

# **FLUX ENHANCEMENT IN CROSS FLOW MEMBRANE FILTRATION: FOULING AND IT'S MINIMIZATION BY FLOW REVERSAL**

**PI:** Shamsuddin Ilias

**Students:** Hari Parthasarathy and Shahera T. Walker

**Institution:** North Carolina A&T State University

**Address:**

Department of Chemical Engineering, North Carolina A&T State University,  
Greensboro, NC 27411

**Telephone:** (336) 334-7564

**Fax:** (336) 334-7904

**E-mail:** [ilias@ncat.edu](mailto:ilias@ncat.edu)

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## **ABSTRACT**

In crossflow membrane filtration, such reverse osmosis (RO), ultrafiltration (UF) and microfiltration (MF), the continuous decline of permeate flux due to concentration polarization and membrane fouling is a serious problem. To overcome this problem, we introduced the concept of flow reversal as a method to enhance membrane flux in liquid filtration [1]. Conceptually, flow reversal prevents the formation of stable hydrodynamic and concentration boundary layers at or near the membrane surface. Further, periodic reversal of the flow-direction of the feed stream at the membrane surface results in prevention and mitigation of membrane fouling. Consequently, these advantages enhance the membrane flux significantly.

Laboratory scale tests on a hollow fiber ultrafiltration membrane module using bovine serum albumin (BSA) and Dextran T-70 as model solutes show that the permeate flux is significantly enhanced under flow reversal condition. This effect is dramatic (by an order of magnitude) with increased feed concentration and operating transmembrane pressure. The essential elements of the system include a crossflow hollow fiber membrane module integrated with a three-way valve to direct the feed flow directions. The three-way valve is controlled by a controller-timer for periodic reversal of flow of feed stream. Another important feature of the system is that with changing feed flow direction, the permeate flow direction is also changed to maintain countercurrent feed and permeate flows for enhanced mass transfer driving force (concentration difference). In this paper we present the performance data on crossflow ultrafiltration of BSA and Dextran T-70 solution under flow reversal and unidirectional flow conditions.

## **References:**

[1] Ilias, S., Sirena, H, and Talbert, M., "Flux-enhanced cross-flow membrane filter," US Patent #6,168,714 (2001).

**List of Published Journal Articles, Completed Presentations and Students Receiving Supports from the Grant:**

**Journal Articles:**

1. Hargrove, S.C., and Ilias, S., "Flux Enhancement in Cross Flow Membrane Filtration by Flow Reversal: A case Study on Ultrafiltration of BSA," In Preparation for Sep. Sci. Technol., (2001).

**Presentations:**

1. Hargrove, S.C., and Ilias, S., "Flux Enhancement in Cross Flow Membrane Filtration by Flow Reversal: A case Study on Ultrafiltration of BSA," IChE Congress, CHEMCON 2000, Calcutta, India, December 18-21, 2000.

**Students Receiving Supports:**

Hari Parthasarathy  
Shahera T. Walker