ABSTRACT

Design guidelines were applied for the production of methyl acetate in a pervaporation membrane reactor. The limits of operation were determined. The shift in equilibrium is evaluated by a simple model involving simultaneously chemical equilibrium and transport across the membrane. This analysis establishes possibilities and limitations of a pervaporation membrane reactor. The performance of a continuous stirred tank reactor with a pervaporation membrane (PV-CSTR) is analyzed. To achieve conversions higher than 90%, conditions must satisfy $D_a > 150$ and $0.01 < P_e < 100$. Increasing temperature has a negative effect on membrane reactor conversion. The effect of sweep is important at high-permeate pressures. Two design charts were created to illustrate dynamics between permeation rates, reaction rates, and selectivity with conversion. The three powerful tools proposed for the analysis of a pervaporation membrane reactor described the system in a systematic way.

Keywords: Pervaporation membrane reactor; Design methodology; Design charts; Methyl acetate