Geophysical Research Abstracts
Vol. 16, EGU2014-9711, 2014
EGU General Assembly 2014

Accumulation and chemical states of radiocesium by fungus *Saccharomyces cerevisiae*

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After accident of Fukushima Daiichi Nuclear Power Plant, the fall-out radiocesium was deposited on the ground. Filamentous fungus is known to accumulate radiocesium in environment, even though many minerals are involved in soil. These facts suggest that fungus affect the migration behavior of radiocesium in the environment. However, accumulation mechanism of radiocesium by fungus is not understood. In the present study, accumulation and chemical states change of Cs by unicellular fungus of *Saccharomyces cerevisiae* have been studied to elucidate the role of microorganisms in the migration of radiocesium in the environment.

Two different experimental conditions were employed; one is the accumulation experiments of radiocesium by *S. cerevisiae* from the agar medium containing ^{137}Cs and a mineral of zeolite, vermiculite, smectite, mica, or illite. The other is the experiments using stable cesium to examine the chemical states change of Cs. In the former experiment, the cells were grown on membrane filter of 0.45 μm installed on the agar medium. After the grown cells were weighed, radioactivity in the cells was measured by an autoradiography technique. The mineral weight contents were changed from 0.1% to 1% of the medium. In the latter experiment, the cells were grown in the medium containing stable Cs between 1 mM and 10mM. The Cs accumulated cells were analyzed by SEM-EDS and EXAFS. The adsorption experiments of cesium by the cells under resting condition were also conducted to test the effect of cells metabolic activity.

Without mineral in the medium, cells of *S. cerevisiae* accumulated 1.5x10^3 Bq/g from the medium containing ^{137}Cs of 2.6x10^2 Bq/g. When mineral was added in the medium, concentration of ^{137}Cs in the cells decreased. The concentration of ^{137}Cs in the cells from the medium containing different minerals were in the following order;

smectite, illite, mica $>$ vermiculite $>$ zeolite. This order was nearly the same as the inverse of distribution coefficient of mineral for ^{137}Cs in the medium solution. The concentration of ^{137}Cs in the cells lowered in the medium containing higher mineral content. These results indicate that radiocesium was competively accumulated in the cells with minerals in the soil. Higher concentration of stable Cs was accumulated in the cells in the metabolically active condition than in the resting cells condition. XAFS analyses showed that the k^3-weighted extended-XAFS functions and the radial structural function of Cs accumulated by the cells in the metabolically active condition were similar to those in the resting condition, indicating that chemical states of the accumulated Cs were nearly the same between both conditions. These results indicate that the fungus accumulates radiocesium by competitively with minerals in the soils, and performs higher retardation of the migration of Cs in the metabolically active condition than the resting one.

A part of this study is the results of "Multidisciplinary investigation on radiocesium fate and transport for safety assessment for interim storage and disposal of heterogeneous waste" carried out under the Initiatives for Atomic Energy Basic and Generic Strategic Research by the Ministry of Education, Culture, Sports, Science and Technology of Japan.