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Study of Adsorption and Desorption of Cs^+ Ions on Chitosan-Grafted Magnetic Bentonite

キトサン接合磁性ベントナイトのセシウムイオン吸着・脱着特性に関する研究

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1. Introduction

The effective removal of $^{137}Cs^+$ ions from radioactive nuclear waste solutions is crucial for public health. Therefore, an economic and high efficient sorbent for capture of radioactive Cs^+ ions from nuclear waste solutions is required and call for. Bentonite has the capacity to withstand intense radiation, elevated temperatures, and high cation exchange capacity. Based on these, magnetic bentonite which can be easy to separate from the solution has been chose. In this study, we use the radio frequency Ar-plasma-induced method to prepare chitosan-grafted magnetic bentonite (CS-g-MB). The adsorption and desorption of Cs^+ on CS-g-MB were investigated by batch techniques.

2. Experiment setup and conditions

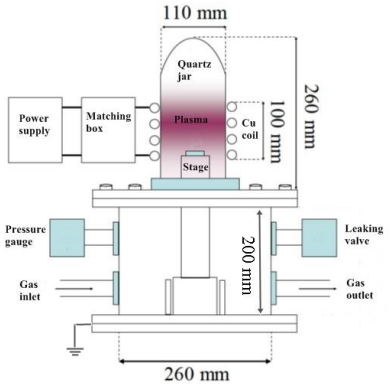

Fig. 1 Schematic view of experimental setup of inductively coupled RF plasma.

In this study, we used an inductively-coupled radio frequency plasma device, as shown in Fig. 1. The plasma-induced grafting chitosan on bentonite consisted of two successive processes: surface activation and chitosan grafting. The ICP-RF plasma chamber conditions were: Ar plasma pretreatment at pressure of 50 Pa, and power of 80 W for 10 min.

3. Experimental results and discussion

The comparison of the exchange efficiency for chitosan, bentonite, and CS-g-MB composites was shown in Fig. 2. The removal percentage was decreased in the order of chitosan < CS-g-MB < bentonite. There is obvious difference between chitosan and CS-g-MB composites. Previous researches showed that the -OH group could plays a very important role in the Cs^+ ion adsorption. However, in our case, we consider that the low removal efficiency of chitosan, it is strongly related to the structure of chitosan. In addition, decreased removal efficiency was observed in CS-g-MB composite compared to bentonite, which is closely related to the combination of reasons, the exfoliation of the bentonite layer and the exchange reaction between Fe^{3+} and the exchangeable cations of bentonite.

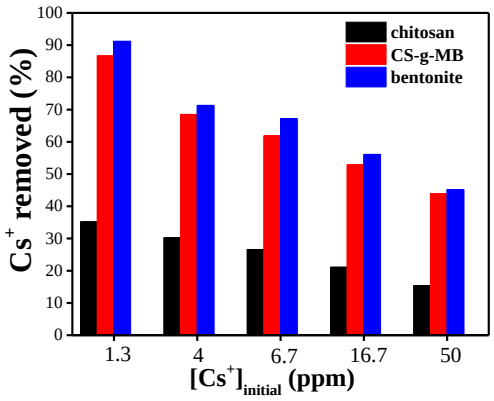

Fig. 2 Comparison of the removal percentage of Cs^+ ions obtained using different materials.

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