

Publication Abstracts - Pervaporation

L.M. Vane, F.R. Alvarez, A.P. Mairal, and R.W. Baker, " Separation of Vapor-Phase Alcohol/Water Mixtures via Fractional Condensation Using a Pilot-Scale Dephlegmator: Enhancement of the Pervaporation Process Separation Factor," *Ind. Eng. Chem. Res.* 43, 173-183 (2004).

In pervaporation, a liquid mixture contacts a membrane surface that preferentially permeates one of the liquid components as a vapor. Our approach to improving pervaporation performance is to replace the one-stage condenser traditionally used to condense the permeate with a fractionating condenser called a dephlegmator. For example, pervaporation of 5 wt% aqueous ethanol yields a vapor containing 35 wt% ethanol. The separation factor for the process is 10. Condensation of this vapor in a dephlegmator yields a vapor product stream containing 90% of the permeating ethanol at a concentration of 85 wt% ethanol. The net result of the combined pervaporation-dephlegmation process is to transform the 5 wt% ethanol feed into an 85 wt% ethanol condensed product. For the overall process, the separation factor increase 11-fold to 108. Pilot-scale parametric experiments were performed with a plate-fin heat exchanger operated as a dephlegmator. The process was modeled with commercial process simulation software; good agreement between the module and the pilot results was obtained.