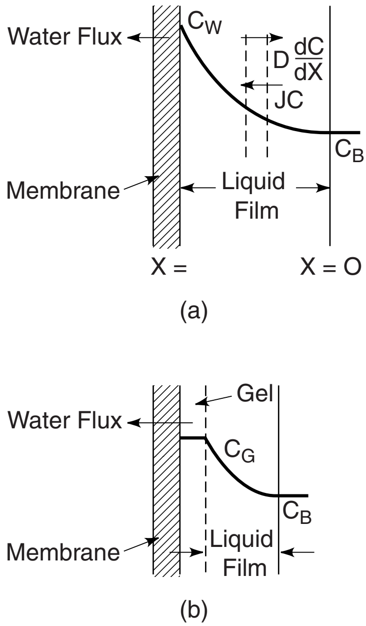

Figure 11.20. Solute transfer in a UF membrane: (a) without gel formation; (b) with gel formation.

of diffusion of solute in the opposite direction because of concentration polarization. That is,

$$D_e \frac{dC}{dX} = JC \tag{11.62}$$

where D_e is the effective diffusivity of solute in liquid film (cm^2/s), J is the volumetric filtration flux of liquid (cm^3/cm^2 s), and C is the concentration of solute (mol/cm^3 liquid).

Integration of eq. 11.62 with the boundary conditions of $C = C_B$ at $X = 0$ and $C = C_W$ at $X = \delta$ yields

$$J = \frac{D_e}{\delta} \ln \frac{C_w}{C_B} \tag{11.63}$$

or

$$J = k \ln \frac{C_w}{C_B} \tag{11.64}$$

where $k = D_e/\delta$ is the mass transfer coefficient and δ is film thickness.

The mass transfer coefficient is a function of fluid and solute properties and flow conditions and is correlated with Re (Reynolds number) and Sc (Schmidt number).