Studies of MLSS Impact on Fouling Propensity using TMP Steps with Relaxation

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INTRODUCTION

• From intuition, an increase in MLSS would lead to an increased fouling rate in a MBR system.
• However, as described in literature the impact of MLSS on the fouling propensity is not that straightforward (1).
• Generally, the net transport of material (N) to the membrane surface can be described by the convective flux, diffusion, surface and particle interactions and hydrodynamics as described below (2).

\[ N = J_c - \frac{dC}{dy} + p(\zeta) + q(r) \quad \text{Eq. 1} \]

• MLSS is included in the convective flux but will also affect the other mechanisms – especially the effect on hydrodynamics is tricky.
• In this study, the impact of MLSS on fouling propensity and reversibility was investigated by short term pressure step experiments.

TMP STEP METHOD

• The applied TMP step method includes intermediate low pressure steps enabling studies of fouling reversibility (3).
• The total and irreversible fouling rates are calculated using Eq. 2 and 3 for comparison of fouling propensity under varying conditions.

\[ \frac{dR_{\text{tot}}}{dt} = \frac{(J_a - J_h) \cdot \mu \cdot 1}{\text{TMP}} \quad \text{Eq. 2} \]
\[ \frac{dR_{\text{irr}}}{dt} = \frac{(J_a - J_h) \cdot \mu \cdot 1}{\text{TMP}} \quad \text{Eq. 3} \]

FOULING REVERSIBILITY

• In conflict with intuition, increased MLSS lead to a decrease in fouling rate under the given operational conditions - probably due to scouring effects of the large sludge particles.
• Current work includes modeling of TMP step results with the aim to design experiments that enables more thorough studies of fouling mechanisms, e.g. blinding of the fouling cake.

CONCLUSIONS

• The figure shows the flux (J_a) of each step as function of pressure for the three different MLSS levels applied.
• It is seen that the most significant flux decline is obtained with 6 g/L whereas almost no flux decline is observed with 14 g/L.

REFERENCES

1. Lousada-Ferreira et al., 2010. MLSS concentration: Still a poorly understood parameter in MBR filterability. Desalination, 250, 618-622.

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