Effect of Particle-size Distribution on Chemical Washing Experiment of Uranium Contaminated Concrete

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1. Introduction

Taken down of nuclear institution was radioactive contaminated concrete over 70% of whole waste. Advanced countries have realized the importance of waste processing. Nuclear institutions keep a lot of radioactive contaminated concrete in internal waste storage. Therefore radioactive contaminated concrete disport to whole waste and reduce for self-processing standard concentration may be disposed of inexpensive more than radioactive waste storage.

This study uses mechanical and thermal technology for a uranium contaminated concrete process in Korea Atomic Energy Research Institute`s radioactive waste storage. Mechanical and thermal technologies are divided based on particle size. Each particles-sized concrete analyzed for uranium contamination using an MCA instrument. A chemical washing experiment was carried out.

2. Methods and Results

2.1 Experiments of crushing of mechanical, thermal processing

This experiment used crushed uranium contaminated concrete for a jaw-crusher instrument to test the mechanical method. The base concentration of the crushed uranium contaminated concrete was measured using an MCA instrument. It was heat treatment to thermal processing equipment for 1 hour at 450 ℃. At the same time, was more frittered to equipment. Less-crushed uranium contaminated concrete was crushed by the crusher device. Fig. 1 shows a photograph of the experiment on crushing uranium contaminated concrete.

Fig 1. Uranium contaminated concrete crushing test

After crushing, the concrete was separated into 2.0mm heavy aggregate, 1.0 ~ 2.0mm light aggregate, and 1.0mm fine powder through a mesh separation machine. The concentration of uranium in the isolated aggregates was using an MCA instrument.

2.2 Experiments of chemical washing decontamination

Particle-sized concrete was washed at a rate of 5ml of 1M-HNO_3 acid per 1g of fine powder and aggregate. Washing was conducted using a stirrer for two hours. The washing solution was exchanged, and additional stirring commenced for two more hours. The contaminated concrete and washing solution was placd in a chemical container.

Table 1. Conditions of decontamination experiment

Reagent	Particle Size (mm)	Mixing ratio	Scrubbing time(h)	Repetition
1 M HNO3	>1.0	1:5	2	2
	1.0-2.0	1:5	2	2
	2.0<	1:5	2	2

2.3 Results and Discussion

Particle-sized uranium-contaminated concrete was distributed in order of heavy aggregate < light aggregate < fine powder. First, the crushing weight was 2000g. The final crushing weight was reduced to 1749.5g. Water and powder existed in the concrete. These disappeared using the thermal processing equipment and crushing device. The analysis results of the initial uranium concentration showed 4.47Bq/g, and the concentration of particle-sized uranium-contaminated concrete showed the order of heavy aggregate < light aggregate < fine powder.

Table 2. Particles-size distribution and radiation detection

Particle size(mm)	Measured sample volumes(g)	Radiation conc. (Bq/g)
2.0mm <	35.5	0.80
1.0 ~ 2.0mm	1045.5	0.87
1.0mm >	660	11.48

The chemical decontamination results of uranium-contaminated concrete showed an efficiency removal of

fine-powder at 92.7%, light aggregate at 65.1% and heavy aggregate at 55.0%. Chemical washing was efficient for removal using two washing periods.

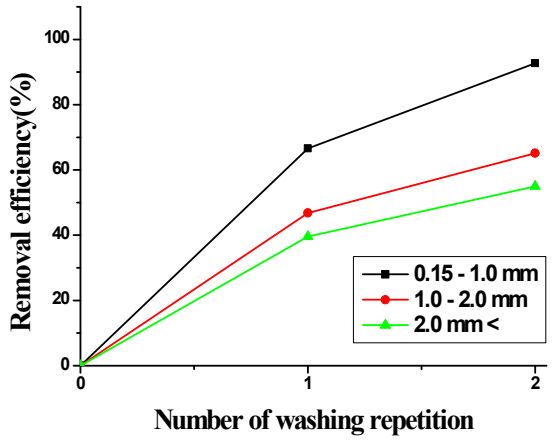

Fig 2. Results of washing experiments with scrubbing time for radioactive concrete particles

Table 3. Removal efficiency of particles-size distribution

Reagent	Particle Size (mm)	Initial conc.(Bq/g)	Removal efficiency(%)
1 M HNO3	>1.0	11.48	92.7 (0.84 Bq/g)
	1.0-2.0	0.87	65.1 (0.42 Bq/g)
	2.0<	0.80	55.0(0.38 Bq/g)

3. Conclusions

Uranium contaminated concrete is considered an effective method for separating concrete aggregate and uranium-contaminated parts using a heating device. After crushing, to reduce of weight was considered among other conditions various conditions that water and dust was removing. Decontamination of the separated fine-powder was possible with a high efficiency of 92.7% through only washing. Therefore, concrete is considered as an effective method for decontamination.

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