

Dedicated to B.I. Buzykin on His 80th Anniversary

Membrane Extraction of Lithium and Sodium Ions with 2-Ethylhexyl Hydrogen [Bis(2-ethylhexyl)amino]methylphosphonate

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Abstract—Lithium and sodium ion transport through membranes impregnated with a solution of 2-ethylhexyl hydrogen [bis(2-ethylhexyl)amino]methylphosphonate in kerosene has been studied. Factors determining the efficiency and selectivity of membrane extraction have been determined. Introduction of neutral aminomethylphosphine oxide into the membrane phase has been shown to enhance the selectivity for lithium ions.

Keywords: extraction, membrane transport, transfer flow, selectivity, alkali metals, organophosphorus compounds

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In recent time, increased demand for lithium metal and lithium compounds (so-called “lithium boom”) is caused by a sharp increase in the use of lithium batteries as energy sources [1, 2]. It is known that the lithium content of the earth’s crust is not high, and constant growth of its production makes it necessary to resort to other promising but relatively poorly explored lithium sources such as natural brines and hydrothermal waters. In this connection, problems related to the environmental safety of metal extraction and separation processes become important. An appropriate method for extraction of lithium from concentrated brines may be membrane extraction [3]. The use of minimum amounts of organic reagents and retention of substrates in the membrane phase ensures minimization of the discharge of harmful compounds into the environment. Despite numerous published studies on membrane extraction of lithium [1–3], including extraction with organophosphorus reagents [4, 5], development of extraction systems based on selective

membrane transport of lithium from various brines containing sodium as the major concomitant and difficultly separable component remains a topical problem.

We previously demonstrated the possibility of membrane extraction of lithium ions from acidic aqueous solutions with synergistic mixtures of a neutral aminophosphoryl reagent, *N,N*-bis(dihexylphosphorylmethyl)octan-1-amine, and higher mono- and dithiophosphoric acids [4]. Herein we report the results of study that describe membrane extraction of lithium and sodium ions with the use of new extraction systems based on aminophosphoryl compounds, 2-ethylhexyl hydrogen [bis(2-ethylhexyl)amino]methylphosphonate (**1**) which was synthesized by us previously [6] and its mixture with a neutral aminophosphine oxide, dihexyl(octylaminomethyl)phosphine oxide (**2**), with the goal of estimating the possibility of using these compounds for selective extraction of lithium from lithium–sodium brines (Scheme 1).

Scheme 1.

