Fouling studies of capillary ultrafiltration membrane

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ABSTRACT

Ultrafiltration (UF) membranes in capillary configuration are deployed in domestic water purification with respect to removal of contaminants. Fouling is an inherent phenomenon in UF process and has been reported to cause decline in flux, reduces membrane life, etc. So, it has to be thoroughly studied in order to optimize the logistics of process operation. Considering the concentration of contaminants in different parts of India, the fouling studies investigations were carried out in the range of 5–15 ppm of various constitutes such as Iron, Manganese, and the organic foulants – sodium alginate and humic acid. Out of various parameters affecting fouling like feed pressure, feed temperature, feed pH, the effort was directed towards studying the effect of various foulants (and at different loadings) on the membrane. Results obtained from experiments suggest that the fouling caused by the organics (sodium alginate and humic acid) is higher than that of inorganics (iron and manganese). Iron caused higher fouling than manganese. Sodium alginate caused higher fouling than humic acid. It is observed that humic acid caused more irreversible fouling than sodium alginate. Attempts have been made to develop a mathematical model to represent the fouling phenomena. The effect of fouling for different loadings of various foulants was seen in terms of change in transmembrane pressure (TMP), under conditions of constant permeate flow. TMP in the proposed model is expressed as the function of feed flow rate, intrinsic membrane porosity, permeability of the membrane, and the plugging constant. The values of plugging constant represent the interactions between the feed and the membrane and thus suggest the degree of fouling, both reversible and irreversible fouling, caused by different foulants and at different loadings. Irreversible pore constriction fraction is a measure of irreversible fouling and it has also been determined for different foulants and at different loadings.

Keywords: Ultrafiltration; Fouling; Trans-membrane pressure; Plugging constant; Irreversible pore constriction fraction

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