

Measurement of Physical Strength of Fixed Soil by Polyelectrolyte Complex

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1. Introduction

It is serious environmental problem that a radioactive contaminated soil by accident of nuclear power plant spread to a residential area and soils by wind and water. According to the analyzed results for radioactive contamination of the soil most of the radioactivity concentrated within 5cm of the soil surface. The radioactive materials such as Cs-137 may hazards to human or the environment because of long half-life (30.2years). Therefore, it is necessary a proper characterization and remediation methods and techniques in order to reduce the radiological hazards to acceptable levels.

In order to prevent the diffusion of a radioactive soil, a soil fixation methods which can prevent a spread of radioactive material by floating on the soil surface have been developing by using polyelectrolyte [1-4].

Polyelectrolyte which consists of polycation and polyanion make into polyelectrolyte complexes (PEC) in a aqueous solution. PEC can fix soil particles by flocculation and formation of crust between soil and polymer due to electrostatic interaction positive and negative charge. But the preparation of optimized PEC for the fixation of contaminated soil is difficult that polyelectrolyte have many complicated behavior as mixed condition.

In this study, in order to find optimized condition and to define interaction mechanism between soil and PEC, we investigated physical strength of fixed soil as treating condition of polyelectrolyte complex solution.

2. Methods and Results

2.1 Preparatin of PEC Solution

Polyelectrolyte complexes (PEC) was made of cationic polymer, Polydiallyldimethyl ammonium chloride (PDADMAC, molecular weight = 100,000, 250,000 and 450,000), and anionic polymer, carboxymethyl cellulose sodium (CMC, molecular weight = 90,000).

To prepare the PEC solution KCl dissolved in water and 10 wt% PDADMAC solution added to the salt solution and then 1~2 wt% CMC solution was added slowly with stirring. Three kinds of PEC solution prepared based on PDADMAC molecular weight.

2.2 Measurement of Physical Strength of fixed soil

Soil for fixation used sea sand (Waco chemical, 25-35 mesh) because the size of soil near nuclear power plant composed of sand with the range of 4.75 mm to 0.075mm.

To prepare fixed soil samples with polymer molecular weight, each 6ml PEC solution with different molecular weight added to 16g of soil and then dried at room temperature during two week. Also a physical strength of fixed soil were measured with number of adding PEC solution. The measurement of physical strength of fixed soil were performed by using universal testing machine.

3. Results

Table.1 show the ratio of sand, gravel, silt and clay of soil samples which were based on the analysis of particle size of soil samples.

Table.1 Ratio of size for the soil samples

Particle size distribution		
Gravel (> 4.75mm)	Sand (4.75 ~ 0.075mm)	Silt & Clay (< 0.075mm)
3.5% ~ 21.3%	72.4% ~ 90.97%	5.18% ~ 16.81%

Fig. 1 show the measurement device of physical strength for fixed soil which were the disk type with the diameter of 5cm and the height of 1.5cm.



Fig. 1. Universal testing machine for the measurement of physical strength and image of fixed soil sample which were the disk type with the diameter of 5cm and the height of 1.5cm.

Fig. 2 show the results of measurement for physical strength of fixed soil by PEC solution. As the increasing the number of adding PEC solution and the molecular weight of PDADMAC, the physical strength of fixed soil sample increased. From the results, physical strength of fixed soil is affected to numbers of adding PEC solution more than a molecular weight of polymer

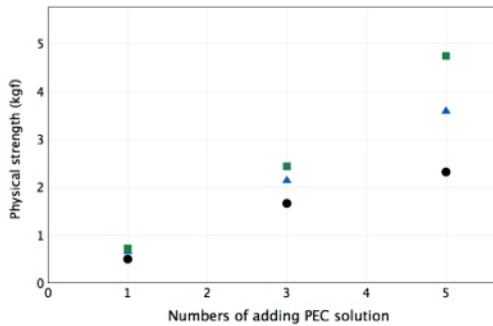


Fig. 2. The change of physical strength of fixed soil with the numbers of adding PEC and molecular weight of polymer

4. Conclusion

The physical strength of fixed soil were increased with increasing numbers of adding PEC solution and the molecular weight of polymer. A molecular weight of polymer and amounts of polymer affected to the condition of soil fixation.

To preparation of optimized PEC solution and to fine optimized condition for fixation of contaminated soil, it also have to considered various factors such as the effect of salt, ion in the soil, pH of PEC solution, water in soil and chemical components of soil in the interaction of soil and polymer.

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