An efficient and renewable natural bead-type adsorbent for critical raw material recovery

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Critical Raw Materials (CRMs) are raw materials whose supply is very risky despite being economically and strategically significant for the European economy. These materials, which are used in environmental technology, steel production, consumer electronics, health, space exploration, aviation, and defense, are essential for market segments and potential future uses, as well as for the long-term health of the European economy [1]. In 2020, the European Union Commission announced a new list of critical raw materials, on which it included 30 raw materials containing the rare earth element group [2]. Critical raw material recovery from industrial and extractive waste appears to be necessary and has a strikingly high potential to support a sustainable and reliable supply. Nowadays, research focuses on hydrometallurgical approaches for separating and recovering valuable raw materials from industrial leftovers with the intention of recycling the recovered metals [1,3]. The search for efficient methods of recovering them continues. One of them is adsorption, and thus the development of new adsorbents using the best available techniques is required. Low-cost adsorbents with high adsorption capacity, selectivity, fast adsorption kinetics, and reusability are being sought.

In order to be an applicable new low-cost adsorbent, the bead-type adsorbent was prepared using alginate (ALG) as a matrix and chitosan (CS) as an additive. The removal of specific rare earth elements (for example La(III), Ce(III)) from aqueous solutions using alginate-chitosan (ALG@CS) beads was then investigated. ALG@CS beads had high adsorption capacities towards rare earth elements, and about 95% of the original removal efficiency was maintained after 6 cycles of the repeated adsorption-desorption process. The research findings reveal that ALG@CS composite beads can be used as a low-cost adsorbent for rare earth element recovery from aqueous solutions.

References

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