

Separation of highly non-ideal mixtures with batch heteroazeotropic rectification

Distillation is the separation method most frequently applied in the chemical industry based on the difference of volatility of the components of a liquid mixture. Because of its high demands of energy the optimal design and operation of the distillation columns is a very important issue.

In the chemical technologies large amount waste solvent mixtures are evolving, frequently forming azeotropic, low relative volatility (α) mixtures.

For the separation of azeotropes and low α mixtures a special distillation method must be applied such as heteroazeotropic distillation. By this method a third component (entrainer) is added to the mixture, which forming heteroazeotrope with at least one component to improve the separation.

Batch distillation has always been an important part of seasonal, uncertain or low capacity and high-purity chemicals' production. It is a process of key importance in the pharmaceutical industry and the regeneration of waste solvent mixtures.

The aim of this thesis to study the separation of a low α , zeotropic mixture (dichloromethane (A)-acetone(B)) in a batch rectifier with a selective entrainer (water(E)) by feasibility and rigorous simulation calculations.

In this thesis I have presented a new feasibility method extending the former methods published for the batch homoazeotropic distillation. The method is based on the analysis of the map of the possible overall liquid composition profiles (extractive and rectifying profile maps) containing also the heterogeneous liquid boiling envelope. I have compared the batch addition and the continuous feeding of the entrainer and I have studied also the influence of the most important operational parameters and I have determined the possibilities extremes of the important operational parameters.

I have suggested a new method for estimation of the number of ideal plates for batch heteroazeotropic distillation, which based on the discrete profile-maps.

I have also investigated the combination of batch addition and continuous feeding (mixed addition) of the heterogeneous entrainer. I have compared the different entrainer addition methods under constant energy and entrainer consumption. The best results were obtained in the case studied by the mixed addition.