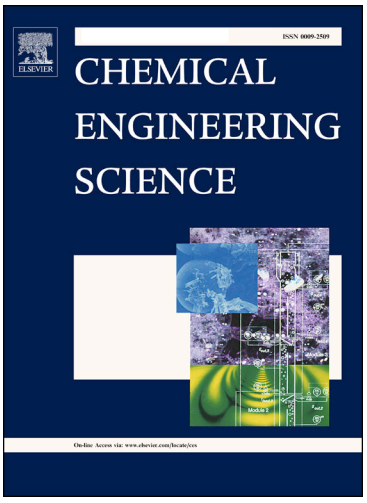

Numerical study of the critical drop size on a thin horizontal fiber: effect of fiber shape and contact angle

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Numerical study of the critical drop size on a thin horizontal fiber: effect of fiber shape and contact angle

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Abstract

Fiber-based coalescers are widely used in the chemical industry to separate two immiscible fluids. Due to the complex structure inside a coalescer and the opaque nature of the fiber material, it is impractical to perform direct visualization and measurement of the multiphase flow inside a coalescer. One fundamental problem in understanding the physics inside a liquid-gas coalescer is to determine the maximum size of a drop that can attach and remain on a fiber. Previous studies [1, 2, 3] have provided models to estimate the maximum size of a drop on a horizontal cylindrical fiber under gravity or cross-flow. However, it is not clear whether these models hold when the fiber shape and contact angle change. In this paper, we numerically investigate the critical drop size on a thin fiber with different shapes and contact angles, and provide a model that can be used for future coalescer modeling and design.

Keywords: conservative level-set method, immersed boundary method, contact angle, liquid-gas flow, droplet, fiber

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