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Enhancement of ultrafiltration flux by coupling static turbulence promoter and electric field

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Abstract

The purpose of this work was to determine the effect of the static metal deployed sheet on the performance of the ultrafiltration process. The sheet was first utilised to provoke turbulence near the membrane, and at the same time as an anode to create an electric field. It was shown that the electro-ultrafiltration module was more efficient for both low crossflow velocity and BSA initial concentration. The global hydraulic membrane resistance may be reduced by half in all cases. The polarisation layer and fouling membrane appeared reversible phenomena, which may be controlled by appropriate electric field strength. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

The difficulties encountered in separation processes are a major limitation of biotechnology processes. To solve this problem, membrane processes can offer great advantages. They are especially suitable for separation of sensitive biological substances because membrane separation is a physical procedure, which can be performed at ambient temperature. In spite of all the advantages encountered with the ultrafiltration technique, the problems arising with concentration polarisation and fouling limit the performance of this membrane process.

As biological products are sensitive to shear stress and temperature, the coupled effects of electric field serving as an additional driving force for the separation was thought to be an interesting way to improve the membrane permeate flux without increasing the shear stress [1–3]. The schematic setup of this technique, called electro-ultrafiltration, is shown in Fig. 1. Two electrodes are positioned, one on either side parallel to the membrane.

Applying a voltage to the electrodes generates an electric field. The field vector perpendicular to the membrane provokes a displacement of colloid species towards the electrode with the opposite sign. This phenomenon is called electrophoresis.

The electro-ultrafiltration was mainly utilised to separate or concentrate proteinous solutions [4–13].

Recent studies modified the electro-ultrafiltra-

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