# Amgen Seminar Series in Chemical Engineering

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## Design and Control of a Fully Heat-Integrated Pressure-Swing Azeotropic Distillation System

by

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If the composition of a binary homogeneous azeotrope changes significantly with pressure, the chemical components can be efficiently separated by using two distillation columns that operate at different pressures. This process is called pressure-swing azeotropic distillation.

This work updates the study reported over two decades ago by Abu-Eishah and Luyben ("Design and control of a two-column azeotropic system" Ind. Eng. Chem. Process Des. Dev. 1985, 24, 132-140). These authors studied a partially heat-integrated two-column system in which an auxiliary reboiler permitted independent adjustment of vapor boilup in both columns. In the present paper, the two columns operate in the "neat" mode without any auxiliary reboiler.

The details of achieving rigorous steady-state and dynamic simulations of the neat system in Aspen Plus and Aspen Dynamics are discussed. The condenser duty in the high-pressure column must equal the reboiler duty in the low-pressure column. The heat-transfer rate depends on the temperatures on the hot and cold sides in the condenser/reboiler, which change with varying process conditions, both dynamically and at steady state. The pressure of the high-pressure column floats with changing conditions.

The dynamic controllability of the fully heat-integrated system is compared with that of the partially heat-integrated system, and a significant trade-off between energy consumption and controllability is demonstrated.

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