

Layer-by-Layer Modified Ceramic Membranes for Micropollutant Removal

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Abstract : Ceramic membranes for water purification combine excellent stability with long-life characteristics and high chemical resistance. Layer-by-Layer coating is a well-known technique for customization and optimization of filtration properties of membranes but is mostly used on polymeric membranes. Ceramic membranes comprising a metal oxide filtration layer of Al₂O₃ or TiO₂ are charged and therefore highly suitable for polyelectrolyte adsorption. The high stability of the membrane support allows efficient backwash and chemical cleaning of the membrane. The presented study reports metal oxide/organic composite membrane with an increased rejection of bivalent salts like MgSO₄ and the organic micropollutant Diclofenac. A self-build apparatus was used for applying the polyelectrolyte multilayers on the ceramic membrane. The device controls the flow and timing of the polyelectrolytes and washing solutions. As support for the Layer-by-Layer coat, ceramic mono-channel membranes were used with an inner capillary of 8 mm diameter, which is connected to the coating device. The inner wall of the capillary is coated subsequently with polycat- and anions. The filtration experiments were performed with a feed solution of MgSO₄ and Diclofenac. The salt content of the permeate was detected conductometrically and Diclofenac was measured with UV-Adsorption. The concluded results show retention values of magnesium sulfate of 70% and diclofenac retention of 60%. Further experimental research studied various parameters of the composite membrane-like Molecular Weight Cut Off and pore size, Zeta potential and its mechanical and chemical robustness.

Keywords : water purification, polyelectrolytes, membrane modification, layer-by-layer coating, ceramic membranes

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