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Ultrafiltration of oily water under different conditions considering critical and limiting flux

M. Hesampour[a]*, B. Simon[b], M. Nyström[a]

[a]*Laboratory of Membrane Technology and Technical Polymer Chemistry, Department of Chemical Technology, Lappeenranta University of Technology, 53851 Lappeenranta, Finland*
Tel. +358 56212258; email: mhesampo@lut.fi
[b]*Department of Measure Physic, IUT Lannion, Renne University, Renne, France*

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ABSTRACT

It is over a decade since the concept of critical flux was introduced. From that time intensive research has been done to find the functionality and dependency of critical flux for different feeds and membranes. The studies focussed on critical flux in the field of oily water filtration are scarce, however, there are numerous membrane units which have been applied to treat wastewater contaminated with oil. It might be due to the fact that in this kind of filtration the oil drops form a gel layer on the surface of the membranes and this gel layer formation is not the case with feeds where the concept of critical flux has been studied (suspended solids forming a cake layer). In membrane filtration of oily water, knowledge on the existence of critical flux and the influence of different parameters on it may enhance a better operation of the membrane units. In order to find the critical flux, a set of experiments was carried out in constant pressure mode using varying pressures from 0.5 to 4 bars. A cycling pressure approach (increasing and decreasing pressure) was applied to find the possible critical flux in a system consisting of emulsified oil and salts. It was found that a weak form of critical flux in some cases might exist close to the lowest pressure. No strong form of critical flux was observed from comparison between pure water and permeate flux since the permeate flux differed significantly from the initial pure water flux even at the lowest pressure. The existence of a limiting flux and its dependency on operating conditions was proven in some cases. The limiting flux was established under different operating conditions, including oil concentration, pH, temperature, salts and flow velocity. The results showed that this flux was significantly influenced by variations in fl ow velocity and temperature.

Keywords: Critical flux; Limiting flux; Oil emulsion; Salts; Ultrafiltration

* Corresponding author.

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