**A model to describe removal of fouling during relaxation**

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**Abstract**

Fouling in membrane bioreactors (MBR) reduces process performance through elevated energy consumption and demands for cleaning and replacement of membranes. To maintain high process performance, membranes are cleaned periodically by relaxation. At relaxation, there is no convective transport of sludge components towards the membrane, which enhances the effect of air scouring. Relaxation should be sufficiently long to remove fouling and elevate permeability but nor should it be too long, as this results in a low net flux. However, the mechanisms of relaxation are still not mapped, thus it is not known how to control fouling removal by relaxation in terms of relaxation length and frequency, and how sludge and membrane characteristics influences on efficiency of relaxation.

In this study, the effect of relaxation is studied in filtrations tests with multiple relaxation lengths. Filtration tests are designed with fixed filtration lengths and decreasing lengths of relaxation throughout the tests. From each filtration-relaxation cycle the net flux can be determined and from this, the optimal relaxation length is found. The methodology is also used on different sludge to determine the differences in optimal relaxation time from system to system. Further a mathematical model is developed to describe the rate of removal of fouling during relaxation at varying relaxation length and filtration flux. From this, the optimal relaxation length can be determined from simulations of filtrations at varying conditions.

**Keywords**

Fouling, Membrane bioreactor, Modelling, Relaxation