

# Processing of Hydrothermal Liquefaction (HTL) products with membrane technologies

**Problem:** Hydrothermal liquefaction of sewage sludge leads to the production of bio crude oil as well as solid, liquid and gaseous byproducts. The liquid phase by product is contaminated with organics and inorganics. Organics shall be recovered while inorganics shall be separated from the treated product before discharge. In additions, separation of the different phases at the product stage of HTL is challenging because of the formation of stable emulsions. Oil-water-solid emulsions shall be processed to recover the whole oil phase in addition to most of the water phase. In order to solve these challenges, innovative engineering solutions are required. Membrane processes represent an innovative alternative to the selective separation of organic and inorganic components in water, as well as the separation of oil from the emulsion.

**Tasks:** The aim of this work is the investigation of the use of various membrane processes (microfiltration, nanofiltration, reverse osmosis, membrane distillation) for the treatment of HTL products. In addition to the measurements of ion retention, retention of organic substances (DOC, org. Molecules), separation of oil from water, permeability and surface layer formation under different conditions (pressure, temperature, pH), the focus is to investigate the influence of the specific mode of operation on the performance of the membranes. Particular attention should be paid to the fouling potential of the investigated process combination and the reduction of energy consumption.

The scope of the assignment can be adapted to a Bachelor's or Master's thesis or a study project as desired.

**Especially suitable for students of the disciplines:** CIW, VT, WaSE

**More Details:** <http://wasserchemie.ebi.kit.edu/>

**Type of work:** Primarily practical

**Beginning:** Immediately, after consultation

**Supervision:** Engler-Bunte-Institute, chair of water chemistry and water technology

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