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*Published in:*
Proceedings of the 18th Nordic Process Control Workshop (NPCW18)

*Publication date:*
2013

*Document Version*
Publisher's PDF, also known as Version of record

# A Modelling Framework for Conventional and Heat Integrated Distillation Columns

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**Abstract:** Diabatic operation of distillation columns can lead to significant reductions in energy utilization and operation cost compared to conventional (adiabatic) distillation columns, at an expense of an increased complexity of design and operation. The earliest diabatic distillation configuration dates back to the late 70s, and various different configurations have appeared since. However, at present, no full-scale diabatic distillation columns are currently operating in the industry.

Current studies related to alternative distillation configurations report very different figures for potential energy savings which constitutes a problem in relations to achieving industrial acceptance. There is clearly a need for research and comparative studies which can help to provide analysis of the pros and cons of novel and intensified distillation processes compared to conventional columns for a range of separations. These studies must provide insight to both the static design properties such as the energy efficiency, utility consumption and operational cost as well as the column operability and dynamic responses to typical disturbances.

Where most efforts have been directed to ideal, binary systems of close boiling mixtures of hydrocarbons such as separations of equimolar mixtures of benzene/toluene or propane/propene described by simple models, a generic, modular, model framework is presented in this work. At present, the framework is able to describe a conventional distillation column, a mechanical vapor recompression column and a heat-integrated distillation column, but due to a modular structure the database can be further extended by additional configurations. The framework provides the basis for fair comparison of both steady state and dynamic performance of the different column configurations for a given binary or multicomponent separation. Furthermore it constitutes a significant improvement in the fundamental modeling of e.g. the heat-integrated distillation column models often reported in literature and hence form a solid basis for quantitative performance evaluations.

*Keywords:* Fluid separations, Distillation columns, Diabatic distillation, Dynamic modeling

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