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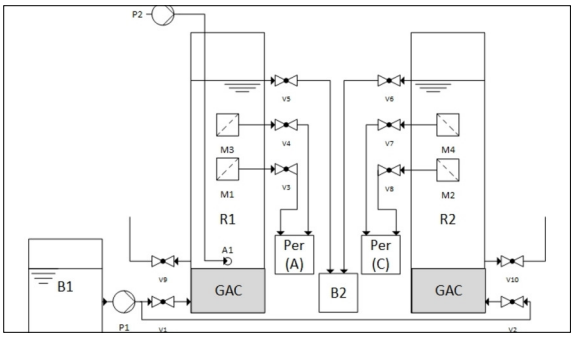
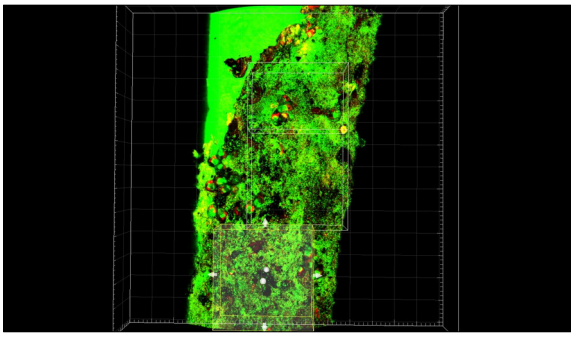
Subject Area	Water treatment

GAC biofilm integrated GDM reactor for municipal wastewater treatment

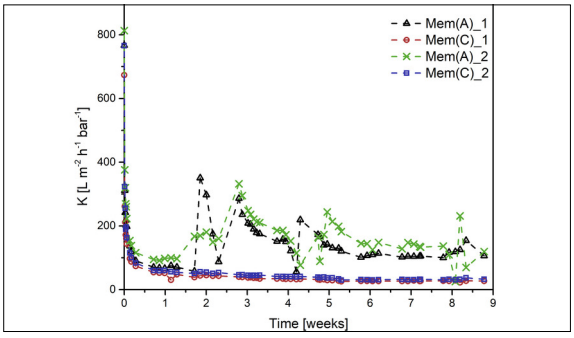
Effect of intermittent aeration cycle



Schematic GDMBR set up
R1: Ceration reactor; R2: Control reactor; MX: Membrane modules; B1: Waste water tank



Biofouling on the membrane's surface



Permeability over 9 weeks
Mem(A): Membrane of aeration reactor; Mem(C): Membrane of

Introduction: In this thesis the influence of an intermitted aeration cycle on a gravity driven membrane bioreactor (GDMBR) process was investigated. GDMBR is a combination of GDM and MBR and could be used for decentralized waste water treatment. Granulated active carbon (GAC) is the biocarrier in the reactors.
Two different GDMBR's set-ups were examined. One the one hand the reactor with intermitted aeration cycle and on the other an control without aearation as a reference reactor. The operation of both two reactors lasted 9 weeks.

Objective: The systems are aerated for two reasons. First, the provided air during the aeration cycle is needed for the conversion of ammonia to nitrate (i.e., nitrification). Second, the shear force derived from the air bubbles could remove the layer cake on the membrane surface. The influence of the aeration on the permeability, DOC removal and total nitrogen (TN) removal was evaluated. Additionally, it was analysed whether the aeration benefits the bacteria activity and population inside the reactor by hte measurement of biological parameters (e.g. building blocks, humics).

Result: The intermitted aeration improved the permeability by four times compared to the con-trol reactor. Main reason for the increase is the removal of the biofilm on the membranes caused by the shear forces provided by the air bubbles.
Aeration benefits the growth of the bacteria population. More bacteria on the GAC layer and inside the reactor increases the DOC removal. The dissolved organic carbon (DOC) removal rate increased by aeration additionally.
Without aeration, almost no nitrification takes place in the reactor. Nitrification is the key process in waste water treatment to remove ammonia. The aeration also increases the removal of TN.
The main energy consumer, besides the pumping of the feed, is the aeration process of the reactors. In further studies, the aeration cycle must be optimised in order to reduce the overall energy consumption. One possibility is to change the on/off rate of the aeration. Another option is to reduce the air flow. The effect on limiting this flow on the permeate quality must be examined in detail.