

Particle Separation of Non-Decontamination Soil using Attrition and Washing

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1. Introduction

Most soil has aggregates of several particles. The operation of an attrition scrubber enables the efficiency of the attrition scrubber to be optimized and the physical separation of contaminated soil to be possible. The operation of an attrition scrubber is a physical method. It enables the efficiency of particle operation to be maximized. It is also a pretreatment process technology for concentrating the contamination using particle separation [1]. The decomposition of a contaminated material by an ultrasonic reaction is regarded using a thermal reaction due to the radicals of the water molecules. An ultrasonic reaction is applicable to several industries on account of the chemical and physical effects from homogeneous and inhomogeneous systems. The sieve of the vibrating screen and the discharge of the separated particles are controlled by the rotation and counter rotation of the vibrator. The upper vibrating screen filters the rubbish from the soil. The lower vibrating screen separated fine granules from the soil. The fine granules are recycled or disposed using a hydro-cyclone process [2-3].

In this study, to improve the decontamination efficiency of uranium soil, a preliminary experiment on the particle separation of non-decontamination soil was carried out using attrition and washing. The characteristics of the attrition and washing system are investigated. A conditional experiment on particle separation of non-decontamination soil will be performed.

2. Attrition and Washing System

2.1 Attrition Scrubber Process

Fig. 1 shows the attrition scrubber system. It consists of an attrition scrubber, ultrasonic reaction, vibrating screen, hydro-cyclone, and filter press. To prepare a preliminary experiment on the attrition and washing system for the particle separation of non-decontamination soil, the ratio of soil (diameter 2mm, 30kg) to water (120kg) is mixed using a gauge, as shown in Fig. 2. The mixing liquid is scrubbed and washed for about 10 minutes by operating the impellers of two attrition scrubbers.

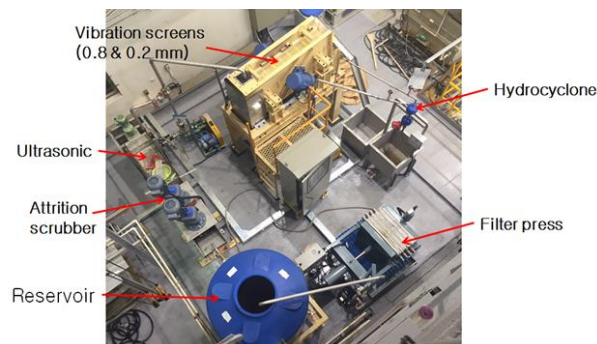


Fig. 1. Attrition and washing system.



Fig. 2. A gauge of water for the progress of work.

2.2 . Ultrasonic Reaction

After the attrition scrubber process, an ultrasonic reaction is conducted for about 10 minutes at frequencies of 330, 320, 290, and 320 Hz of the respective oscillator. Fig. 3 shows the ultrasonic reaction process. After conducting the ultrasonic reaction process, the mixing liquid of non-decontamination soil is sent to a stirring tank, as shown in Fig. 4.



Fig. 3. Ultrasonic reaction.



Fig. 4. Stirring tank.

2.3 Vibrating Screen Process

After stirring the mixing liquid of non-decontamination soil in a stirring tank, particles of 0.8 mm, 0.2~0.8 mm, and 0.2 mm are separated by operating the motor of a vibrating screen. According to the experiment procedure, the activity of the mixing liquid (particle soil of 0.8 mm, particle soil of 0.2~0.8 mm) is measured. If their activity is below the tolerable value, they are recycled. If their activity is above the tolerable value, the attrition and washing process is conducted again. Particle soil of 0.2 mm is sent to the hydro-cyclone.

2.4 Hydro-cyclone Process

After the vibrating screen process, particle soil of 0.2 mm is sent into the exit of the upper part of the hydro-cyclone. Particle soil of 0.2 mm is separated from two groups through the operation of the hydro-cyclone. The fine particles are discharged through the upper exit of hydro-cyclone process. The coarse particles are discharged through the lower exit of the hydro-cyclone. Fig. 5 shows particle soil of 75 μm and 75 μm ~ 0.2 mm with operation of the hydro-cyclone.



Fig. 5. Separation of particle soils.

3. Conclusion

A preliminary experiment on the particle separation of non-decontamination soil was carried out to improve the decontamination efficiency of uranium soil. This experiment was performed with the ratio of soil to water (1:4) for the particle separation of non-decontamination soil. The operations of all equipments such as attrition scrubber, ultrasonic reaction, vibrating screen, and hydro-cyclone were conducted and confirmed. In the future, the additional experiments will be conducted for optimal experimental condition.

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