245d Membrane Pervaporation Process for Diacetone Alcohol – Water Separations

C. Stewart Slater, Timothy Schurmann, Joshua MacMillian, and Angela Zimarowski

Membrane pervaporation is a very effective technology for organic solvent–water separations in specialty chemical manufacture. It has the ability to perform solvent dehydrations and produce solvents of high purity without complex distillations. With the proper selection of membranes, pervaporation can be used in many applications from organic recovery from dilute aqueous process streams to final solvent purification. Pervaporation has been successfully utilized in the dehydration of diacetone alcohol (DAA)-water mixtures. Studies have been conducted to examine the effect of various operating parameters such as feed concentration, temperature, and permeate-side pressure on flux and selectivity. The use of a polyvinylalcohol membrane was quite selective for the parameters studied. At benchmark processing conditions of feed concentration of 90% DAA, 50ºC and 2 mmHg (abs) permeate-side pressure, water selectivity was 169.9 and total flux was 0.26 kg/m2-hr. Our studies examined feed concentrations over the range of 1-50% w/w water in DAA. Feed temperature affected flux in an exponential manner; as temperature was increased, so too did the flux. Decreasing the permeate side pressure showed no significant effect on the quality of separation, but as pressure increased, flux decreased exponentially. A selection of Sulzer dehydration membranes were also compared over benchmark conditions. Data correlated well, and empirical models were developed. Scale-up calculations were performed to determine needed membrane area for a commercial dehydration. The model we developed predicts a membrane area of 85 m2 is needed to achieve a final product purity of 99% DAA from a feed of 90% DAA.