Study on Adsorption of Heavy Metals and Radioactive Materials by Adsorbent from Fish Bone

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(1) <u>Research background</u>

Recently, the environmental pollution by heavy metals such as soil pollution in Toyosu has become a problem. The environmental pollution by heavy metals is very harmful to the human body. For example, arsenic causes bronchitis and liver cancer, hexavalent chromium causes skin cancer and lung cancer, and mercury causes kidney failure. It is urgent issues to remove heavy metals from the environment. In addition, in the incident at the Fukushima Dai-ichi NPS of Tokyo Electric Power Company in 2011, a large amount of radioactive materials were dispersed over a wide area, and there are still a wide range of forests that have not been decontaminated, and the volume of contaminated soil has not yet been reduced. In order to solve these problems, the adsorption characteristics of heavy metals and radioactive materials have been investigated with regard to fish bone derived adsorbents (hereafter referred to as FbA), which are recycled materials.

(2) <u>What's FbA?</u>

The FbA used in this study is made by calcination of fish bone and is a kind of calcium phosphate (See the picture on the right.). It is made by reusing fish bones discarded in fishery, etc., and is manufactured by simple work processes such as boiling and firing. Furthermore, it is inexpensive and can be expected to be mass-produced. In addition, the safety is high in the environmental aspect, because it is used in the medical aspect such as artificial bone and artificial tooth root.

(3) <u>Objectives</u>

The main purpose of this study is to grasp the basic adsorption performance, considering the removal of heavy metals and radioactive materials polluting soil and groundwater.

(4) <u>Experimental and analytical method</u>

1. Pour 300 mL of distilled water into a cylindrical container.
2. Add 10 mL each of cadmium, zinc, lead, nickel, manganese, iron, mercury (II) chloride, a solution of potassium dichromate in nitric acid, and a solution of diarsenic triate, sodium chloride, and acidic hydrochloride, and 5 mL each of a solution of cesium chloride and a solution of strontium carbonate in nitric acid. The samples are added to different containers and the experiments are carried out separately.
3. 10 pieces of the FbA (about 6.0 g) are put into a commercially available draining net and immersed for a fixed period (7 days).
4. After the immersion, the FbA is removed from the container and the solution is analyzed using ICP-AES (Cs Only AAS).

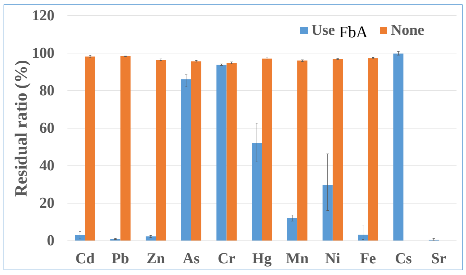

Fig. 1 Residual fraction of each ion

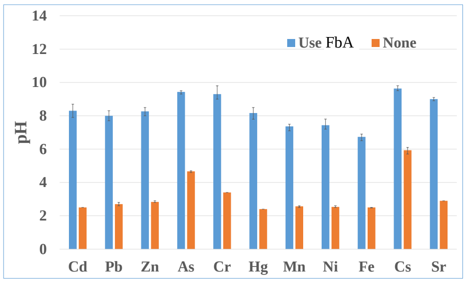

Fig. 2 pH of each test solution after the test

(5) <u>Experimental result</u>

In the experiment, the residual concentration (Fig. 1) and pH (Fig. 2) of ions in distilled water 7 days after immersion were analyzed. The experimental results are shown in the residual rate. In order to clarify the adsorption effect by the FbA, a sample without the FbA (None) was prepared for comparison purposes, and the experiment was carried out under the same condition. From Fig. 1, it can be seen that almost all ions remained in None, but the residual rate decreased when the FbA was used. In particular, almost all of Cd, Pb, Zn, Fe and Sr were adsorbed. It can be seen from Fig. 2 that pH changes from acidic to alkaline in all specimens when the FbA is used. This is thought to be due to the exchange with Ca contained in the FbA, and the adjustment of pH, etc. should be considered for the optimum adsorption.