The 3rd International Inn-ECOSysChem ERC Symposium

Next-Generation Technologies for Carbon Management and Renewable Energy

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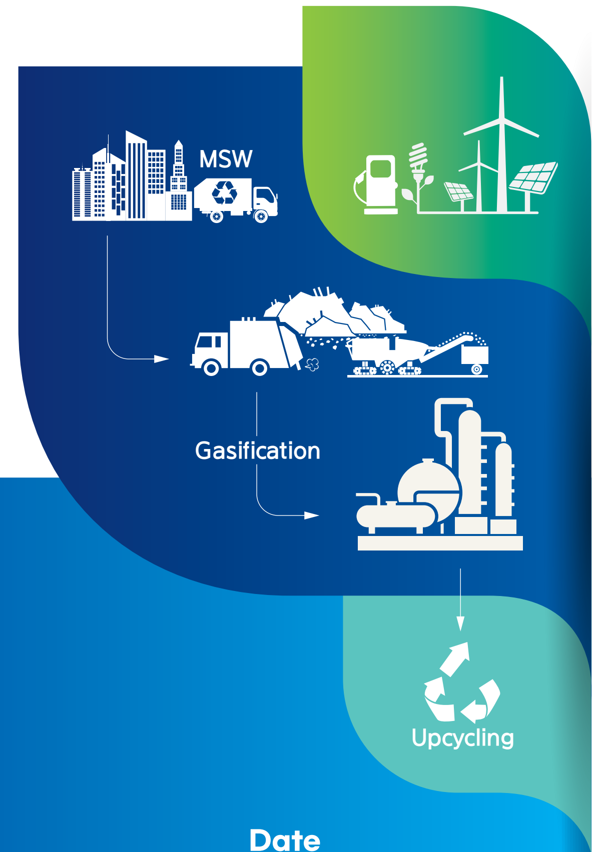

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The 3rd International Inn-ECOSysChem ERC Symposium

Next-Generation Technologies for Carbon Management and Renewable Energy

Gwangju Institute of Science and Technology

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Abstract NO. 05

Design of an LATP-Incorporated Cellulose Membrane for Electrochemically-Driven Lithium Extraction from Salt-Lake Brine

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Abstract

The extraction of lithium (Li^+) from salt-lake brine has received significant attention due to the abundant availability of Li^+ resources. However, there are inherent challenges for extraction because of the low concentration of Li^+ and the high levels of impurity ions present. In this study, we introduce a Li^+-selective membrane based on $Li_{1.3}Al_{0.3}Ti_{1.7}(PO_4)_3$ (LATP) incorporated within a cellulose acetate (CA) polymer, designed for use in electrically-driven systems. The membrane exhibited excellent ionic conductivity (0.677 $mS \cdot cm^{-1}$ at 300 K) and a low activation energy (0.15 eV) for Li^+, surpassing competing ions such as K^+, Na^+, Mg^{2+}, and Ca^{2+}. During binary solution tests, the membrane achieved Li^+ fluxes reaching 64.3 $mmol \cdot m^{-2} \cdot hr^{-1}$ and a Li^+/Mg^{2+} selectivity of 39.4. When tested under simulated salt-lake brine conditions, a lower applied current (-200 μA) showed more effective for Li^+ separation, with selectivity achieving at 467.3 for Li^+/Mg^{2+}. Furthermore, a two-step extraction process was developed, effectively reducing the concentrations of Na^+, K^+, Mg^{2+}, and Ca^{2+} from 6430-1084 ppm to 15.2-0.2 ppm. The highest selectivity obtained during this process was 543.6 for Li^+/Na^+. These results indicate that the LATP/CA membrane is highly promising as a Li^+-selective material for electrically-driven systems, offering a more sustainable approach to Li^+ extraction.

Abstract NO. 06

Optimization of Liquid-Liquid Extraction for Enhanced Acetic Acid Recovery from Acetogenic Fermentation Broth

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Abstract

With the urgent need to reduce greenhouse gas emissions in the petrochemical industry, CO gas fermentation using acetogenic bacteria is emerging as a promising way to sustainably produce platform chemicals. Notably, it utilizes gaseous substrates that are cheaper than sugar, such as industrial waste gas or syngas, to produce valuable compounds like acetic acid. Moreover, this process operates under milder conditions and requires less energy compared to catalytic chemical conversions of C1 gases. To date, various fermentation strategies have been employed to increase the low productivity, but research on separating acetic acid from actual fermentation broth remains limited. The development of efficient downstream processes is also crucial for successfully scaling up to a commercial level. In this study, liquid-liquid extraction was implemented using various solvents to improve the efficiency of acetic acid recovery from the acetogenic fermentation broth. The results showed a high distribution coefficient (Kd) with TOA 35% (w/w) in 1-octanol solvent, achieving an extraction efficiency exceeding 98%. Additionally, acidification and activated carbon treatment were employed to reduce impurities that interfere with extraction in the actual broth, further enhancing efficiency. Future study should focus on refining these processes to reduce costs and improve the overall sustainability of the production chain, ultimately paving the way for industrial application.