Calculation of osmotic reflection coefficients through hexagonal periodic arrays of cylinders

Kittipitch Yooprasertchuti

Department of physics, Faculty of science, Chulalongkorn University,
Tel.: 088-2125168, e-mail:

Abstract: Effects of solute molecular shape of rigid macromolecules on the osmotic flow through a hexagonal array of cylinders (resembling the bundles of fibers observed in the glycocalyx cell coating) were studied theoretically using a hydrodynamic model. The Reynolds number characterizing the flow is assumed to be very low such that the fluid flow is a creeping flow moving in the direction parallel to the cylinder axes. The solute-cylinder steric interaction excludes the solutes from the region at the periphery of the cylinders, causing a concentration-dependent drop in pressure near the cylinder surfaces which creates an osmotic flow. To investigate effects of solute shapes on an osmotic flow of a dilute binary solution, osmotic reflection coefficients of prolate and oblate spheroids (resembling the shapes of globular proteins) were calculated as a function of its cross-section aspect ratio, and presented as a function of the solute Stoke-Einstien radii. The equilibrium partition coefficient (the ratio between the upstream solute concentration confined among the hexagonal array of cylinders and that of the external bulk solution) is also determined, and its relation with the osmotic reflection coefficient is also discussed.

PS 024