J. Chem. Research (S), 1998, 411
J. Chem. Research (M), 1998, 1844–1852

A Convenient Method for the Synthesis of Bis[2-(2-carboxymethylphenoxy)ethyl] Ether and Bis[2-(2-carboxyphenoxy)ethyl] Ether and their Application for Transport of Alkali Metal Cations Across a Supported Liquid Membrane

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The non-cyclic carboxylic ionophores bis[2-(2-carboxymethylphenoxy)ethyl] ether (**I**) and bis[2-(2-carboxyphenoxy)-ethyl] ether (**II**) have been synthesized and used as ionophores; ionophore **I** exhibits K^+ selectivity.

Ligands of carboxylic type are of great interest as the hydrogen bonding of the carboxylic groups may hold the ligand in a cyclic conformation suitable for complexation. This observation might provide novel tools for rationally altering the ion gradients which control biological systems. The cation selectivity of macrocycles can also be exploited in the preparation of ion-selective electrodes.

A convenient method for the synthesis of non-cyclic carboxylic ionophores bis[2-(2-carboxymethylphenoxy)ethyl] ether (**I**) and bis[2-(2-carboxyphenoxy)ethyl] ether (**II**)[12] have been reported (Fig. 2). These synthetic non-cyclic open chain polyethers **I** and **II** having carboxylic end groups mimic the structurally related carboxylic antibiotic ionophore nigericin.[8,9] **I** and **II** have been used as carriers for transport of alkali metal cations (Na^+ and K^+) across a supported liquid membrane[4] (Fig. 1). The membrane used as support was extracted from egg shell by dissolving the shell in dil. HCl. An influence of cation concentration and ligand concentration on the transport behaviour was observed. Ionophore **I** exhibits a high K^+/Na^+ selectivity of 614:1 in single ion transport and 57.7:1 in competitive transport at a high metal ion concentration of 1×10^{-2} M, keeping the ligand concentration constant at 1×10^{-3} M.

A valinomycin membrane shows greater potassium selectivity, about 3800 times that of sodium and much better than that observed (30:1) with the best available potassium sensitive glass electrode. Ionophore **I**, which shows intermediate potassium selectivity appears to be a good candidate as an ion sensitive electrode.

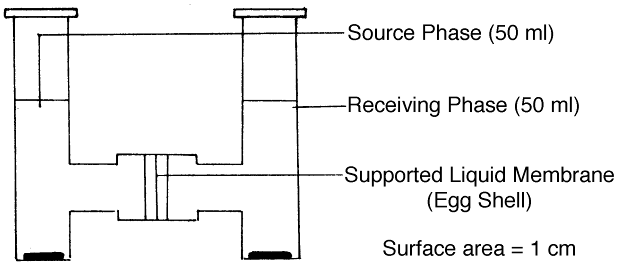
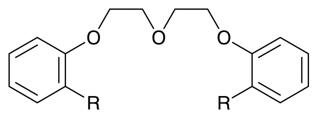


Fig. 1 Apparatus for supported liquid membrane transport



I (R = CH_2CO_2H)
II (R = CO_2H)

Fig. 2

Techniques used: IR, ^1H–^{13}C NMR, ion transport

References: 17

Tables 1–5: Ion transport and selectivity results

Fig. 3: Plot of concentration of Na^+ transported by **I** and **II** at varying metal ion concentrations

Fig. 4: Plot of concentration of K^+ transported by **I** and **II** at varying metal ion concentrations

Fig. 5: Plot of concentration of Na^+ transported by **I** and **II** at varying ligand concentrations

Fig. 6: Plot of concentration of K^+ transported by **I** and **II** at varying ligand concentrations

Fig. 7: Comparison of concentrations of cations transported by **I** and **II** in competitive transport

Received, 22nd October 1998; Accepted, 27th April 1998
Paper E/7/07629K

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