Technische Universität Braunschweig

ICTV
Institute for Chemical and Thermal Process Engineering

**Abstract** **Continuous multicomponent distillation in thin film and short path evaporators**

**Author** Stefan Jahnke, N. Schwerdtfeger, Stephan Scholl
TU Braunschweig, Institute for Chemical and Thermal Process Engineering (ICTV), Braunschweig, Germany

Fabian Kappatsch, Marc Dittmann, Merck KGaA, Darmstadt

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The change-over of batch-wise production to continuous processing offers the possibility of energy-efficient and sustainable manufacturing. Advantages can be the saving of process steps or reducing waste streams. Especially where the annual production quantity is low a modular set-up for multi-propose applications is a viable alternative.

In the field of distillation of multicomponent mixtures, a consecutive set-up of a thin-film and a short-path evaporator presents a promising approach for a continuous two-stage distillation. As a result, it is possible to separate the low and high boiling components successively and to enrich a mid-boiling value component. In thin film evaporators (TFE) process pressures down to 1 mbar abs and in short-path evaporators (SPE) down to $10^{-3}$ mbar abs can be realized. This allows the boiling temperature to be adapted to the process task and material properties in a wide range.

However, the estimation of the distillation as well as separation performance of TFE and SPE is very challenging based on experimental data of analogous problems. This is due to the yet unresolved interaction of physical properties, phase equilibria, apparatus design and operational conditions for a given case.

For preliminary investigations, a computer based flowsheet simulation was undertaken. The set-up of the evaporators was implemented by a multi stage steady state model with differential evaporation. The fluid properties were taken into account by group contribution method UNIFAC. First results show that varying feed rate and heating side conditions lead to opposite trends regarding yield and purity. Additionally, axial product and heating side temperature profiles can be recorded and changes of heat transfer conditions can be observed.

For further investigations, a lab-scale test facility made of borosilicate glass is operated at ICTV. Feed rates are varied between 0.2 and 4 kg/h. On the heating side, temperatures up to 300 °C are set and the rotor velocity is adjusted. The control system allows the recording and evaluation of any plant condition. With regard to purity and yield of the overall process a spectroscopy analysis will be implemented and compared to the simulation data. At the same time at Merck KGaA a pilot plant made out of steel is installed and offers the possibility to determine

scale-up factors for a large operating window. In the presentation first experimental results of the lab-plant will be shown and discussed.