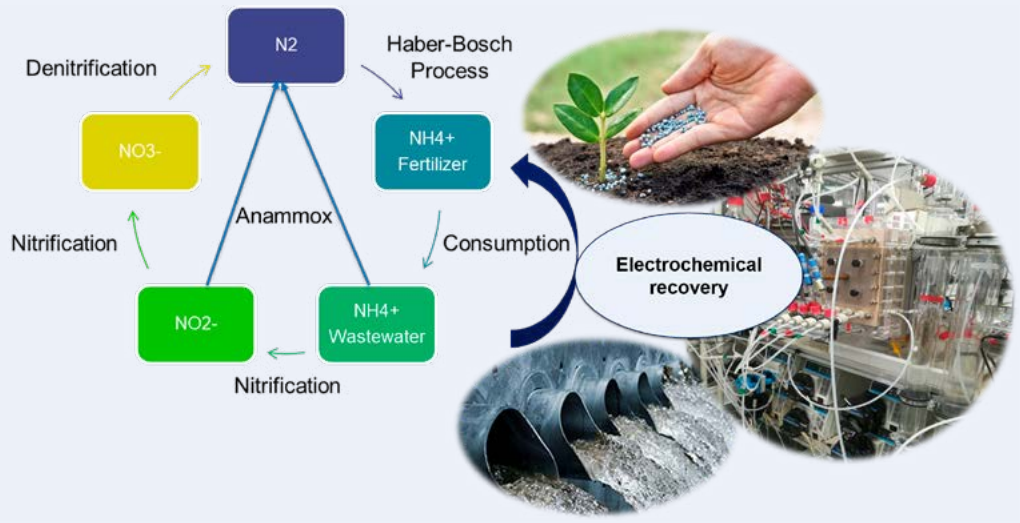


*Fig 3. Electrochemical recovery, a new alternative in the Nitrogen cycle.*

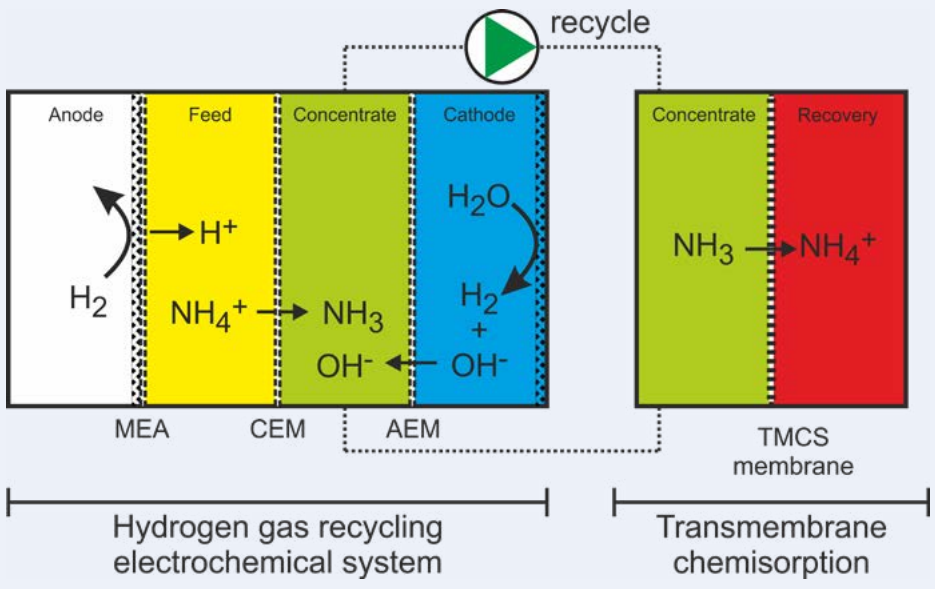


*Fig 1. Scheme of the up-scaled electrochemical system for TAN recovery.*[1]

## Technological challenge

This project aims to improve and **scale-up** an electrochemical system for TAN recovery using different **real wastewater streams** (source separated urine, digester effluent, etc.) in a **multiple stacked** cell system.

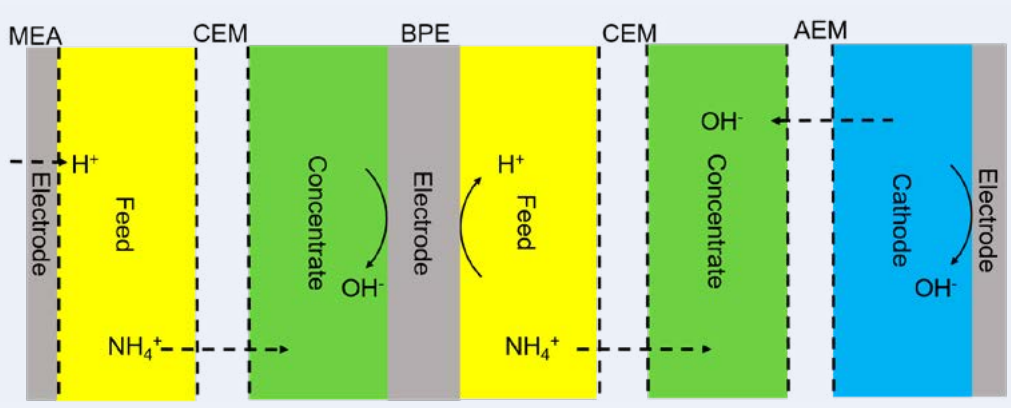


*Fig 2. Principle of operation of an up-scaled electrochemical system using a bipolar configuration (BPE – Bipolar eletrode) for TAN recovery.*

## Research goals

The process will be optimized to a simple and compact system, capable to treat a significant volume of influent and to achieve high TAN recovery at low energy input. We propose the following work packages:

- Demonstrate a novel technique to extract ammonium.
- Study the Donnan dialysis effect on the performance of the system.
- Up-scale an ES by integrating multiple cell pairs with a bipolar configuration (Figure 2).
- Investigate wastewaters with different N concentration
- Mathematical modelling of the ammonia recovery system.

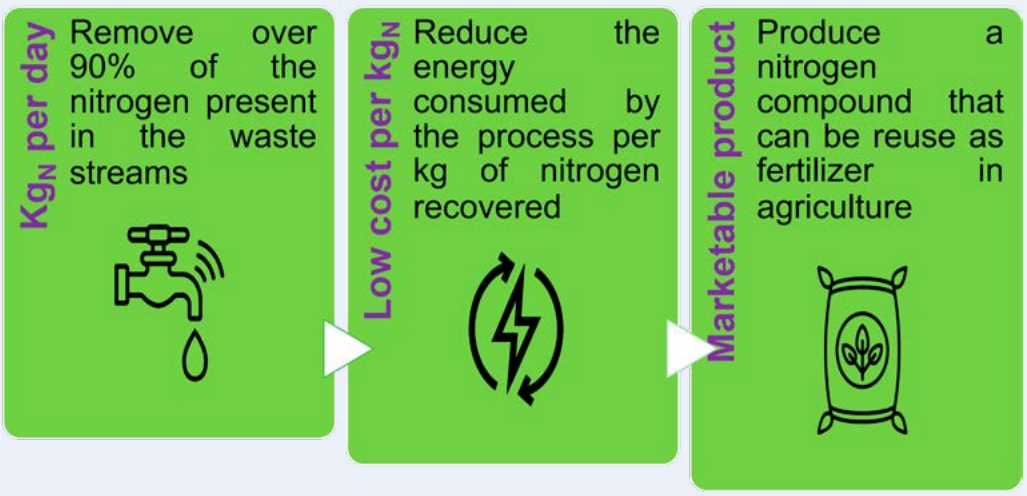


*Fig 4. New Challenges for ES.*

[1] P. Kuntke et. al, Journal ACS Sustainable Chemistry & Engineering (2018) 7638-7644.

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