Development of washing Technology for a Radioactive Concrete Particle

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1. Introduction

A great volume of radioactive concrete is generated during the operation and the decommissioning of nuclear facilities in Korea. Until now it has been stared in a radioactive waste storage house. The main radionuclide in the concrete is uranium and radioactive concentration of concrete was below 20 Bq/g. Therefore, if the radioactive concentration of the concrete is decontaminated below a self-disposal basis concentration, the radioactive concrete can be disposed of in reclaimed land cheaper than the disposal cost at a middle-low level radioactive repository. In this study, the washing technology for concrete particle was developed to decontaminate the radioactive concrete generated during nuclear facility operation.

2. Contamination distribution of radioactive concrete particle

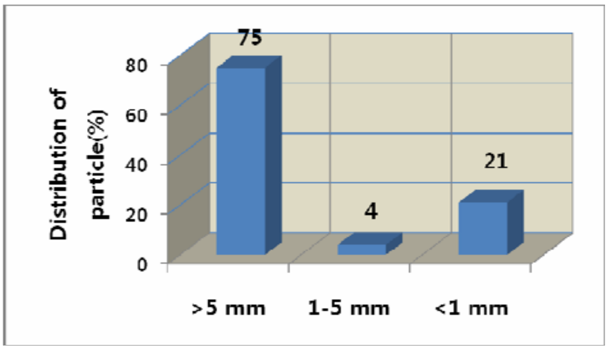

Fig. 1. Weight distribution of concrete particles based on size

First of all, the radioactive concrete contaminated with uranium which were sampled from radioactive facility were crushed by a thermic crusher.

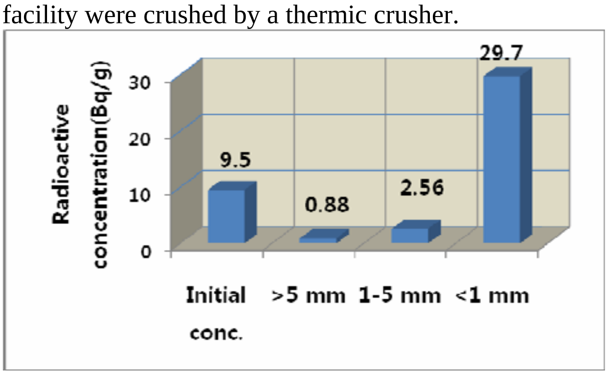

Fig. 2. Radioactive concentration of concrete particles based on size

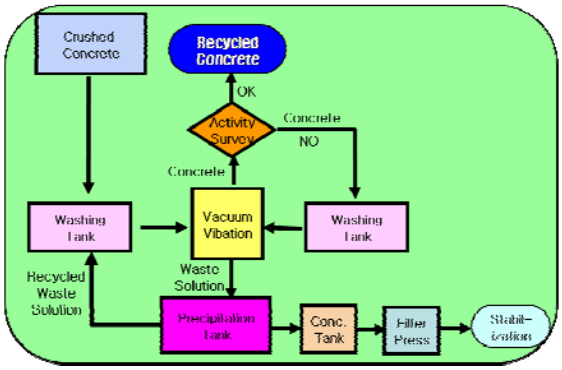

Fig. 3. Process diagram for concrete particle washing

The weight distribution of concrete particles based on their size and radioactive concentration of concrete particles based on their size are shown in Fig. 1 and Fig.2. The weight distribution percentage of the concrete particle whose size is more than 5mm was 75%. The radioactive concentration of a concrete particle whose size is more than 5mm was 29.7 Bq/g. Also, a process diagram for concrete particle washing is shown in Fig.3.

3. Experiments for radioactive concrete particles

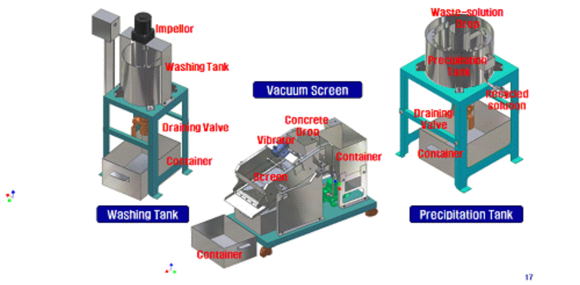

Fig. 4. Chemical washing equipment of 15L size for concrete particles

Chemical washing equipment of 15L size for concrete particle is shown in Fig. 4, which consists of washing tank, vacuum screen, and precipitation tank. Removal efficiencies of uranium along reagent type, mol number, and scrubbing time were measured for a decision of optimum washing conditions with washing equipment.

4. Results and Discussion

Results of washing experiments with 5 types of reagents by two time repetitions are shown in Fig. 5. Removal efficiencies with HCl, H_2SO_4, and HNO_3 were more than 90%. HNO_3 was selected as an optimum reagent due to its easy handling. Results of washing experiments with different mol numbers are shown in Fig. 6. 1.0 mol was selected as an optimum mol number of HNO_3, because an increasing rate of removal efficiency becomes smaller in case of an increase of above 1.0 mol.

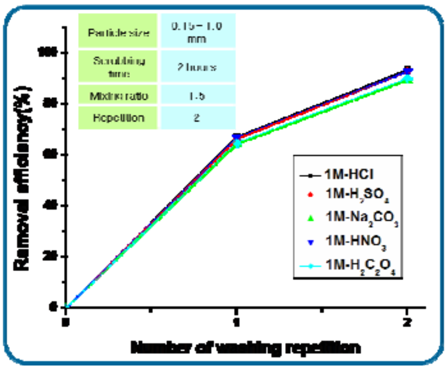

Fig. 5. Removal efficiency of uranium along reagent type

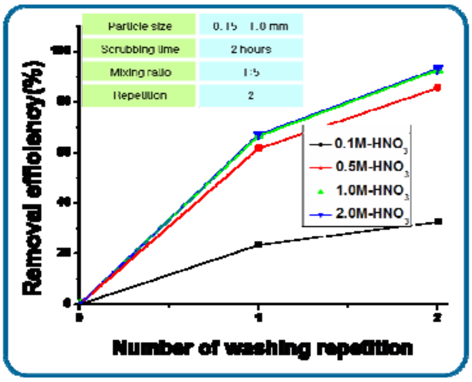

Fig. 6. Removal efficiency of uranium along mol number

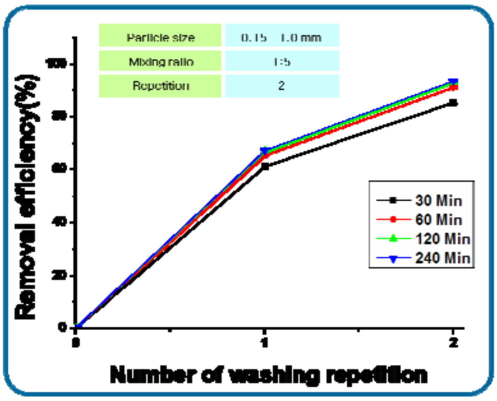

Fig. 7. Removal efficiency of uranium along scrubbing time

Results of washing experiments with different scrubbing times are shown in Fig. 7. 120 minutes was selected as an optimum scrubbing time, because an increasing rate of removal efficiency becomes smaller in case of an increase of above 120 minutes.

5. Conclusion

The washing technology for concrete particle was developed to decontaminate the radioactive concrete generated during nuclear facility operation. Removal efficiencies with HCl, H_2SO_4, and HNO_3 were more than 90%. HNO_3 was selected as an optimum reagent due to its easy handling. 1.0 mol was selected as an optimum mol number of HNO_3. Also, 120 minutes was selected as an optimum scrubbing time.

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