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Synthesis, experiments and simulation of heterogeneous batch distillation processes

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Abstract

The presence of azeotropes in multicomponent mixtures complicates the design of batch distillation separation processes widely used in pharmaceutical and speciality chemical industries. Most of those processes include the use of a homogeneous entrainer to ease the separation. We describe novel methods to break azeotropes using an entrainer that is partially miscible with one of the initial binary mixture components. We depict some of the advantages of heterogeneous batch distillation processes: more design alternatives for the separation of an azeotropic binary mixture than with homogeneous batch distillation, batch distillation boundary crossing thanks to a controlled reflux of the entrainer-rich phase, simplified distillation sequences as a consequence of less distillation tasks. Three examples based on the separation of non-ideal azeotropic or close boiling point binary mixtures through heterogeneous batch distillation are simulated using a commercial batch distillation package. Experiments validate the simulated separation of a minimum boiling azeotropic mixture.

Keywords: Heterogeneous batch distillation; Azeotropic mixture; Close boiling mixture; Heterogeneous entrainer