

Change of Adsorption/Desorption of Cesium on Illite Depending on the Ionic Strength of Ion Exchange Electrolyte

Sung Man Kim^{1,2}, Chan Woo Park¹, Il-Gook Kim¹, Kune-Woo Lee¹, So-Jin Park², and In-ho Yoon^{1*}

¹ Decommissioning Technology Research Division, Korea Atomic Energy Research Institute, 111, Daedeokdaero 989, Yuseong-gu, Daejeon, Republic of Korea

² Department of Chemical Engineering and Applied Chemistry, Chungnam National University, Daehakro 99, Yuseong-gu, Daejeon, Republic of Korea

*ihyoon@kaeri.re.kr

1. Introduction

Cs is known to selectively adsorb strongly to 2: 1 type clay minerals. Radioactive cesium is adsorbed on interlayer and weathered edges in clay minerals and on the outer surface of clay. Generally, frayed edge sites are formed by weathering illite, which is highly selective for Cs.

In this study, it was collapsed due to K^+ in the interlayer, so that other cation exchange ions were hardly adsorbed and other cation exchange electrolyte were adsorbed on illite because Cs desorption was difficult. In other words, we intend to confirm the adsorption / desorption and structural change of Cs by Ca^{2+} , Na^+ , K^+ adsorption, Ca^{2+} with high hydration energy and de-collapse between layers through ion exchange electrolyte at high concentration and increase CEC capacity.

2. Materials and Method

2.1 Materials

The clay used in the experiment was purchased from clay mineral society as an illite. Cesium chloride used for Cs contamination, Oxalic acid dehydrate for removing Cs from clay, Calcium chloride dehydrate used as an ion exchange electrolyte, Sodium chloride, Potassium Chloride was purchased from Sigma-Aldrich.

2.2 Preparation of ion exchange electrolyte adsorbed illite

Ion exchange electrolyte 0.01M is mixed with each electrolyte solution (50ml) in illite (5g), and electrolytic solution (20ml) is mixed with illite (2g) in 0.5M and shaken at 25 °C for 1day. After separating the solid and liquid, discard the supernatant and dry the solid sample.

2.3 Sorption experiment

CsCl solution (35ml) was added to the sample which was adsorbed to Illite (0.35g) in the previous step stirred at 30mM, 3 mM, 0.3 mM and 0.03 mM concentration at 25 °C for 7 days in a shaking incubator and adjusted to pH 7.0. In addition, the desorption experiment using oxalic acid was carried out in a shaking water bath at 80 °C for 3 days at a concentration of 0.015, 0.15, and 1.5M of oxalic acid on a sample adsorbed at the previous stage and adsorbed with CsCl (3 mM). Analysis was performed by inductively coupled plasma mass spectroscopy (ICP-MS; ELAN DRC II, PerkinElmer, USA) for filtering(0.45 μ m) the supernatant.

3. Results and Discussion

3.1 Adsorption characterization of ion exchange electrolytes

As shown in Fig. 1, the change of adsorption characteristics according to the ion exchange electrolyte was not significant. However, adsorption amount was adsorbed in order of Na^+ , K^+ , Ca^{2+} . The adsorption amount of Ca^{2+} decreased due to the largest hydration radius.

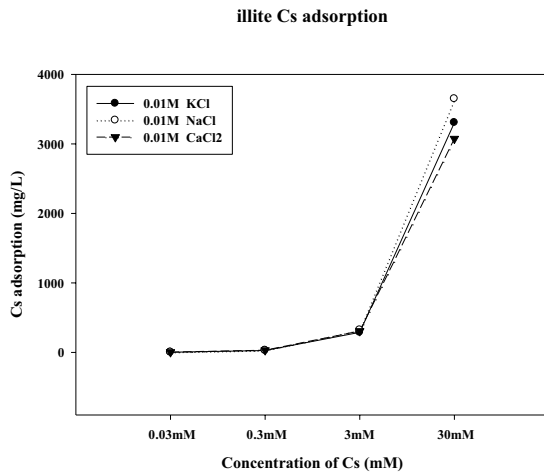


Fig. 1. Cs adsorption behavior on illite adsorbed ion exchange electrolyte(K^+ , Na^+ , Ca^{2+}).

3.2 Cesium desorption of illite by ion exchange electrolyte

The change of Cs desorption of oxalic acid in illite adsorbed ion exchange electrolyte was studied. As shown in Fig. (2), desorption rate increased with increasing desorbent concentration. However, there was not increase in CEC and desorption rate due to Ca^{2+} treatment, and the desorption rate of Na^+ was the largest.

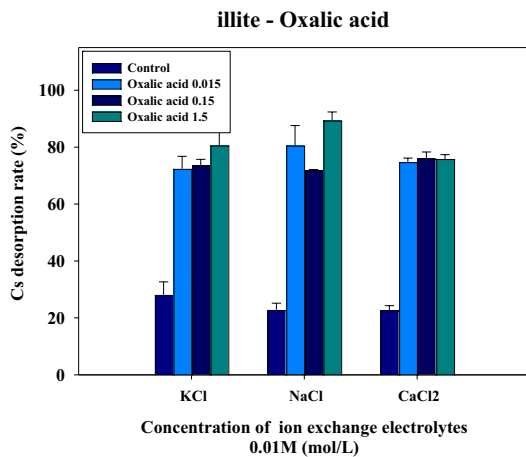


Fig. 2. Desorption characteristics of Cs by Oxalic acid treatment on illite adsorbed ion exchange electrolyte (K^+ , Na^+ , Ca^{2+}).

4. Conclusion

We have experimented to changes of adsorption and desorption depending on Na^+ , K^+ , Ca^{2+} ionic strength. However, as a result of experiments, we

could not confirm the large change according to the ionic strength. it was considered that one of the reasons why the concentration used for desorption of Cs was fixed at a low concentration of 3mM and could not be changed. Fortunately, we have found a good desorption effect on oxalic acid in 2:1 non-expandable clay.

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