

## Selective adsorption of lanthanum ions with recyclable materials and experimental design using response surface methodology

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### ABSTRACT

It is necessary to better separate and recover rare earth elements from acid solution. The adsorbent that magnetic tripod ligand was synthesized was used to selectively adsorb lanthanum (La (III)). The adsorbent was characterized by transmission electron microscope, X-ray diffraction and Fourier-transform infrared spectroscopy. The adsorption effect of the adsorbent was studied by single-factor experiments, wherein the single factors included dosage, time, interfering ions and pH. For better predicting the test results, we used response surface methodology (RSM) to analyze the interaction between every single factor. Also, experiments on adsorbent recovery were carried out, and the adsorption mechanism was briefly discussed. The results of the study indicated that the magnetic tripod ligand was successfully synthesized. The predicted removal rate of La(III) can reach 99.42% by RSM with the dosage of 0.8 g/L, time of 100 min, and pH of 5. Moreover, the experimental results showed that the removal rate of lanthanum ion could reach 97.9%. After five cycles of reuse of the adsorbent, the adsorption effect was reduced to 78%. The reason for the high removal of La(III) by the adsorbent may be the important role of coordination chelation.

*Keywords:* Adsorption; Rare earth elements; Magnetic; Response surface methodology

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