Hydrogenphosphate Ion Permeability of Dialysis Membranes with Varying Zeta Potentials

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To clarify ion transport, dialysis membranes are evaluated in terms of zeta potential calculated by the Helmholtz-Smoluchowski equation from data on streaming potential ΔE and pressure drop ΔP depending upon the operating conditions at which the values are measured. The objective of the present study is to design an improved method for measurement of ΔE and ΔP of hollow-fiber dialysis membranes and to clarify the diffusive permeability of hydrogenphosphate ion.

A polytetrafluoroethylene (PTFE) cylindrical cell of an inside diameter of 14mm and a height of 10mm was packed with 2,000-3,000 pieces of hollow fibers, and glass filters were set on either side of the cell. Deaerated water purified by both ion exchange and reverse osmosis of an electric conductivity of approximately 150μS/m was caused to flow in the hollows at 293K to determine ΔE and ΔP.

A good linear relationship between ΔE and ΔP and the reproducibility of the data were obtained, demonstrating the utility of the improved method to measure ΔE and ΔP and the validity of the Helmholtz-Smoluchowski equation to calculate zeta potential from data on ΔE and ΔP. Hydrogenphosphate ion permeability increased with zeta potential for the membranes of about the same pure water permeability. This indicates that hydrogenphosphate ion permeability depends on both the charge and internal structure of dialysis membranes.