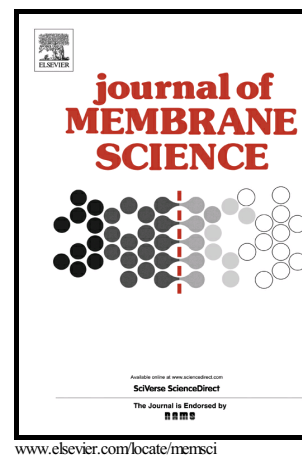


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Hydraulic irreversibility of ultrafiltration membrane fouling by humic acid: Effects of membrane properties and backwash water composition

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Abbreviation: AFM, atomic force microscopy; ANOVA, analysis of variance; CA, cellulose acetate; CaBW, CaCl₂ solution backwash; DI, deionized; EDS, energy dispersive spectrometer; HA, humic acid; HABW, HA solution backwash; HACaBW, backwash with solution containing HA and Ca²⁺ ions; HANaBW, backwash with solution containing HA and Na⁺ ions; HCE, hydraulic cleaning efficiency; HA+Ca²⁺, feed water consisting of HA and Ca²⁺; HA+Na⁺+Ca²⁺, feed water consisting of HA, Na⁺ and Ca²⁺; IR, infrared; MQBW, ultrapure water backwash; NaBW, NaCl solution backwash; NF, nanofiltration; NOM, natural organic matter; PES, polyethersulfone; PVDF, polyvinylidene fluoride; RO, reverse osmosis; TMP, trans-membrane pressure; UF, ultrafiltration; UFPBW, UF permeate backwash.

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