J243-005 **Room: 202** **Time: May 20 11:45-12:00**

Increase in Soil Hydrophobicity and Change in Organic Matter Content of Organic Andisol under Soil Surface Burning

ATSUKO OBUCHI[1]; Masaru Mizoguchi[2]; Taku Nishimura[3]; Hiromi Imoto[4]; Tsuyoshi Miyazaki[5]

[1] Agriculture, Tokyo Univ.; [2] IIIS, Univ. of Tokyo; [3] Agricultural and Life Sciences, Univ. of Tokyo; [4] Univ. Tokyo; [5] Dep. of Bio. and Env. Eng., The Univ. of Tokyo

Introduction

Soil is known to exhibit hydrophobic properties after a forest fire. Experiments conducted by DeBano et al. (1976) showed that the organic compounds in the soil become volatized under high-temperatures, moving downward along the soil temperature gradient before forming a hydrophobic layer deep in the soil profile. However, neither of studies considered the effects of oxygen atmosphere on chemical changes of soil organic matter. In this study, we sought to clarify the increase in soil hydrophobicity as well as the changes in organic matter content in response to heating of the ground surface in the field and in the laboratory.

Experimental Methods

Field experiments were conducted in a designated burning area in the Tokyo University Forest in Chichibu. The ground surface of the burning area was heated using a charcoal fire for 5.5 hours. During the heating, the soil temperature at depths of 0, 2, 4, 6, 8, 16, and 24 cm below the surface and the oxygen concentration at 4 and 8 cm depth were monitored. Degree of hydrophobicity, carbon and nitrogen contents were measured at the halt of burning.

The column experiment was conducted in a 1 mm-thick tin cylinder, filled with Andisol passed through a 2 mm sieve from the Tokyo University Forest in Chichibu. The column was wrapped with glass wool for thermal insulation. A nichrome wire heater was placed on the soil surface and heated for two hours. Monitoring and the measurements were same as the field experiment.

The temperatures used for the Muffle furnace experiment were 200, 300, 400, 500, 600, and 700 degree celcius. Andisol from the Tokyo University Forest in Chichibu was used for the experiment. The soil was placed into a crucible and heated for 1.5 hours, either with the lid of the crucible on (aerobic condition) or off (oxygen-deficient condition). After heating, the degree of hydrophobicity, carbon and nitrogen contents were measured.

Results

Field experiments

Surface temperatures increased to 500 to 700 degree celcius within approximately two hours. Soil hydrophobicity was marked in layers that reached 300 to 500 degree celcius. The C/N ratio tended to increase with soil temperature.

Column experiment

The surface temperature in the column increased to approximately 700 degree celcius. Soil hydrophobicity was marked in soils exposed to temperatures of 100 to 300 degree celcius, but was not observed in soils heated to 400 degree celcius or above. The C/N ratio remained relatively constant in soils heated up to 400 degree celcius, increasing gradually at 400 degree celcius, and then increasing considerably at temperatures of 600 degree celcius and above.

Muffle furnace test

i) Oxygen-deficient conditions: Samples heated to 300 and 400 degree celcius were highly hydrophobic. Although carbon and nitrogen contents both decreased with an increase in temperature, both remained high in soil heated to 700 degree celcius. The C/N ratio increased with an increase in temperature.

ii) Aerobic conditions: Soil samples heated to 300 degree celcius or above did not exhibit hydrophobicity. Carbon and nitrogen contents decreased to approximately 0 g kg-1 at 500 degree celcius and higher, and the C/N ratio decreased with an increase in temperature.

Discussion

In the muffle furnace test, soil samples heated under oxygen-deficient conditions exhibited similar carbon and nitrogen dynamics and increased hydrophobicity with temperature as those observed in the field and column experiments, indicating that conditions within the soil are anaerobic when the ground surface is heated. Consequently, under conditions of ground-surface heating, the presence or absence of oxygen atmosphere appears to have a more marked effect on soil hydrophobicity than the downward movement of volatized organic compounds.