Impact of Sodium Ion Stress on the Mechanism of Lead Ion Migration in Electrochemical Treatment of Lead-Contaminated Soil

Yinyin Zhang, Jiangtao Han*, Libin Zang

College of GeoExploration Science and Technology, Jilin University, Changchun 130026, China

* Correspondence: hanjt@jlu.edu.cn (J.H.)

Abstract:

This study specifically validates the migration patterns of lead ions under sodium ion stress in soil and concludes that a high concentration of sodium ions, when coexisting with lead ions, diminishes the migration rate of lead ions, consequently reducing the removal efficiency of lead ions.

Keywords: Electrochemical treatment; Lead-contaminated soil; Sodium ion stress; Lead ion migration mechanism; Competitive behavior.

The "ElectroElectrochemical" was revised as "Electrochemical".

1. Introduction

Treatment of lead-contaminated soil has become a prominent research concern, with electrochemical treatment (ECT) technology demonstrating significant potential in this regard. ECT not only overcomes the drawbacks of traditional technology of soil remediation, such as long remediation periods, low efficiency, and high costs, but also enables in-situ remediation. However, the influence of varying concentrations of non-contaminant ions on the removal efficiency of heavy metal ions during electrochemical treatment remediation of different naturally polluted soils remains unclear. Therefore, investigating the impact of sodium ion stress on the migration of lead ions is essential.

2. Methods

This study applies a DC power supply connected to the experimental device. The device was constructed using plexiglass and consisted of three compartments: the soil compartment, two electrolytic compartments. A multimeter was installed by wire between the DC power and the soil reaction device for monitoring the current.

3. Results

The study indicates a significant influence of the presence of sodium ions on the migration of lead ions during ECT. The high concentration of sodium ions induces ion competition in the soil, hindering the migration of lead ions and causing a decrease in their migration rate. Additionally, the competitive interaction between sodium ions and lead ions has a pronounced effect on the efficiency of ECT, leading to a reduction in the removal efficiency of lead ions.

4. Conclusion

These results emphasize the importance of considering sodium ion stress in the electrochemical remediation of lead-contaminated soil and provide valuable insights for optimizing electrochemical remediation strategies.