A Strategy of Soil Washing Water Purification Using Selective Media

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1. Introduction

After permanent shutdown of Kori #1, Korea has developed various decontamination and decommissioning technologies. Due to the long period operation, Kori NPP's would be a little contaminated with radioactive material. Thus, it is necessary to develop the technology of soil washing and contaminated water purification. For this, Elim Global Inc. is developing the decontamination technology for contaminated soil management. This study introduced the characteristic of zeolite adsorbents and application of ion-exchange fibers for effective removal of activity.

2. Tech. of soil washing water purification.

Among of several technology such as sorption, ion-exchange, chemical precipitation, coagulation /flocculation and membrane separation, adsorption technology is noticeable technology because of no preparation, small amount of sludge and simple process without any energy consumption from the outside.

2.1 Zeolites as radioactive material adsorbents

Many studies have been carried out on decontamination of radioactive material in water using zeolite because natural zeolites as well as synthetic zeolites have good sorption capability, strong affinity for alkaline metal and high stability under high temperature. In addition, Previous study shows that the adsorption characteristics depend on the type and structure of zeolite. Thus, Zeolites that have good adsorption selectivity for radio-nuclides have been chosen through assessment for zeolite properties and assessment for sorption capability using simulated wastewater.

As shown in Fig. 1, zeolites are made of silicon dioxide and aluminum oxide. Si has a charge balance, but Al has a negative charge because it is trivalent. Adsorption takes place in an environment surrounding oxygen. (Fig.2).

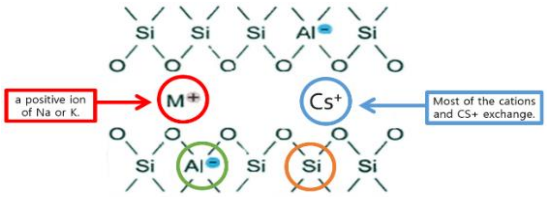

Fig. 1. Mechanism of cation adsorption of zeolite.

2.2 Natural Zeolite

Zeolites present in nature are cheaper than synthetic zeolites, but are a mixture of various natural zeolites and minerals. Adsorption study using rocks including zeolites can't represent the properties of a particular zeolite. Until this time, a study of various selective adsorption has assessed adsorption capability of particular natural zeolites through the systematic study. As reportedly did, natural zeolites have less adsorption capability than synthetic zeolite due to the inside impurities.

2.3 Manufacture of synthetic zeolite

Hydrated radius of ion influences cation sorption capability in water. Thus, the synthetic zeolite itself can be an adsorbent by synthesizing the structure that the hydrated radius of the adsorbate and size of the zeolite pores are similar. and then zeolites have high affinity with the adsorbate.

Even though powdered zeolites have an excellent sorption capability because of wide surface contact

area. These powdered zeolites are difficult to separate from wastewater. So, Zeolites is made in bead type through the immobilizing with polyvinylalcohol (PVA). Metal Ferrocyanide (MFC), which has highly adsorbent on Cs nuclide, is made of small parti- cle(about 30 nm) and exists in colloidal into water. So MFC has weakness of remarkably reducing the liquid to solid separation efficiency. But, Numerous pores of zeolites has a merit as supporter for other materials. And also, after adsorption and separation of nuclides using zeolite, it can be insolubilized by immobilization of radionuclides through pyrolysis at high temperature. So, if we could develop the technology of impregnation of selective media on zeolite material, we could use the various nuclides using high efficiency adsorbent.

3. Master plan for experiments

3.1 Adsorption experiments using zeolite

Adsorption capability will be assessed by lab-scale adsorption experiment using non-radioactive material after providing under the manufacturing method using ^{133}Cs of non-radioactive. The adsorption capability assessment uses Cs isotope because particular zeolites have a good adsorption capability for ^{137}Cs(half-life≈30.1 yr). [2]

Zeolites immerse in 50 mL of simulated wastewater polluted by the stable isotope, ^{133}Cs, and stir for 2.5 h. The wastewater then passes through a 0.20 ㎛ membrane filter, and the Cs^{+} concentration measures by inductively coupled plasma mass spectrometry. [2]

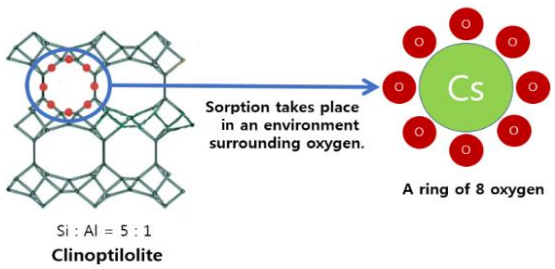

Fig. 2. Adsorption behavior of Cs.

3.2 Adsorption experiment on other nuclides

In the long term, adsorption technology for various nuclides besides Cs is required for water purification. Selected adsorbent by removal experiment using non-radioactive material will be used at hot laboratory for real testing. And also adsorption capability for the ß-nuclides such as ^{3}H, ^{14}C and ɣ-nuclides will be assessed by LSC and HPGe Detector. Finally, removal efficient testing of contaminated soil will be carrying out to evaluate the purification capability using selected adsorbent.

4. Conclusion

Next researches talk about synthesizing zeolite that has good adsorption capability for particular radionuclides and develop hybrid-treatment device of the synthesized zeolite and ion-exchange fibers and perform treatment experiments of wastewater from decontaminated soil-washing.

ACKNOWLEDGEMENT

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