9503

Mechanisms of Active Transport for Inorganic and Organic Ions through Various Ion Exchange Membranes

Tadashi Uragami and Takashi Miyata
Faculty of Engineering, Kansai University

Summary

Characteristics and mechanism of active transport for alkaline metal ions through cation exchange membranes have been reported in an earlier paper. In this study, in order to reveal details of the active transport of ions, characteristics and selectivity in the active transport of halogen ions through anion exchange membranes, and those of amino acids and nuclear acid bases through cation exchange membranes were studied under various transport conditions. Also, mechanisms of the active transport for these ions are discussed in detail.

Anion exchange membranes were prepared from chitosan and poly(vinyl alcohol) (Chitosan / PVA). Cation exchange membranes were prepared from poly(isobutylene-alternative co-maleic anhydride) (ISBN) and PVA (ISBN/PVA) and poly(styrene sulfonic acid) (PSA) and PVA (PSA/PVA).

When one side of the Chitosan/PVA membrane was acidic and the other basic, halogen ions were actively transported against their concentration gradients across the Chitosan/PVA membrane from the acidic side to the basic side. This transport of halogen ions was significantly influenced by an initial OH^- ion concentration on the basic side and a permeation fraction of diffusion of Na^+ ion from the basic side to the acidic side. Selectivity in the active transport of halogen ions through the Chitosan/PVA membranes with lower ion exchange capacity and smaller swelling strongly depended on hydrated ionic radius of halogen ion but that with higher ion exchange capacity and larger swelling was lowered.

As one side was acidic and the other side basic in the ISBN membrane, amino acids such as glycine and *L*-phenylalanine were actively transported against their concentration gradients. A transport direction of amino acids in this active transport was significantly dependent on an initial pH on the acidic side. Namely, when an initial pH on the acidic side was lower than unity, amino acids could be actively transported from the acidic side to the basic side and when that was higher than unity, vice versa.

When nuclear acid bases such as adenine and uracil were applied to such similar transport experiments through the PSA/PVA membranes, adenine and uracil could be actively transported. A transport direction of adenine was strongly governed by the initial pH on the acidic side as well as amino acids. However, uracil was always transported against its concentration gradient from the acidic side to the basic side regardless of the initial pH on the acidic side.

Mechanisms of the active transport for the above ions under different transport conditions are discussed from the viewpoint of an electrostatic interaction between the transporting species and the membrane.