Removal of ^{125}I from radioactive experimental waste using an anion exchange paper membrane

Hiroyoshi Inoue* and Kozue Kaibara**

*Radioisotope Institute for Basic and Clinical Medicine, Kurume University School of Medicine

**Department of Chemistry, Faculty of Science, Kyushu University

Summary

The removal of ^{125}I from the radioactive iodine waste generated by biological experiments, medical treatment and diagnoses, through the use of an anion exchange paper membrane was investigated in our laboratory. The membrane was created by homogeneously applying diethylaminoethyl or trimethylhydroxypropyl amino group to a paper membrane so as to modify the permselectivity of ^{125}I through the membrane.

The transmembrane potential, membrane conductance, and ion flux were measured to quantitatively evaluate the ^{125}I selective transport performance, which is controlled by the modes of ionic migration within the paper membrane and by the ionic distribution between the membrane and the solution phases.

Phenomenological analyses of the membrane transport processes are performed utilizing linear formulations relating the thermodynamic driving forces to the fluxes across membrane in terms of non-equilibrium thermodynamics. An appropriate set of linear phenomenological equations formulating the coupling of driving forces and fluxes can be derived for the various transport phenomena arising across a membrane.

A cellulose-paper anion exchange membrane was employed in the present experiments. Aqueous solution phases I and II were separated by the paper membrane, where $Na^{125}I$ or $Na^{36}Cl$ in phase I was varied between 1×10^{-3} and 1×10^{-1} mol dm^{-3}, and $Na^{125}I$ or $Na^{36}Cl$ in phase II was maintained constant at 10^{-2} mol dm^{-3}.

Electroconductive permselectivities of anions were larger than those of cations over the measured concentration range. Notably, the P_I/P_{Cl} ratio at 10^{-3} mol dm^{-3} phase I increase to 2 - 3. This characteristic appears advantageous for the separation of ^{125}I from radioactive waste that has been contaminated with various anions. The permeabilities of all the diffusional membrane systems tested in this study were almost identical except an anion exchange paper membrane treated with trimethylhydroxypropyl amino group.

As a result, the separation with an anion exchange paper membrane is appropriate to remove ^{125}I from radioactive experimental waste. However, in order to achieve the purpose, it is important to introduce more ion exchange group into paper membrane.