A novel soft sensor for measuring and controlling recovery in a high-purity, multi-component, side-draw distillation column

The use of soft sensors for monitoring purposes is an established practice in the process industry. In this study, the focus has been on developing a soft sensor that can be used to monitor the product recovery rate of double-ended, high-purity distillation columns with a side-draw. To this end, this study specifically focuses on developing a cost-effective and accurate soft sensor for an industrial methanol distillation unit where a side-draw is used to meet the parts per million level impurity specifications. The novel soft sensor is based on the unique characteristics of the mass balance in this type of column, and uses the density measurement at the side-draw together with the flow rates of the side-draw and product draw to calculate the product recovery rate. The developed soft sensor was validated against real plant data as well as on a process simulation of an industrial methanol distillation column. The soft sensor demonstrated the ability to predict product recovery to an accuracy of 0.05% and showed good dynamic performance. The proposed soft sensor was next used as a process variable in the development of a supervisory scheme and a model predictive control scheme, which were able to operate the process at product recovery rates of 99.5% while honoring critical product and bottoms product specifications.

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