Entrainer Selection Rules for the Separation of Azeotropic and Close-boiling Temperature Mixtures by Homogeneous Batch Distillation Process

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Abstract

Batch distillation of nonideal mixtures usually produces the azeotropes often associated with those mixtures. Among various techniques available to break azeotropes, azeotropic and extractive distillation processes have a place of choice. They rely upon the selection of a suitable entrainer. Entrainer screening is therefore a key step for the synthesis and design of these processes. From an analysis of all ternary residue curve maps under assumptions of a large number of stages and total reflux/reboil ratio, we devise in this paper a complete set of rules for the selection of a suitable entrainer enabling the separation of minimum- and maximum-boiling azeotropic binary mixtures and close-boiling-temperature binary mixtures. These rules complete previously published rules and expand by many times the set of entrainer alternatives previously considered. Feasible batch distillation processes can always be obtained considering two batch task sequences using rectifier and stripper configurations. The effect of distillation boundary curvature on the selection of entrainers is analyzed, and in this case, a sequence of up to a three batch distillation configurations must be used to separate the original mixture components. Several practical examples are shown to illustrate the application of the defined rules in each studied case.