INVESTIGATION OF ALTERNATIVE PROCESS CONFIGURATIONS FOR BIOFILM-MBR SYSTEMS FOR MUNICIPAL WASTEWATER TREATMENT

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Coupling biofilm reactors with membrane processes as biofilm membrane bioreactors (BF-MBR) is an interesting development as an alternative technology to activated sludge membrane bioreactors (AS-MBR). Biofilm technology for wastewater treatment can provide substantially lower suspended solid environments for membrane filtration compared to activated sludge processes. Potential benefits are; reduced energy consumption for aeration systems (*i.e.* no viscosity / mass-transfer challenges), less membrane clogging problems, lower fouling potentials, ease of membrane cleaning, and new membrane module designs (*i.e.* higher membrane packing densities). This study was aimed to propose and investigate alternative designs and configurations of the BF-MBR process.

To apply biofilm technology with membranes, design of the biofilm reactor should be refined. Alternative and novel biofilm reactor designs have been investigated, for example; a double-deck aerated moving bed biofilm reactor, two-stage aerobic-anaerobic biofilm reactor. The performance and design of the biofilm reactors was aimed to determine TSS control, effluent quality, and enhanced membrane filterability. The biofilm effluent on average had low TSS (typically <50 mg/L), low turbidities and FCOD. Alternative membrane modules and membrane filtration unit designs have been investigated based on low pressure submerged concepts. These include flat sheet systems, tubular and capillary membranes supplied from various manufacturers. Sustainable operation with low fouling rates and low specific aeration demands for air scouring compared to typical values reported for AS-MBR have been achieved.

This paper will summarize findings for alternative process configurations tested and different membrane module systems applied with regard to overall process performance, in particular the membrane unit response and behaviour for the systems tested.