Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

AGE030-P11 Room: Convention Hall Time: May 26 17:15-18:30

Retention and transport of dissolved organic carbon from sugarcane-molasses ethanol vinasse in soils

Koji Kameyama[1*], Teruhito Miyamoto[1]

[1]National Institute for Rural Engineering

Presently, bio-ethanol is demonstratively produced from biomass materials (sugarcane molasses, wheat straw, rice straw, etc.) all over Japan. Up to 20 liters of stillage may be generated for each liter of ethanol produced (Wilkie et al., 2000). Disposal and utilization of the stillage are important problems for the sustainable production of bio-ethanol. In the southeast region of Japan, demonstrative studies have been conducted to produce bio-ethanol from sugarcane-molasses generated at sugar factories (e.g. Okushima et al., 2007). Stillage, called Vinasse, is generated by the distillation process in bio-ethanol production from sugarcane molasses. Vinasse contains ingredients that can be used as fertilizer, so application as fertilizer water to agricultural lands is a hopeful method for utilization. However, vinasse contains very large amounts of dissolved organic carbon (DOC) (about 60,000 mg L^{-1}) so application of vinasse to agricultural land may raise concerns about groundwater pollution. Most soils have a capacity to adsorb DOC but adsorption capacities are influenced by the soil properties (i.e. specific surface area and organic carbon content). The retention (adsorption and desorption) properties of DOC by soils affects groundwater quality when vinasse is applied to agricultural lands. Therefore, the retention properties and transport properties of DOC from vinasse were evaluated for different soils (calcareous soil, Andisol and Toyoura sand) in this study.
DOC retention properties of the soils were measured by batch equilibrium experiments using diluted vinasse. DOC transport properties in the soils were measured by column experiments. At an initial DOC concentration of 630 mg L^{-1}, the calcareous soil retained 28%, the Andisol retained 30% and the Toyoura sand retained 0% of the total DOC in solution. The Toyoura sand contained little clay so DOC was not adsorbed. The adsorption capacity of DOC by calcareous soil was lower than Andisol. Desorption studies indicated that 38-45 % and 19-32 % of adsorbed DOC desorbed for calcareous soil and Andisol. Desorption of adsorbed DOC for calcareous soil was higher than Andisol. These results suggest that DOC leaching with vinasse application in calcareous soil is larger than Andisol.
This work has been supported by Grant-in-Aid for Scientific Research (B) from Japan Society for the Promotion of Science (JSPS).

Keywords: Bio-ethanol, Vinasse, Dissolved organic carbon, Adsorption, Desorption