Modeling of biofouling in reverse osmosis membrane processes

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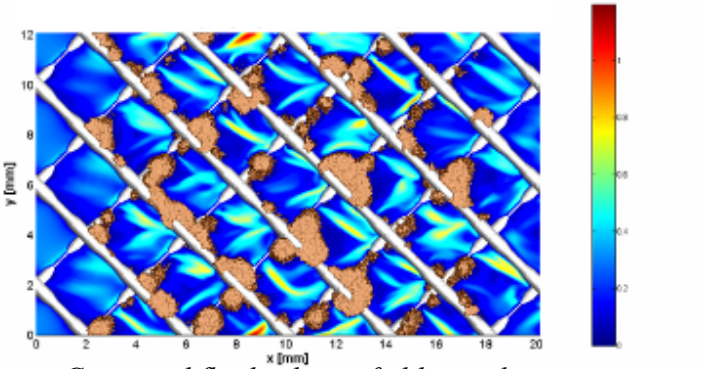
A major problem related to reverse osmosis and nano-filtration applications in drinking water production is membrane biofouling. Biofilm development in the membrane devices is affecting negatively the performance of the installation. Effective solutions for solving this problem are lacking at the moment. In this context a modeling approach could lead to significant understanding of biofouling mechanisms and suggest new designs or experimental strategies to restrict the impact of biomass accumulation.

The objective of this project is the development of a numerical model to describe membrane biofouling in relation to process conditions. The two- or three-dimensional model will include liquid flow, salt and substrate mass transport with reaction and biofilm development the feed spacer channel of a reverse osmosis membrane device.



Computed fluid velocity field in a slice through the fouled membrane module

Simulation results will be compared with experimental data obtained from membrane monitor studies. Spatial fluid velocity distribution can be, for example, determined using Magnetic Resonance Imaging (MRI). The influence of operational parameters such as flow rate, water composition temperature and membrane/spacer geometry on the deposition of microbial cells, biofilm formation, scaling and concentration gradients in the membrane module will be analyzed using this model.

References

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