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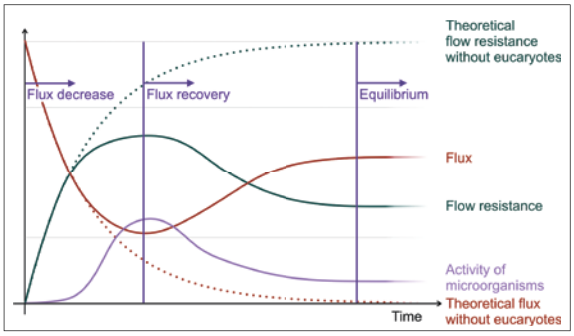
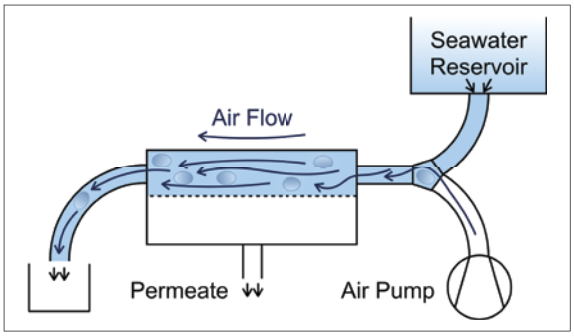
Subject Area	Wasseraufbereitung

Effect of Periodical Flushing on GDM Performance

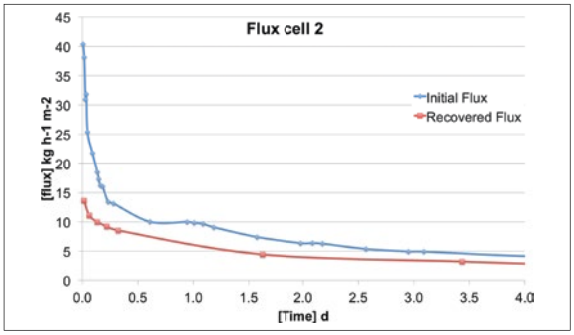
GDM flux control by periodic removing of the biofilm in RO pretreatment



Expected flux development in GDM over time. The more predators are in the biofilm the higher the flux



One example of a flushing process. In this process air is pumped through the filtration cell to increase the sheer force on the biofilm



Flux in a membrane cell at the filtration start and after flushing for 5 min with forward bubbling (schema above)

Introduction: To match the global fresh water need, the total amount of the installed desalination capacity increased over the past 25 years almost exponentially. State of the art is reverse osmosis (RO) technology (~2/3 of the total capacity). Modern RO is close to the thermodynamic limit of the process. Future energy savings at the RO process will be very limited. Thus the pre- and post-treatment of RO water need almost the same amount of energy as the RO process itself (~2 kWh/m^3). UMTEC in collaboration with EAWAG (Swiss Federal Institute of Aquatic Science and Technology) and NEWRI (Environment and Water Research Institute, Singapore) investigate gravity-driven ultra filtration (GDM) as a pretreatment for RO. The low pressure filtration at 40 mbar to 100 mbar is very efficient from the energy perspective, but the flux is much lower compared to conventional filtration (0,5 bar to 10 bar). During filtration a biofilm develops on the membrane surface mainly consisting of particles from the feed water and bacteria (growing and sedimentation). The flux decreases over the first days from ~40 l h-1 m-2 to less than 5 l h-1 m-2. The goal of this thesis is to find out if the long term flux can be improved by a periodical removal of the biofilm.

Proceeding: During the project several different flushing processes were developed and tested in the lab experiment. Six to nine filtration cells were used at the same time in parallel to test 42 flushing procedures. The flux recovery in percentage of the initial flux was measured to compare the different methods and the different attempts.

Result: The decrease of the flux after the flushing was comparable to the decrease at the beginning of the filtration. The highest flux recovery achieved was close to 50 % of the initial flux. Promising was the so-called forced flushing (FF). FF is a process based on flushing the filter surface (Re > 8000) with a high amount of water for 16 s resulting in 42 % flux recovery. Nevertheless, the flushing processes executed did not deliver a long-term recovery. The impact on the predators existing in the biofilm seems to become worse with flushing than without. Interestingly, the biofilm is much very resistant to physical stress by flushing and the start conditions have massive influence to the biofilm formation.