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On the concept of a supervisory, fuzzy set logic based, advanced filtration control in membrane bioreactors

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ABSTRACT

The filtration process within a membrane bioreactor (MBR) is mostly controlled in a classic way through typical set-points such as aeration flow rate, filtration duration, backwash frequency or relaxation duration. The values of these filtration set-points result from "experience" and remain often unchanged during the installation's operational lifetime. Filtration is dictated considerably by membrane fouling phenomena. The fouling potential of the mixed liquor however can significantly fluctuate, even daily, from changing influent characteristics. Fixed set-point values thus may represent sub-optimal filtration conditions. Consequently, a supervising advanced control system, being able to continuously adapt the set-point's values would be beneficial regarding the MBR filtration process optimization. Such optimization could reduce the corresponding MBR energy consumption, e.g. linked to the filtration related membrane aeration. An Advanced Control System (ACS) based on Fuzzy Set Logic (FSL) is introduced here, enabling to supervise an existing classic membrane filtration control system. Such ACS is able to daily (or even more frequent) optimize the set-points of the underlying classic control system, from the input of various sensor and process parameter values. The theoretical background and practical implementation of the FSL based ACS concept is explained.

Keywords: Bioreactor, Membrane, Fouling, Fuzzy, Advanced, Control, Optimization

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