process of removing phosphorus using a phosphorus anion remover is essential. This complicates the process of converting Li_3PO_4 into $LiOH \cdot H_2O$ and Li_2CO_3 and causes lithium loss, so there is a problem in that efficiency of the process is reduced.

SUMMARY ~~OF THE INVENTION~~

The present ~~invention~~ disclosure is directed to provide a method of extracting lithium from a lithium solution by an economical, efficient, and simple method.

The present disclosure~~invention~~ is also directed to provide a method of preparing lithium carbonate or lithium hydroxide from a lithium solution by an economical, efficient, and simple method.

In an aspect, there is provided a method of extracting lithium, comprising:

adding a phosphorus source material to a first solution containing a lithium cation (Li^+) and an alkaline earth metal cation to produce a lithium precipitate containing magnesium, calcium, strontium, and phosphorus,

wherein the total concentration of the alkaline earth metal cations in the first solution is 100,000 mg/L or more.

In another aspect, there is provided a method of preparing lithium carbonate, comprising using the precipitate of the lithium extraction method as defined above.

In another aspect, there is provided a method of preparing lithium hydroxide, comprising using the precipitate of the lithium extraction method as defined above.

One ~~aspect~~ example of the present ~~invention~~disclosure provides a method of extracting lithium.

The method of extracting lithium includes adding a phosphorus source material to a first solution containing a lithium cation (Li^+) and an alkaline earth metal cations to produce a lithium precipitate including magnesium, calcium, and phosphorus, wherein the total concentration of the alkaline earth metal cations in the first solution is 100,000 mg/L or more.

The lithium precipitate may have a lithium dissolution rate of 25% or more, calculated according to the following Equation 2:

[Equation 2]

Lithium dissolution rate = A/B x 100

(in Equation 2, B = Total concentration of lithium cation contained in the lithium precipitate (units: mg/L),

the slurry of the lithium precipitate for 12 hours to 60 hours and then filtering the slurry to obtain a second solution, wherein the second solution may contain the lithium cation

The concentration of the lithium cation in the second solution may be 200 mg/L or more.

The method may further include adding 0.1wt% to 5wt% diluted hydrochloric acid in an amount of 5 to 20 times the weight of the lithium precipitate to the lithium precipitate at room-temperature, stirring the slurry of the lithium precipitate for 1 hour to 5 hours and then and then filtering the slurry to obtain a third solution, wherein the third solution may contain the lithium cation.

The concentration of the lithium cation in the third solution may be 200 mg/L or more.

The method may further include preparing lithium hydroxide or lithium carbonate from the second solution.

Another ~~aspect~~ example of the present ~~invention~~ disclosure provides a method of preparing lithium carbonate.

The method of preparing lithium carbonate includes using the lithium precipitate of the lithium extraction method of the present ~~invention~~disclosure.

Still another aspect of the present ~~invention~~ disclosure provides a method of preparing lithium hydroxide.

The method of preparing lithium hydroxide includes using the lithium precipitate of the lithium extraction method of the present ~~invention~~disclosure.

The present ~~invention~~ disclosure provides a method of extracting lithium from a lithium solution by an economical, efficient, and simple method.

The present ~~invention~~ disclosure provides a method of preparing lithium hydroxide or lithium carbonate from a lithium solution by an economical, efficient, and simple method.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent to those of ordinary skill in the art by describing exemplary embodiments thereof in detail with reference to the accompanying drawings, in which:

FIG. 1 shows the concentration of lithium cations remaining in the first solution and the lithium extraction rate according to a reaction time after a phosphorus source material is added to a first solution containing the impurities and lithium cations;

FIG. 2A shows a first solution containing the impurities and a lithium cation; FIG. 2B shows the slurry obtained after a phosphorus source material is added to the first solution of FIG. 2A and allowed to react; and FIG. 2C shows the appearance of the lithium precipitate including magnesium, calcium, strontium, and phosphorus, which is separated from the slurry obtained after a phosphorus source material is added to the first solution and allowed to react;

FIG. 3 shows X-ray diffraction patterns for lithium phosphate (Li_3PO_4); and

FIG. 4 shows lithium dissolution rates according to a stirring time when each of lithium phosphate and the lithium precipitate including magnesium, calcium, strontium, and phosphorus is added to 90 °C water and then stirred for 12 hours to 60 hours.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS