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Hydrodynamic Simulation of Co-Current and Counter Current of Column Distillation Using Euler Lagrange Approach

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Abstract : Packed columns of liquefied petroleum gas (LPG) consists of separating the liquid mixture of propane and butane to pure gas components by the distillation phenomenon. The flow of the gas and liquid inside the columns is operated by two ways: The co-current and the counter current operation. Heat, mass and species transfer between phases represent the most important factors that influence the choice between those two operations. In this paper, both processes are discussed using computational CFD simulation through ANSYS-Fluent software. Only 3D half section of the packed column was considered with one packed bed. The packed bed was characterized in our case as a porous media. The simulations were carried out at transient state conditions. A multi-component gas and liquid mixture were used out in the two processes. We utilized the Euler-Lagrange approach in which the gas was treated as a continuum phase and the liquid as a group of dispersed particles. The heat and the mass transfer process was modeled using multi-component droplet evaporation approach. The results show that the counter-current process performs better than the co-current, although such limitations of our approach are noted. This comparison gives accurate results for computations times higher than 2 s, at different gas velocity and at packed bed porosity of 0.9.

Keywords : co-current, counter-current, Euler-Lagrange model, heat transfer, mass transfer
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