Session: Tools & modelling

Differentiating biofilm growth on spacer and membrane in flat sheet membrane units with optical coherence tomography

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The development of tools for biofilm imaging and quantification allows for a better monitoring of processes in which biofilm plays a crucial role. One of these processes is membrane filtration, where biofouling can cause a severe deterioration of the membrane performance. In this work optical coherence tomography (OCT) was used for *in situ* characterization of the biomass occluding the spacer filled feed channels of flat-sheet membrane units. The setup was run in crossflow mode. The evaluation of the OCT dataset was performed with a house made macro for image analysis. A method for differentiating biofilm formation on the membrane itself and on the spacer using two parameters (ME, for the membrane and SP, for the spacer) was developed. An attempt was made to understand how the occurrence of fouling can affect the process, depending on whether it takes place on the membrane or on the spacer. Pressure drop along the module and flux were measured at constant inlet pressure and then confronted with ME and SP. Results clearly showed that biofilm grew on the spacer at first and on the membrane during the latter stage. This was due to the hydrodynamics and to the higher susceptibility of the spacer material for biological attachment compared to the membrane. During a first phase, pressure drop was promoted by bioaccumulation on the spacer and, later, by accumulation on the membrane. Flux decline was correlated only to fouling on the membrane surface. Interestingly, ME started increasing when SP reached its maximum, indicating that attachment on the membrane only happens when the spacer is saturated with biofilm. Moreover, fouling of the membrane also contributed to the pressure drop increase. The biofilm observed in this study was relatively compact, probably due to the high applied pressure and the high content of calcium in the feed.