Transforming Agricultural Waste Into Green Technology for Lithium Enrichment From Dilute Brines

Liu, John (School: Mounds View High School)

Lithium is essential for rechargeable batteries, and demand is rising rapidly due to E-mobility and clean energy growth. About 66% of the world's lithium is produced through brine pond evaporation, a process requiring 18-24 months and causing significant land, water, and ecosystem impacts. A more efficient and environmentally responsible method for lithium pre-concentration is needed. This project uses the naturally porous structure of corn stalk pith (CSP), an agricultural byproduct, to develop a sustainable approach for lithium pre-concentration from brines. The 3D porous CSP enables coupled capillary wicking and evaporation, driving spatially resolved crystallization of ions based on their solubility. Evaporation kinetics, crystallization behavior, and separation performance were measured under controlled conditions. Ion distribution was analyzed using flame tests, microscopy, SEM, and elemental analysis. Untreated CSP increased evaporation rates from 0.008 to 0.05 kg/m?²/h?¹ (6.25× improvement), while hydrophilic surface treatments increased rates up to 0.48 kg/m?²/h?¹ (60× improvement) compared to open evaporation, due to CSP's high surface areas. Lithium selectivity (Li/Na by percentage) ranged from 68% to 72%. A combined tannic acid/chitosan treatment produced both the highest evaporation rate and Na/Li separation. The system consistently formed a Na-rich zone near the brine immersed base and a Li-rich zone near the evaporation front of the CSP. Lithium rich deposits were recovered by sectioning the upper region of the CSP. Compared with conventional brine evaporation methods, this passive and energy efficient process offers a promising, environmentally responsible pathway for lithium pre concentration using compostable agricultural waste.

Awards Won:

Second Award of $2,400

Office of Naval Research on behalf of the United States Navy and Marine Corps: The Chief of Naval Research Scholarship Award of $20,000