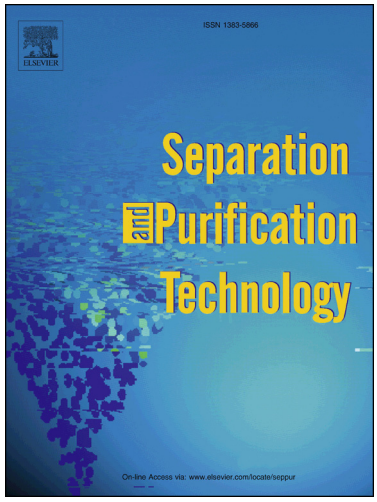

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Xiaolei Cai, Jiaqing Chen, Meili Liu, Yipeng Ji, Shan An

PII: S1383-5866(16)31548-9
DOI: http://dx.doi.org/10.1016/j.seppur.2016.12.002
Reference: SEPPUR 13413

To appear in: *Separation and Purification Technology*

Received Date: 29 August 2016
Revised Date: 30 November 2016
Accepted Date: 4 December 2016

Please cite this article as: X. Cai, J. Chen, M. Liu, Y. Ji, S. An, Numerical studies on dynamic characteristics of oil-water separation in loop flotation column using a population balance model, *Separation and Purification Technology* (2016), doi: http://dx.doi.org/10.1016/j.seppur.2016.12.002

Numerical studies on dynamic characteristics of oil-water separation in loop flotation column using a population balance model

Xiaolei Cai[a], Jiaqing Chen*[1b], Meili Liu[b], Yipeng Ji[b], Shan An[b]

a School of Mechanical and Electrical Engineering, Beijing University of Chemical Technology, Beijing 100029, China;

b. School of Mechanical Engineering, Beijing Institute of Petrochemical Technology, Beijing 102617, China

Abstract

Oily wastewater needs to be effectively treated to minimize the hazardousness to the environment. Flotation is an excellent pre-treatment technology for low-content oily wastewater with small oil droplets. The separation process of flotation is very complicated and involves the theories of thermodynamics, kinetics and hydrodynamics. Despite the numerous theoretical, numerical simulation and experimental investigations, the mechanism of flotation remains far from been fully understood. This paper uses the CFD-PBM numerical simulation method to research the dynamic separation characteristics of oil droplets including the oil droplet diameter distribution, the Sauter-Mean diameter, and the oil-water separation efficiency under different circulating flow rates (Corresponding to different turbulent kinetic energy) both from micro and macro scale. The results showed that the oil droplet diameter distribution is consistently changing during the separation process because of coalescence and breakup of oil droplets. The improvement of turbulent kinetic energies or turbulence intensity can effectively promote the collision efficiency of oil droplets and accelerate the oil-water separation process. While the turbulent kinetic energies or turbulence intensity is too strong, the strong shear stress of the fluid will promote the breakage of oil droplets and result in the decrease of oil-water separation efficiency. When the circulating flow rate is about 0.75m^3/h, the collision and coalescence efficiency of oil droplets is strong enough and the shear stress of the fluid is relatively weaker, and the oil-water separation efficiency reached the highest of 75%. The numerical simulation results are verified by the experimental results and it shows that the simulation results are in agreement with the experimental results both from micro scale and macro scale, which indicates that the numerical simulation method of CFD-PBM are stable and reliable.

Key words: **Flotation; Turbulent kinetic energy; Oil droplets; PBM; Coalescence; Breakage; Separation characteristics**

1. Introduction

Oily wastewater exits in various fields such as oil-gas exploitation, petroleum refining and machinery

[1] * Corresponding author. Tel.: +86 10 81392134..

E-mail address: jiaqing@bipt.edu.cn (Jiaqing Chen)