

Decontamination of the ground by the Fukushima nuclear accident.

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Abstract

A lot of radioisotope was emitted by the accident of the first nuclear power plant of Fukushima in an East Japan great earthquake. The purpose of this research is to wash the ground of radioactive contamination. The safety of a schoolyard and a park is secured and the society which can live in comfort is aimed at. The radioisotope of agricultural products is reduced and it aims at stable eating habits.

Ground 10 g and each solution which were extracted from Fukushima Prefecture were put into the beaker, and the whole capacity was set to 500 ml. It agitated 200 times, the solution filtered using filter paper was measured by Becquerel-Monitor, and it measured by radioactivity per liter. Solution is pure water, 3.6% chloride, and macromolecule polymer of 10 time dilution, pH 12 alkaline water, and chitosan solution of 100 time dilution. Macromolecule polymer solution is used for the printing technique of a fiber. Alkaline water is created by dissolving the powder of a scallop in water. It is macromolecule polymer solution that was the most efficient and it showed one about 5.8 times the ratio of this. The cesium 137 adhering to the ground pasted macromolecule polymer, and has judged that it separated from the ground. The decontamination effect of chloride was about 3.5 times the pure water. It seems that chloride reacted with cesium and had the decontamination effect by a chemical reaction. Chitosan solution was effective from the consideration to fields. The chitosan used in agriculture can be used in comfort. Chitosan shows 2.7 times and is the large method of expectation.

The method of decontaminating the ground using various solutions can be chosen according to a use. This suggested possibilities that it could decontaminate, such as a schoolyard, a park and fields, and a forest.

Key Words: Decontamination, Fukushima nuclear power plant, Dosimetry

Purpose

It aims at decontaminating by washing with solution to the soil of radioactive contamination. This research aims at the society which feels easy and can live by securing the safety of a life of a schoolyard, a park, etc. The shift of radioisotope to vegetables is reduced and stable eating habits are carried out.

Methods

Soil 10 g extracted from Fukushima Prefecture was put into the beaker of 500 ml, and the whole capacity was set to 500 ml by adding solution. It agitated 200 times, the solution filtered using filter paper after that was measured by Becquerel-Monitor, and it measured by radioactivity per liter. The number of the used solution is five and it is pure water, 3.6% chloride, macromolecule polymer solution of 10 time dilution, pH 12 alkaline water, and chitosan solution of 100 time dilution. Among these, macromolecule polymer solution is used for the printing technique of a fiber, and alkaline water is created by dissolving the powder of a scallop in water.

Result and Discussion

The rate of a ratio of concentration in comparison with the radioactivity per liter. And pure water which was detected with each solution is described in Table 1.

Table 1 The decontamination result for every solution

	Raw water	Chloride	Macromolecule polymer	Alkaline water	Chitosan
Activity concentration	105 Bq/l	370 Bq/l	612 Bq/l	178 Bq/l	286 Bq/l
Ratio	100%	352.4%	582.9%	169.5%	272.4%
Dilution magnification		3.6%	10 times	pH12	100 times

The value of activity concentration means that radioisotope shifted to solution from soil by having washed soil. Washing soil with water is computing the ratio of activity concentration with pure water in the meaning which compares the efficiency, although a Fukushima within the prefecture is carried out. Therefore, a thing with these larger values has the higher decontamination effect.

It is macromolecule polymer solution that was the most efficient and it showed one about 5.8 times the ratio of this. Macromolecule polymer makes it the principle to be used for the printing technique of a fiber and to paste up ink on a fiber. ¹³⁷Cs adhering to soil pastes macromolecule polymer, and can judge that it has dissociated from soil. Next, chloride is efficient and it showed one about 3.5 times the ratio of this. It seems that chloride reacted with cesium and had the washing effect by a chemical reaction. However, since chloride serves as highly poisonous substance use, sufficient consideration is required for the use to general soil and fields. Chitosan

solution is effective from the field of the consideration to fields, and since the agricultural field is also used, chitosan can be used in comfort. Comparatively as high also as a ratio a numerical value as 2.7 times is shown, and it is the large method of expectation. As the consideration, chitosan made the complex from the relation with ^{137}Cs in soil, and considers that it made ^{137}Cs separate from soil by that cause. Since alkaline water was uniquely generable using the shell of a scallop, it was cheap, but the conspicuous decontamination effect which is used for general cleaning did not show up.

Conclusion

It is very important to decontaminate the polluted soil, and if it is not performed efficiently, it does not become a safe life. Soil must be divided into various kinds, such as a domain of livelihood, fields, a forest, and must be considered. The method of performing soil washing using this various solution can be chosen according to the use, and brought the result of having fully expressed effect nature. This suggested possibilities that it could decontaminate, such as a schoolyard, a park and fields, and a forest.

Moreover, in absorption control verification of radioisotope performed before, chitosan is decreasing the space dose of radiation in soil 1 cm quantity. Although based on the quantity of the chitosan mixed with soil, the space dose of radiation was 30 to 70% of reduction. By sprinkling chitosan to the soil polluted from this, a space dose of radiation is decreased and it is thought that decontamination of soil is possible.