Real-time fouling monitoring in membrane filtration systems

Impact
Fouling is considered the bottleneck of membrane filtration systems. Fouling characterization is performed destructively ex-situ (i.e. membrane autopsies). An innovative approach employing interferometric technique was developed to monitor the fouling development in-situ under continuous operation.

CAKE LAYER ANALYSIS UNDER OPERATION

The cake layer developed in an activated sludge membrane bioreactor was monitored continuously under continuous operation despite the high turbidity and the high concentration of mixed liquor suspended solids.

Results
The proposed approach enables to visualize and quantify the fouling developed on the system under continuous operation. The approach was successfully employed to monitor the fouling in wastewater treatment (MBR), desalination (RO) and brine treatment (MD). The data generated allowed to correlate the impact of the foulants on the flux decrease and pressure drop increase.

In spiral wound elements employed for seawater desalination, the biomass thickness map was proposed to quickly assess the biofouling developed in the system. At early stage, most of the biomass was deposited on the feed spacer.

Conclusion
The systems were monitored in-situ non-destructively under continuous operation. The approach enabled correlated the effect of fouling on the process performance decrease.

In membrane distillation for the treatment of highly saline feeds, the approach was employed to monitor the formation of different foulants on the membrane surface over the time.

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