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Mathematical modelling of Liquid –Liquid extraction in the slug flow regime in a microchannel SUNDARI RAMJI, DINESH BHAGAVATULA, ARJUN RAKESH, PUSHPAVANAM S, None — Mixing in the slug flow regime in microchannels is enhanced by the presence of internal circulations induced by shear due to wall. This helps improve mass transfer in this flow regime. We exploit the low Re characteristic of the flow and seek a numerical solution to understand the structure of the vortex patterns formed in the two phases in the slug flow regime. We study liquid-liquid extraction in the system to determine the improvement in mass transfer. The system was analyzed for two cases when there is (i) no film surrounding the slug (ii) a thin film surrounding the slug. The 2D governing equations for fluid flow are solved using two approaches: a) a stream function formulation based on finite differences b) primitive variable formulation with the Chebyshev collocation method. The effect of viscosity ratio, slug length and film thickness on the vortex structure were studied. While secondary vortices were induced in the less viscous phase in the case where the thin film is absent, they are always generated in the slug irrespective of the viscosity ratio in the case where the film is present. The species balance equation was then solved numerically using two approaches: a) an Alternating Direction Explicit method and b) the Locally One Dimensional splitting technique. The effect of varying Peclet number from 0 to 10^4 on the solute transfer from the slug to the continuous phase was studied. The extraction performance is analyzed in terms of extraction efficiency and mass transfer coefficient.

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None

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