

Accepted Manuscript

Modeling and simulation of mitigating membrane fouling under a baffle-filled turbulent flow with permeate boundary

Wenjuan Zhang, Xuehua Ruan, Yongliang Ma, Xiaobin Jiang, Wenji Zheng, Yuanfa Liu, Gaohong He

PII: S1383-5866(16)30649-9
DOI: <http://dx.doi.org/10.1016/j.seppur.2017.01.022>
Reference: SEPPUR 13485

To appear in: *Separation and Purification Technology*

Received Date: 5 June 2016
Revised Date: 6 January 2017
Accepted Date: 9 January 2017

Please cite this article as: W. Zhang, X. Ruan, Y. Ma, X. Jiang, W. Zheng, Y. Liu, G. He, Modeling and simulation of mitigating membrane fouling under a baffle-filled turbulent flow with permeate boundary, *Separation and Purification Technology* (2017), doi: <http://dx.doi.org/10.1016/j.seppur.2017.01.022>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Modeling and simulation of mitigating membrane fouling under a baffle-filled turbulent flow with permeate boundary

Wenjuan Zhang ^a, Xuehua Ruan ^b, Yongliang Ma ^c, Xiaobin Jiang ^a, Wenji Zheng ^b,
Yuanfa Liu ^a, Gaohong He ^{a,b*}

^a School of Chemical Engineering, State Key Laboratory of Fine Chemicals, Research and Development Center of Membrane Science and Technology, Dalian University of Technology, Dalian, 116024, China

^b School of Petroleum and Chemical Engineering, State Key Laboratory of Fine Chemicals, Dalian University of Technology, Dalian, 116024, China

^c School of Aeronautics and Astronautics, Dalian University of Technology, Dalian 116024, China

*Corresponding author: Gaohong He. E-mail address: hgaohong@dlut.edu.cn

Abstract

Mitigating membrane fouling by using turbulence promoters (TP) is an important issue in the microfiltration field. Considering the particles accumulation on the walls of permeable membrane tubes (one kind of fouling mechanism) with TP, we proposed a three-dimensional numerical model for random decision that decides particle movement on the membrane boundary. We investigated and predicted the permeate flux, fouling layer thickness and optimal TP arrangement modes with different operational parameters with this model. The dynamics process of cake deposition was precisely quantified and visualized. And then the simulated results ignored of pore blockage for the permeation flux were deviated less than 10% compared with the experimental data in literatures. After TP condition being optimized, the mass transfer resistance sharply reduced. Average thickness of the cake layer decreased from 0.318 mm to 0.026 mm, and the permeate flux increased more than 60%.

Keywords crossflow microfiltration; membrane fouling; turbulence promoter; deposition process; computational fluid dynamics

1 Introduction

Particle deposition on microfiltration (MF) membrane surfaces is a type of general membrane fouling that has been a universal obstacle in the continuous service of MF membrane[1-4]. Thus, it is extremely significant to reduce particle deposition in MF process [5, 6]. According to particle deposition mechanism, an increase in fluid disturbance on membrane surface is an effective means

Download English Version:

<https://daneshyari.com/en/article/4990054>

Download Persian Version:

<https://daneshyari.com/article/4990054>

[Daneshyari.com](https://daneshyari.com)