4072359323 : MAJOR CHEMICAL TECHNOLOGY

KEY WORD: PERVAPORATION / SIMULATION / SOLUTION-DIFFUSION.

TOUCHPONG CHOOSRI : THESIS TITLE. NUMERICAL SIMULATION OF UNSTEADY-STATE WATER PERVAPORATION. THESIS ADVISOR : KHANTONG SOONTARAPA, Ph.D., 85 pp.
ISBN 974-333-496-3.

Mass transfer in pervaporation process of water through polyacrylic acid membrane can be described by solution-diffusion mechanism. The diffusion of component through membrane follows Fick's law of diffusion. Phase change of permeate occurs in pervaporation process because liquid feed is touched with membrane on upstream side and the downstream side of membrane is under vacuum. So, the membrane is consisted of swollen part and dry path in series from upstream to downstream. Diffusion coefficient of i component in swollen part is concentration dependent. Exponential dependent diffusion coefficient is chosen to consider the interaction between permeate component and membrane as follows.

$$D_i^l = 2.4\times10^{-11}\exp\left(0.58\times\frac{c_i^l}{c^0}\right) \quad m^2/s \quad \text{at } 25\ ^\circ C$$

$$D_i^l = 4.3\times10^{-11}\exp\left(0.6\times\frac{c_i^l}{c^0}\right) \quad m^2/s \quad \text{at } 40\ ^\circ C$$

$$D_i^l = 4.8\times10^{-11}\exp\left(0.61\times\frac{c_i^l}{c^0}\right) \quad m^2/s \quad \text{at } 50\ ^\circ C$$

In case of considering phase change within membrane, the diffusion coefficient in dry part is considered constant as follows, $D_i^v = 4\times10^{-13}$, $D_i^v = 4.12\times10^{-13}$ and $D_i^v = 4.13\times10^{-13}$ m^2/s at 25, 40 and 50 °C, respectively. The thickness change of dry part can be divided into 3 zone that is i) changing with time following equation $y = kt^{1/2}$. in unsteady state region ii) The transition zone iii) steady state zone with constant dry layer 4.07×10^{-10}, 2.65×10^{-10} and 1.17×10^{-10} m. at 25, 40 and 50 °C, respectively for water-polyacrylic acid system. Heat for phase change of this study is supplied from liquid feed but calculated temperature drop is very small. It is reasonable to assume isothermal condition. It is also meant that the dissolution of permeate component into membrane and diffusion through swollen part is much faster than the diffusion in dry path to compensate the temperature drop in membrane.

We can assume that the phase change is occurred on the downstream side of membrane if the equilibrated saturated membrane with feed solution is used for pervaporation. However, the phase change inside the membrane must be considered in case of using dry membrane for operation.

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