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Hydrodynamic Studies on Liquid-liquid Two Phase Flow Separation in Microchannel by CFD Modelling

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Microfluidic systems undergo rapid expansion of its application in different industries over the few decades as its surface tension-dominated property provides better mixing and improve mass transfer between two immiscible liquids. Synthesis of biodiesel via transesterification of vegetable oil and methanol in microfluidic system by droplet flow requires separation of the products after the reaction occurred. The separation technique for multiphase fluid flow in microfluidic system is different from the macro-system, as the gravitational force is overtaken by surface force. To understand these phenomena completely, a study on the hydrodynamic characteristics of two-phase oil-methanol system in polydimethylsiloxane (PDMS) microchannel is carried out. A multiphase Volume of Fluid (VOF) model is develop to predict the fluid flow in microchannel. An inline separator design will be proposed along with its variable to obtain effective separation for the oil-methanol system. The separation performance will be evaluated based on the amount of oil recovered and its purity.

Keywords: microchannel; immiscible liquids separation; CFD volume of fluid model; multiphase