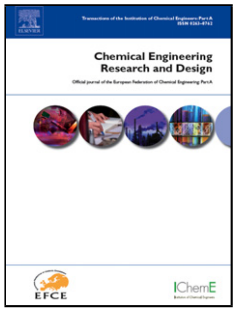

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Optimal selection of operating pressure for distillation columns

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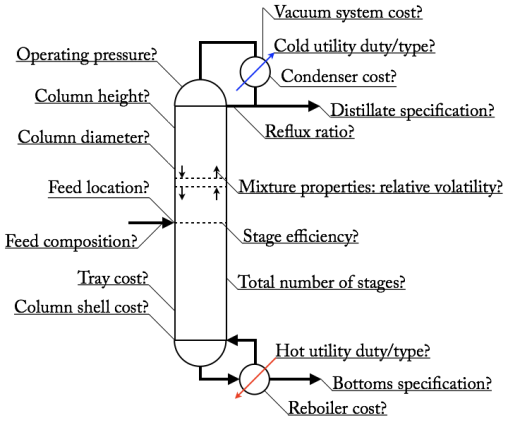
Graphical abstract



Highlights

- A shortcut simultaneous optimization model for optimal column selection;
- The model calculates total annualized cost to make evaluations;
- The accuracy of the model is verified through rigorous simulations.

Abstract

Optimal design of distillation columns is complex because of many entangled design variables, such as operating pressure, reflux ratio, number of stages, product specifications, etc. Amongst these parameters, operating pressure is the premise towards more economic performance related to not only capital investment but also energy cost. A common heuristic is to arbitrarily fix the pressure if inexpensive cooling water can be used at condenser. However, it cannot always guarantee an optimum column. The traditional way to obtain the optimum pressure is to perform time-consuming iterative rigorous simulations. That is, basically no handy systematical method is available to quick determine optimum column pressure. To eliminate this research gap, this study is devoted to provide an equation-oriented shortcut optimization model to determine optimum pressure avoiding manual iterative calculation. The proposal pathway can estimate column total annualized cost considering capital and energy costs simultaneously before being used to initialize rigorous design. Feasibility and accuracy of this approach are perfectly verified on Aspen Plus through five case studies – propylene-propane, benzene-toluene, cyclohaxane-cyclohexanol, methanol-water, and n-pentane-n-hexane-n-heptane systems.