Beyond Traditional Methods: High-Performance Layered Double Hydroxides and Greener Keratin Composites for Selective Lithium Extraction from Brines

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Abstract (Arial 10)

The rising demand for lithium, driven by the rapid growth of electric vehicles and renewable energy technologies, has highlighted the need for efficient and sustainable extraction methods. Adsorption, a process in which substances adhere to a solid surface, is emerging as a promising and cost-effective approach for lithium recovery.
This study investigates the potential of layered double hydroxides (LDHs) and their derivatives as high-performance adsorbents for lithium extraction from synthetic brine. LDHs are layered materials with a unique structure that can be modified to enhance their adsorption properties. The use of a novel LDH exhibited a significant lithium adsorption capacity of 79.7 mg/g. To further optimize adsorption performance, the study explored the impact of surface functionalization on LDHs. By introducing negative functional groups onto the LDH surface, the researchers were able to substantially increase the adsorption capacity to up to 126.9 mg/g. Furthermore, the study investigated the use of a composite material combining LDH with waste-derived keratin. This composite demonstrated a substantial increase in lithium uptake, reaching 149.8 mg/g.
These findings highlight the potential of LDH-based materials, especially when functionalized or combined with other materials like keratin, as promising adsorbents for sustainable lithium recovery from brine solutions. Further research and optimization of synthesis conditions and adsorption parameters are necessary to translate these laboratory-scale results into practical, large-scale applications.