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Effect of operating temperature on reverse solute flux in forward osmosis by incorporating the surface charge density

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ABSTRACT

In order to investigate the effect of operating temperature on the reverse solute diffusion, the forward osmosis-only model incorporating the surface charge on solute partitioning is developed to obtain the reverse solute flux as a function of operating temperature and draw solution concentration using MATLAB. By comparing the calculated reverse solute flux for bulk draw solution concentrations at different operating temperatures, the range of the draw solution concentration at the support layer-active layer interface applicable to the constant surface charge density is found. The concentration beyond which the surface charge density is not constant, which is caused by the variety of the Debye length with the draw solution concentration, decreases with increasing operating temperature. The dilutive internal concentration polarization at 45°C is greater than that at 25°C due to the greater structural parameter and ratio of the structural parameter to diffusion coefficient at 45°C. The lower reverse solute flux at 45°C than that at 25°C is due to the fact that the ratio of the effective concentration between 25°C and 45°C outweighs that of the effective solute permeability coefficient.

Keywords: Operating temperature; Reverse solute flux; Surface charge density; Concentration polarization

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