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In-line coagulation prior to ceramic microfiltration for surface water treatment—minimisation of flocculation pre-treatment

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ABSTRACT

In-line coagulation/flocculation with subsequent low pressure ceramic membrane filtration has emerged during the last years as a treatment alternative for surface waters with high natural organic matter (NOM) content and low turbidity. In such a hybrid process, the requirements on the flocculation step may significantly differ, if compared to treatment schemes where for example rapid filters are used instead of a membrane. Thus, process performance, expressed as DOC and colour removal, membrane fouling and residual metal concentration, was investigated in dependence on the coagulant dosage, flocculation time and shear, while all other coagulation conditions were kept constant. Minimum flocculation requirements were established. A synthetic surface water (DOC 6.8 mg C l^{-1}, colour 55 mg Pt l^{-1}) was treated by rapid inline coagulation with Polyaluminium chloride (PACl), at Al-dosages of 2.6 and 4.4 mg l^{-1} and a coagulation pH of 6, followed by inline flocculation at varying conditions (G-values: 4–300 1 s^{-1}, retention times: 10–240 s), and final membrane filtration at 250 l m^{-2} h^{-1}. While the DOC removal only depended on the coagulant dose and not on the flocculation conditions, flocculation times of at least 60 s were necessary in order to stabilise the irreversible fouling rate below 1 mbar h^{-1}. In general, the process performance was improved by increasing the coagulant dosage. The findings of this study were confirmed by the evaluation of experimental design and described by linear regression modelling.

Keywords: NOM removal; Colour removal; Ceramic membranes; Microfiltration; Coagulation; Flocculation; Surface water

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