Improvement of Pilot -Size Electro-Kinetic-Remediation Equipment of Cobalt and Cesium Contaminated soil

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1. Introduction

Electro-kinetic is the most efficient method to remove the radionuclide in the soil that has contaminated radionuclide from around nuclear facilities during the operation and decommissioning of those facilities in South Korea. This study researched the solution and improvement method concerning problems generated, when previously developed laboratory size electro-kinetic equipment, was scale upped to pilot size electro-kinetic equipment and had developed the improved equipment.

2. Problems of developed pilot size electro-kinetic equipment

2.1 Development of pilot size electro-kinetic equipment

Fig. 1 shows previously developed laboratory size electro-kinetic equipment, that has a capacity of 1L. Fig. 2 shows improved pilot size electro-kinetic equipment and that have a capacity of 50L.

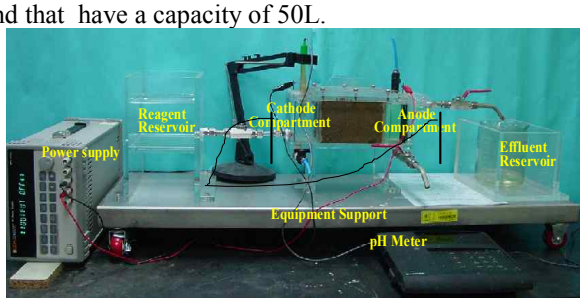

Fig. 1 **Manufactured 1L size electro-kinetic flushing equipment(old)**

Fig. 2 **Manufactured 50L size electro-kinetic flushing equipment(new)**

After equipment development, the soil was contaminated with ^{60}Co, ^{137}CS was remediated under the same conditions like laboratory size electro-kinetic equipment. But in the experiment of contaminated soil with ^{60}Co, ^{137}CS was stopped because metallic oxides stuck to cathode too much.

2.2 Problems of developed equipment

The experiment was stopped by produced metallic oxides stuck to the cathode plate. Produced metallic oxides had not been reported during the laboratory sizes equipment experiment. A summary of problems follows:
(1) Excessive metallic oxides occurrence in cathode
(2) Metallic oxides stuck to electrode
(3) Melting of filter paper and cathode wire net

Fig. 3 and Fig. 4 show metallic oxides occurrence and metallic oxides stuck to cathode plate.

Fig. 3 Metallic oxides occurrence

Fig. 4 Sticking of metallic oxides to cathode plate

3. Cause of problems and the solution

First experiment after development of pilot size electro-kinetic equipme nt was not continued because of too many problems which had been not occurred on experiment of 1L size electro-kinetic equipment, and table. 1 shows the problems and reason.

Table.1 Problems and reasons

No.	Problem	Reason
1	Occurrence of hydroxides	Increase of PH due to OH^- occurrence at the cathode
2	Sticking of metallic oxides to cathode plate	Stagnant of water
3	Melting of filter paper and cathode wire net	Increased equipment size and low acid resistance quality of the material
4	Occurrence of metallic oxides	Leaching of Metallic ion from the soil

This study analyzed the problems and reasons which occurred during the experiment of pilot size electro-kinetic equipment and suggest the methods for solving problems as following Table. 2.

Table. 2 Methods for solving problems

No	Methods for solving problems
1	- Attachment of pH auto adjustment system for prevention of hydroxides occurring
2	- Installation of circulation pump,
3	- Replacement of filter paper with PVC tamis - Replacement of cathode wire net with PVC net
4	- Circulation of leachate and removal of the sticking metallic oxides with H_2SO_4 solution

4. Application and conclusion

This study suggests methods for solving problems on the experiment of developed pilot size electro-kinetic equipment shown in Table. 2. Fig. 5 shows improved pilot size electro-kinetic equipment.

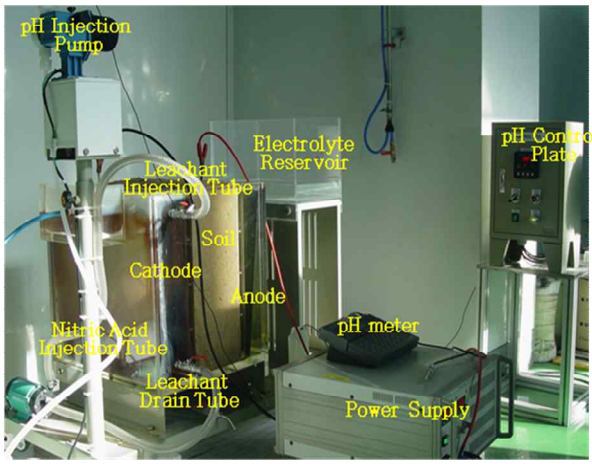

Fig. 5 Improved pilot size electro-kinetic equipment

Improved pilot size electro-kinetic equipment added a nitric acid injection tube to reduce of hydroxides through keep PH 2~3 and a rotation pump was added to reduce metallic oxides sticking at the cathode plate. Also a dredge valve was added for efficient stickwater changing when excessive metallic oxides occured. Lastly, the filter paper and the cathode wire net were replaced with a PVC tamis and a PVC net.

The improved equipment was able to decontaminate experiment with artificially contaminated and results of test, metallic oxides were decreased as possible to continue a experiment. Sticking metallic oxides at the cathode plate could be removed using the H_2SO_4 solution. Fig. 6 shows the recycling method using the H_2SO_4 solution. Fig. 7 shows the results of the experiment of decontaminant efficiency of ^{60}Co, ^{137}CS and Fig. 8 shows the analyzed results of cathode sticking metallic oxides.

(a) Immersion of cathode electrode in H_2SO_4 solution | (b) After removal of metallic oxides

Fig. 6 metallic oxides removal

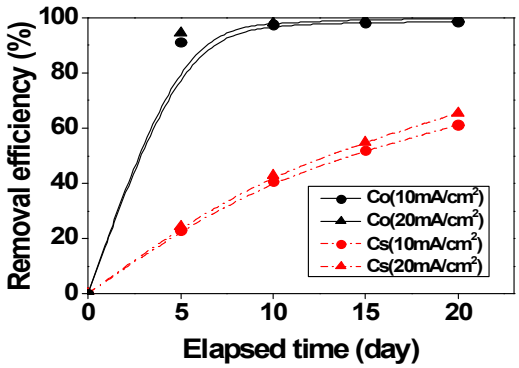

Fig. 7 Decontaminate efficiency of artificial contaminated soil

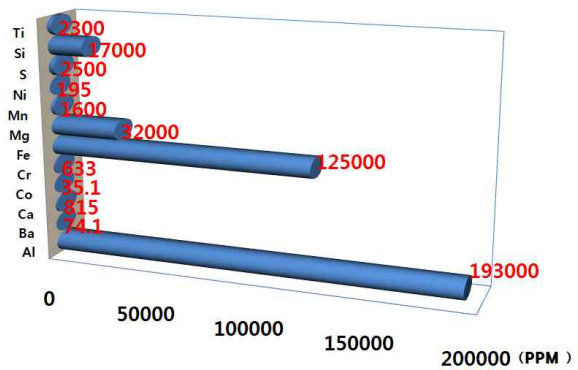

Fig. 8 Analyzed results of cathode sticking metallic oxides

Results of improved pilot size electro-kinetic equipment experiment were produced satisfactory results and hereafter it is necessary to experiment with contaminate soil around the nuclear facilities for application examination.

REFERENCES

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[2] Wang, J.Y.; Huang X.J.; Kao, J.C.M.; Stabnikova, O. Simultaneous removal of origanic contaminants and heavy metals from kaolin using an upward electro-kinetic soil remediation process. Journal of Hazardous Materials. 2007, B144, 292.