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The Development of Treatment Process Technology for Uranium Soil washing Leachate

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1. Introduction

Eectrokinetic treatment technology is a good method for removing radioactive substances such as U, Co, Cs; but it has a weakness. It takes a long time to get high removal efficiency. The Soil washing method compensates for this weak point with its short reaction time. and with this method it is possible to remove a lot of uranium-contaminated soil. But a great deal of leachate is generated. That is, about more amounts of leachate are generated for the decontamination of the same volume of radioactive soil using the electrokinetic equipment.

Therefore, the development of a treatment process for The Soil washing leachate is important so that there is a reduction of leachate waste volume and a choice of process.

Previously, studies for liquid radioactive waste were in process at various nuclear facilities. Nuclear fuel plant survey appropriate cohesion quantity of liquid waste of radioactive. Nuclear power plants manage liquid radioactive waste with centrifugation equipment.

In this study, the treatment technology for uranium Soil washing leachate generated on Soil washing decontamination for the soil contaminated with uranium was developed. A treatment process suitable to the contamination characteristics of Soil washing leachate was proposed.

2. Methods and Results

Table 1. shows condition for Soil washing method in uranium Soil washing leachate generated during Soil washing decontamination. Nitric acid is selected a solvent to decontamination as Soil washing method. Because another solvents as NaHCO3, HCl, H2SO4, occur to troubles that have bad efficiency, gas, oxided metal.

Table 1. Conditions of Soil washing experiment for soil decontamination.

Reagent	1M HNO_3	1M HNO_3	2M HNO_3
Mixing ratio	1:5	1:2.5	1:2.5
Scrubbing time(hr)	2	3	3
Sieve(mm)	0.075	0.075	0.075
Repetition(time)	3	2	2
Initial conc. (Bq/g)	42.2	49.6	42.1
Removal efficiency (Bq/g)(%)	4.09 (90.3%)	4.05 (91.8%)	3.73 (91.14%)
waste water(Bg/g(w))	0.82	1.52	1.36
Initial weight(g)	40	40	40
Remaining weight(g)	28.8	26.45	29.66
Remaining(%)	72	66.12	74.15

Previous research of leachate on Soil decontamination is based on the size of precipitate particles. Bigger precipitate particles are good to precipitate and lengthen filters. But the standard size of precipitate particles is not appropriate process of continuous leachate waste volume. A sedimentation test is suitable method for the leachate of Soil washing decontamination. Because sedimentation test make it possible to rapidly determine the value than measure the size of precipitate particle.

Fig. 1 shows precipitation with the lapse of time. The leachate of uranium electrokinetic does not settle down in the precipitant for several weeks. On the contrary Soil washing leachate settles down in the precipitant for several hours. In other words, the character of uranium electrokinetic leachate is distinct from Soil washing leachate.

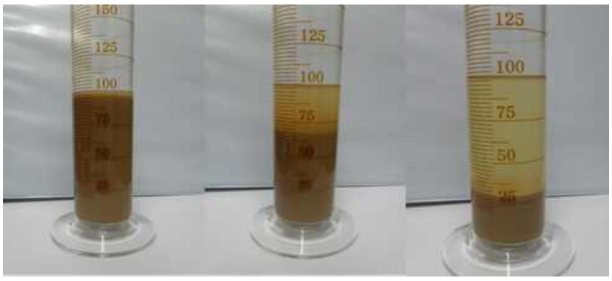

Fig.1 precipitation with the lapse of time.

A large volume of uranium Soil washing leachate was generated during the Soil washing decontamination experiment to remove uranium from radioactive soil.

The main process in the treatment of generated leachate is considered to be precipitation and filtration. Sodium hydroxide, calcium hydroxide, alum and magnetite are used as precipitants. When calcium hydroxide is put into the uranium leachate, the precipitation velocity is faster than Sodium hydroxide and the supernatant volume is larger, as shown in Fig. 2. Therefore, calcium hydroxide was selected as the precipitant.

For the estimation of the removal efficiency of uranium from uranium leachate, calcium hydroxide is used as a precipitant and aluminum sulfate is used as a cohesive agent. Also, in order to increase the particle size of the precipitate and to settle down rapidly, magnetite is used as a cohesion additive agent, and cohesive capacity is estimated

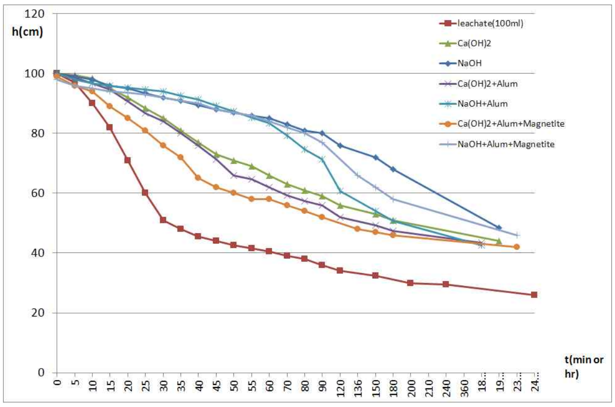

Fig. 2 Difference of Sedimentation that put in to the several cohesive agents.

The Settling velocity of original Leachate on Soil decontamination is faster than the others. But the original Leachate of Soil decontamination is a strong acid. Therefore original Leachate of Soil decontamination is hard to control and eats into metals. Accordingly, neutralization that weakens precipitation is needed. Cohesive agents increase sedimentation, the removal efficiency of uranium from the leachate precipitate though filtration also increases.

Fig. 2 shows the change in Settling velocity based on the cohesive agents at leachate. The results of the above settling experiments show that a mixture of $Ca(OH)_2$+alum+magnetite is an optimal precipitant for sedimentation due to its faster Settling velocity.

3. Conclusions

Original Leachate of Soil decontamination is hard to control and eats into metals. Accordingly, neutralization that weakens precipitation is needed. Cohesive agents increase sedimentation, when calcium hydroxide was put into a uranium leachate as a precipitant, the precipitation time was shorter in comparison with Sodium hydroxide. Besides, the mixture of $Ca(OH)_2$+alum+magnetite is more profitable than other chemical species, as shown in Fig. 2. Results of our precipitation experiments showed that a mixture of $Ca(OH)_2$+alum+magnetite is an optimal precipitant for sedimentation.

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