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Subject Area	Wasseraufbereitung
Project Partner	Norwegian Institute for Water Research

Fouling over the full length of a RO membrane during seawater desalination

Laboratory tests

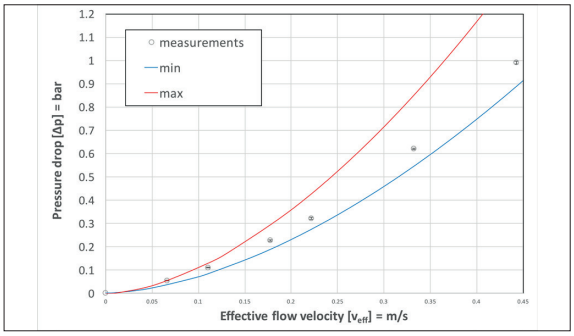

Figure 1: Comparison of theoretical and measured pressure drop over feed spacer (UMTEC, Switzerland)

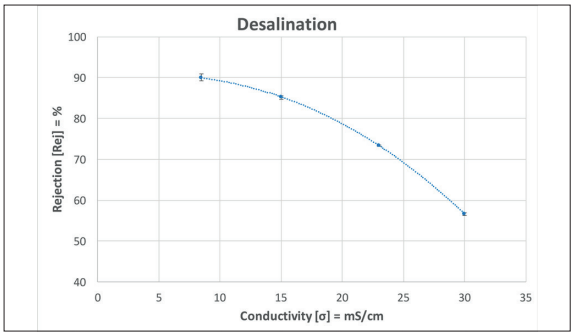

Figure 2: Salt rejection with increasing feed concentration (NIVA, Norway)

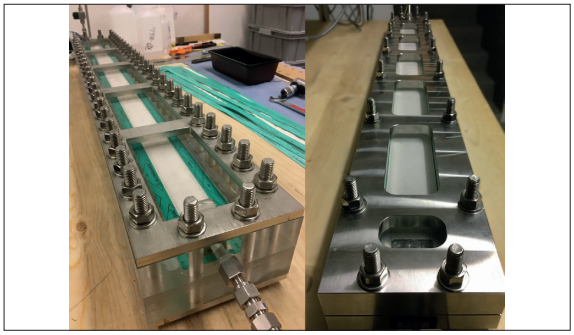

Figure 3: Testing device for membrane fouling at NIVA (left) and at UMTEC (right)

Introduction: The population growth and climate change has resulted in increasing water shortages in many cities around the world. Therefore, a lot of countries use seawater desalination plants to produce drinking water. This has always lead to huge energy consumption and costs. However, for desalination reverse osmosis (RO) membranes were commonly used. One of the main restrictions for membranes is fouling correspondig with limited water flux in the membrane and significant maintenance. Different types of fouling are classified: particle, bacteriological or organic fouling. They all reduce the efficiency of water treatment plants.

Objective: In this bachelor thesis, different experiments on two test rigs were set to get insights to the influence of organics in biofouling. At UMTEC, pressure drop and membrane homogeneity experiments were conducted as well as literature research. This lead to a better understanding of membrane technology and systematic links. At NIVA in Norway, the main objective was to investigate fouling during seawater desalination. Artificial seawater with acetate as nutrient for bacteria and alginate for organic fouling was used as medium. The foulants on the spacer and membrane were analysed and bacteria counted, using flow cytometry. During different experiments, typical membrane operating parameters were logged. After all, the results obtained were compared to the literature research and fundamentals.

Result: As a result of first experiments, improvements on test rig and sensor validations were done. However, the pressure drop of feed spacer was as expected and predicted in theorie. The salt rejection of membrane decreases with increasing salt concentration of feed water. When fouling occurs, pressure must be increased to achieve a constant permeate flow. The volume flows as well as permeability of permeate change over the length due to fouling.