

## **Master thesis**

<Student>

### **Investigation of Electro Dialysis Membrane as in-situ separation step in carbon acid fermentative processes**

#### Background:

Fermentative process concepts face several challenges during process development. On the level of technical feasibility, the bioreaction and product separation / purification steps often are the main challenges. For the reaction step, development of the biologic system and its reactor environment are typically key to a feasible synthesis pathway. In the subsequent separation and purification steps, it's an economic challenge for bulk chemical fermentations to achieve marketable product quality. In this thesis, the characterization of a separation for recovery of carbon acids as fermentative products from fermentation broth is considered.

An electro dialysis membrane unit applies an electric field, affecting the fermentation broth flow-through membrane chamber. The membrane (IEX) is permeable for ions – including dissociated carbon acids. Being dragged by the electric field through the membrane, a permeate flow withdraws the separated ions from the unit through the second chamber. Such mechanism seems promising to act as in-situ product removing step in carbon acid fermentations with endotoxic limitations.

#### Scheduled tasks:

Understanding the functionality and characteristics of a process step are key for a proper application in a process concept and subsequent development of the process step towards industrialisation. The unit "Electro Dialysis Membrane" system available at IKFT should be described and characterised by membrane properties, relevant membrane gradients and application limitations in a fermentative context. For such, suitable fermentation broth surrogate mixtures are to define and to use. Relevant parameters for are the current density, pH, osmotic and concentration gradient, conductivity of both compartments and membrane properties. Before, the state of the art is identified by a literature review providing reference values for main parameters and allow the definition of key performance indicators. Based on the findings, the applicability of the method for in-situ fermentative product recovery is evaluated.

Consequently, concepts for application in processes should be discussed.

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