Lithium recovery from wastewater using a hybrid supercapacitor

Seoni Kim, Minhyuk Im, Jaehan Lee, Jeyong Yoon

World Class University (WCU) program of Chemical Convergence for Energy & Environment (C2E2), School of Chemical and Biological Engineering, College of Engineering, Seoul National University (SNU)
Daehak-dong, Gwanak-gu, Seoul 151-742, Republic of Korea
alichino@snu.ac.kr, jeyong@snu.ac.kr

Lithium is considered as an important element in various fields including energy storage, medicine manufacturing and the glass industry. As the lithium ion batteries with large capacity are required for electric vehicles and energy storage systems, the demand for lithium is projected to grow rapidly.

Currently, the main process for lithium extraction is lime soda evaporation process from the brine lake water. However, this process takes 12-18 months for evaporation, which make the system difficult to satisfy the rapidly changing demands. In addition, it causes numerous environmental problems due to the increase of industrial waste.

Meanwhile, the electrochemical system can be a great alternative to the evaporation process when we want to recover lithium from brines, because this method can recover lithium in short time and without producing any hazardous byproducts. Also, we found that the wastewater of a battery recycling plant contains considerable amount of lithium ions, so we utilized the wastewater for lithium recovery instead of brine lake water.

In this study, lithium ions were recovered from the real wastewater using λ-MnO2/Activated Carbon hybrid supercapacitor system (Fig.1) with excellent performance and reliability. Lithium ions in wastewater inserted selectively in tetrahedral sites of λ-MnO2 and sulfate ions make electric double layer on the surface of activated carbon. This system enables to extract lithium ions from the wastewater and make a concentrated lithium solution only in 1-2 hours.

Fig.1 λ-MnO2/Activated Carbon hybrid supercapacitor system for lithium recovery from wastewater