Lithium Isotope Separating Characteristics of Specific Lithium Adsorbents

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Summary

Lithium isotope effects shown by specific lithium adsorbents were investigated in batch and chromatographic experiments, with the final goal of developing a highly effective lithium isotope separation process. The adsorbents studied were two spinel-type manganese oxides, abbreviated as MnO_2(Li) and HMnO(2Mg), prepared by extracting Li or Mg from $LiMn_2O_4$ or Mg_2MnO_4, respectively. The major findings of the present work are summarized as follows:

(1) $(NH_4)_2S_2O_8$ was found to be a good extractant of Li or Mg from $LiMn_2O_4$ or Mg_2MnO_4 in preparing the adsorbents, if appropriate extracting conditions are strictly controlled.

(2) MnO_2(Li) and HMnO(2Mg) prepared in this work had high selectivity for the lithium ion among the alkali and alkaline earth metal ions and had large adsorption capacities for lithium, both equivalent to those in the literature.

(3) The two adsorbents captured the lighter isotope ^6Li more preferentially than the heavier isotope ^7Li from aqueous solutions. This tendency was the same as those observed in the cases of commercially available organic ion exchangers, crown ethers, mercury and so forth.

(4) The maximum values of the single-stage separation factor defined as $^7Li/^6Li$ isotopic ratio in the solution phase divided by that in the adsorbent phase were about 1.014 for both adsorbents at 25 °C. This value corresponds to lithium isotope effects one order of magnitude larger than those shown by organic ion exchangers. $LiMn_2O_4$ and Mg_2MnO_4 were thus not only excellect specific lithium adsorbents but potentially effective lithium isotope separators.

(5) In column chromatographic experiments using $LiMn_2O_4$ and Mg_2MnO_4 as packing materials, accumulation of single-stage lithium isotope separation effect was observed. However, further study has to be done to find optimum column operating conditions.