NovEED
GA-No. 606304 (FP7-SME-2013)
Nov. 2013 – Oct. 2015
http://www.noveed.eu

Summary description of the project context and the main objectives

Electrodialysis (ED) is an electrochemical membrane process technology which is used especially for desalination of sea or brackish water, e.g. for drinking water supply. In this case, the salt ions of the inlet stream (seawater or brackish water) are separated by an applied electric field and using cation and anion exchange membranes. The main target of this application is to remove the salt from the inlet stream, while the concentrate and by-products are not important and usually disposed.
Using bipolar membranes (BPM) membranes in ED stacks enables not only desalination, but also the efficient transformation of salts into their respective acids and bases.
The required H+ and OH- ions for the acid and base production are provided by water splitting at the bipolar membranes. One current disadvantage of recovery of acids and bases by electrodialysis apart from the relatively high membrane costs is the high energy consumption of the process.
Target of this project was a significant reduction of the energy consumption of ED to make more applications economically feasible. This target was achieved by development and demonstration of novel electrode configurations and materials: The anode and cathode typically produce oxygen and hydrogen respectively and therefore typically require a total additional voltage of around 1.8 V to 2 V to drive the reactions. With the NovEED electrode concept this voltage loss can be significantly reduced.

The NovEED concept was realized for two different applications:

a) Salt splitting (alkaline electrode rinse solutions)
b) Acid recovery from metal processing solutions (acidic electrode rinse solutions)

The project achieved:

- Development of suitable low cost catalysts for the novel electrodes: For the salt splitting applications, non-noble metal catalysts can be used. During the project, several commercially available and home-made catalysts were developed and tested in half-cell measurements.
- Laboratory confirmation of suitable low cost catalysts for the novel electrodes.The catalysts were embedded into porous carbon layers for electrodes with high surface to volume ratio. The electrodes enabled significant reduction of the overpotentials of the electrode reactions.
- Implementation of this electrode concepts in laboratory demonstrators
- Laboratory validation with synthetic and real sample solutions. Industrially relevant experiments with real process solutions were performed. Different ion exchange membranes were tested. The test runs validated the acid recovery from process solutions

- Design and build of prototype equipment of these processes
- Confirmation of the complete ED process with real process solutions

The project partners acquired:

- A process model based on Comsol simulation allowing future adaptation to new process waters.The electrodialysis process including electrodes and membranes was modelled. The work performed can be used to evaluate the electric field and ion concentration profiles as well as the fluid flow distributions in real reactors.
- Expertise in electrode and catalyst fabrication and characterization
- Industrial design specifications
- Economic benchmarking on several application processes based on own measurements

The potential application of the NovEED technology is not just limited to the mining and electroplating industry. It has wider potential in all processes in which a process stream or wastewater stream is partially or completely neutralised.

Coordinator contact:
Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB
Christiane Chaumette
Nobelstr. 12, 70569 Stuttgart
Tel.: +49 711 970 4131
christiane.chaumette@igb.fraunhofer.de