

Removal of Bulk Parameters and Chromophoric Fractions of Natural Organic Matter by Porous Kaolin/Fly Ash Ceramic Membrane at South African Drinking Water Treatment Plants

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Abstract : The high cost of precursor materials has hindered the commercialization of ceramic membrane technology in water treatment. In this work, a ceramic membrane disc (approximately 50 mm in diameter and 4 mm thick) was prepared from low-cost starting materials, kaolin, and fly ash by pressing at 200 bar and calcining at 900 °C. The fabricated membrane was characterized for various physicochemical properties, natural organic matter (NOM) removal as well as fouling propensity using several techniques. Further, the ceramic membrane was tested on samples collected from four drinking water treatment plants in KwaZulu-Natal, South Africa (named plants 1-4). The membrane achieved 48.6%, 54.6%, 57.4%, and 76.4% bulk UV₂₅₄ reduction for raw water at plants 1, 2, 3, and 4, respectively. These removal rates were comparable to UV₂₅₄ reduction achieved by coagulation/flocculation steps at the respective plants. Further, the membrane outperformed sand filtration steps in plants 1-4 in removing disinfection by-product precursors (8%-32%) through size exclusion. Fluorescence excitation-emission matrices (FEEM) studies showed the removal of fluorescent NOM fractions present in the water samples by the membrane. The membrane was fabricated using an up-scalable facile method, and it has the potential for application as a polishing step to complement conventional processes in water treatment for drinking purposes.

Keywords : crossflow filtration, drinking water treatment plants, fluorescence excitation-emission matrices, ultraviolet 254 (UV₂₅₄)

Conference Title : ICW 2024 : International Conference on Water

Conference Location : San Francisco, United States

Conference Dates : September 26-27, 2024