

International Session (Oral) | Symbol A (Atmospheric, Ocean, and Environmental Sciences) | A-GE Geological & Soil Environment

## [A-GE03\_30AM2]Subsurface Mass Transport and Environmental Assessment

Convener:\*Yasushi Mori(Graduate School of Environmental and Life Science, Okayama University), Hirotaka Saito(Department of Ecoregion Science, Tokyo University of Agriculture and Technology), Ken Kawamoto(Graduate School of Science and Engineering, Saitama University), Shoichiro Hamamoto(Department of Biological and Environmental Engineering, The University of Tokyo), Ming Zhang(Institute for Geo-Resources and Environment, National Institute of Advanced Industrial Science and Technology), Chair:Yasushi Mori(Graduate School of Environmental and Life Science, Okayama University), Ming Zhang(Institute for Geo-Resources and Environment, National Institute of Advanced Industrial Science and Technology)

Wed. Apr 30, 2014 11:00 AM - 12:44 PM 213 (2F)

This session covers the topics on mass transport, water and energy cycles in geoenvironment. Subjects related to laboratory and field measurements, theoretical analysis, and numerical modeling will be discussed. Presentations on geo-pollution, remediation, geological disposal of hazardous wastes, ground source heat utilization, mass transport in vadose zone, soil-water monitoring, and environmental assessment are encouraged.

12:20 PM - 12:35 PM

## [AGE03-P07\_PG]Remediation of a Tsunami affected saline and sodic soil by calcium carbonate and rice straw

3-min talk in an oral session

\*Sakuya ISHIBASHI<sup>1</sup>, Taku NISHIMURA<sup>1</sup>, Shoichiro HAMAMOTO<sup>1</sup>, Hiromi IMOTO<sup>1</sup> (1. Graduate School of Agricultural and Life Sciences, The University of Tokyo)

Keywords: Tsunami affected soil, saline and sodic soil, rice straw, calcium carbonate

Japanese government recommends leaching of soluble salts as well as adding calcium amendments for remediating saline and sodic soil after Tsunami by the earthquake on March 11, 2011,. Application of calcium carbonate ( $\text{CaCO}_3$ ) is recommended for soils having pH lower than 6 and calcium sulfate ( $\text{CaSO}_4$ ) is that for pH higher than 6. However, since  $\text{CaCO}_3$  has low solubility to water, it has not been often used in reclamation of sodic soils (Shainberg et al, 1989). Solubility of  $\text{CaCO}_3$  is controlled by  $\text{CO}_2$ - $\text{H}_2\text{O}$ - $\text{CaCO}_3$  equilibrium in water. The concentration of calcium ion in  $\text{CaCO}_3$  solution is affected by  $\text{CO}_2$  concentration (partial pressure) of air phase. The higher partial pressure of  $\text{CO}_2$  causes the higher concentration of  $\text{Ca}^{2+}$ . In general, addition of organic matter may enhance soil respiration and increase partial pressure of  $\text{CO}_2$  in soil. This might potentially enhance solubility of  $\text{CaCO}_3$  and increase  $\text{Ca}^{2+}$  concentration in soil solution. Increase in  $\text{Ca}^{2+}$  concentration in soil decreases exchangeable sodium percentage (ESP) of the soil. Lower ESP may inhibit soil dispersion and help to keep aggregation. Stability of aggregates has a role on soil permeability, and it affects efficiency of leaching practice. Objective of this study was to investigate the effect of changes in partial pressure of  $\text{CO}_2$  by organic matter decomposition on dissolution of  $\text{CaCO}_3$ , and subsequent  $\text{Na}^+$ - $\text{Ca}^{2+}$  ion exchange of a Tsunami affected soil. Soil was collected at a former paddy field at Terashima, Miyagi, Japan, where was damaged by Tsunami at the Great East Japan Earthquake. EC (1:5) of the soil was  $5.2 \text{ dS m}^{-1}$ . The soil was mixed with rice straw and/or  $\text{CaCO}_3$ , and then packed into plastic columns of an inner diameter of 8.5cm and 20cm-high with the bulk density of  $0.95 \text{ g cm}^{-3}$ . Amount of rice straw and  $\text{CaCO}_3$  application was  $10 \text{ t ha}^{-1}$  and  $1 \text{ t}$

ha<sup>-1</sup>, respectively. The soil columns were incubated for 23 days. During the incubation, 18mm of water was supplied for each three days. The temperature inside and around the columns, and soil water pressure were continuously monitored. The CO<sub>2</sub> concentration in soil air phase was measured at 5-days interval. After the incubation, the columns were leached by 4 pore volumes of 4mmol L<sup>-1</sup> KCl solution with. The leachate was collected for further analysis of EC, pH and concentration of cations. After the leaching, the soil columns were separated to 3cm thick layers. Each 3cm thick soil sample was used to measure EC, pH, soluble cations, and exchangeable cations of the soil. In average, soil CO<sub>2</sub> concentration inside the column was high under the rice straw treatment regardless of CaCO<sub>3</sub> application. The CO<sub>2</sub> concentration rose at the periodical water application, and gradually decreased with time. Rise in CO<sub>2</sub> concentration could be due to the enhanced organic matter decomposition and the restricted CO<sub>2</sub> diffusion by higher soil water content following the water application. Exchangeable cations of the column soil were measured after the leaching. Exchangeable Ca<sup>2+</sup> slightly increased at whole layer of the four treatment. Increase in exchangeable K<sup>+</sup> coincided with decrease in exchangeable Na<sup>+</sup>, suggesting ion exchange between Na<sup>+</sup> and K<sup>+</sup> was a dominant reaction during the leaching. In this experiment, the effect of organic matter and CaCO<sub>3</sub> application on remediation of the Tsunami affected saline and sodic soil was not clear. With fluctuating soil water content, soil CO<sub>2</sub> concentration was not always high during the column incubation experiment. It is expected that depression of soil CO<sub>2</sub> concentration with decrease in soil moisture after water application could not enhance dissolution of applied CaCO<sub>3</sub>.