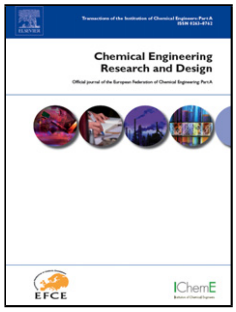

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Numerical study on the flow of high viscous fluids out of conical vessels under low-frequency vibration

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Abstraction: The flow processes of high viscous fluids out of a conical vessel under low-frequency vibration are studied numerically by computational fluid dynamics (CFD), and the effects of various rheological parameters as well as vibration parameters on the flow processes are investigated in detail. The results show that the flowrates of Newtonian fluids are dependent on the flow coefficients for outflow and inflow, while the flowrates of non-Newtonian fluids are affected by the change of viscosity induced by vibration in addition to the flow coefficient difference. An outflow enhancement occurs in the high viscous shear thinning fluids. However, for low viscous shear thinning fluids, the outflow reduction induced by the flow coefficient difference is large enough to offset the outflow enhancement induced by the decrease of viscosity. Likewise, for shear thickening fluids, the outflow retardation is observed due to the increase of viscosity induced by the vibration. What's more, the flow processes of fluids in a vertically-vibrated conical vessel are also dependent on vibration frequency and amplitude, and different settings of vibration parameters may lead to outflow enhancement, outflow retardation or even backflow, which is helpful to achieve the control of flowrate through adjusting vibration parameters only.

Keywords: mechanical vibration; non-Newtonian fluids; CFD; outflow control; process intensification