Group : Advanced Materials for Chemical Selectivity
Project : Selective recovery of lithium from water by modified Fe_3O_4 beads
Supervisors : Sevil Sahin, Louis de Smet

Keywords: Organic synthesis, ion-selectivity, magnetic beads, lithium recovery

Currently, lithium is recovered from mines and salt lakes, but these resources cannot sustain the increasing demand for lithium with the present annual production. In order to sustain the global lithium demand, future recovery of lithium should be generated more efficiently and possibly from novel resources. **We aim to develop a method for lithium recovery from dilute aqueous solutions.**

Various lithium-selective molecules (lithium ionophores) will be synthesized and attached on magnetic Fe_3O_4 beads. The synthesized lithium ionophores will have certain functional groups to facilitate the reaction between the ionophore and the amino ($-NH_2$) terminated magnetic beads (*Figure 1a*). The coupling reaction will be studied and optimized. The modified beads (*Figure 1b*) will be tested with different salt solutions to study the selectivity for lithium over interfering ions. In order to recover lithium, the beads will be separated from the solution by magnet (*Figure 1c*) and dried. Then, a solution at pH 2 will be used to discharge the beads.

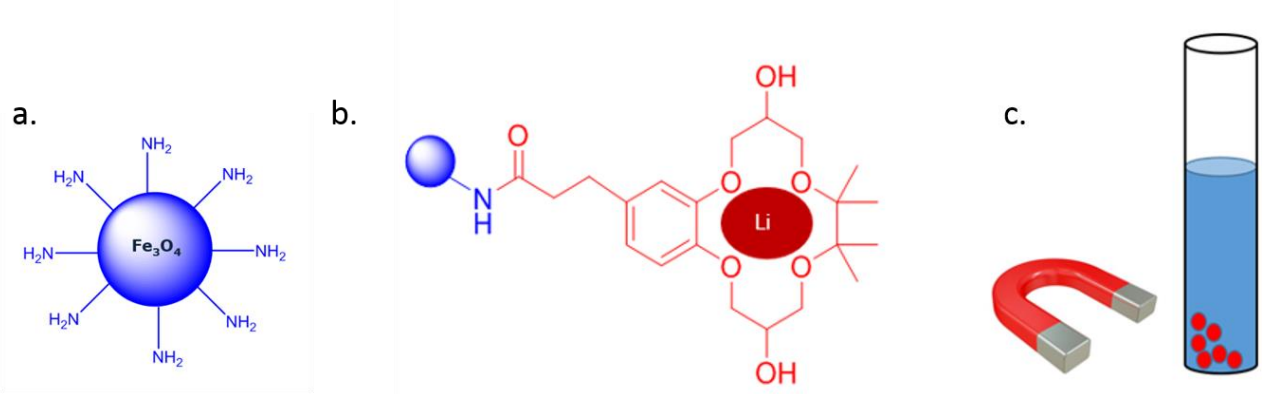

Figure 1: a. *The structure of amino terminated magnetic microbeads.* ***b.*** *Lithium ion captured by the modified bead.* ***c.*** *Schematic representation of magnetic separation of the beads from aqueous solutions.*

Opportunities for BSc and MSc students

- Lithium-selective Ionophores: Synthesis and characterization
- Coupling Reaction: Coupling the ionophores with the amino terminated beads
- Lithium Recovery: Selectivity over interfering ions and recovery of lithium

Techniques to be used

Synthesis (synthetic techniques, various chromatographic separation and isolation techniques, NMR, UV-Vis, IR, HRMS), surface modification (XPS, AFM, SEM, DLS), zeta potential experiments (in collaboration with the Chair of Physical Chemistry), analytical techniques to study the concentration of ions in aqueous solutions (*e.g.*, ion chromatography and ion-coupled plasma, in collaboration with the Chair of Environmental Technology).

Contact

Sevil Sahin, sevil.sahin@wur.nl, 0317-482375, Helix 7.037.
Louis de Smet, louis.desmet@wur.nl, 0317– 481268 / 82361, Helix 7.034.