



Contribution of charred and buried plant fragments to humic and fulvic acids in Japanese volcanic ash soils

H. Shindo, S. Nishimura, T. Hirota and O. Hirahara

Faculty of Agriculture, Yamaguchi University, Yamaguchi, Japan (shindo@yamaguchi-u.ac.jp / Fax: +81-83-933-5836 / Phone: +81-83-933-5836)

Japan is a typical volcanic country and volcanic ash soils developed in deposits of volcanic materials are widely distributed. An important feature of humus in these soils is the predominance of Type A humic acids, which have a high degree of darkening and graphite-like structure¹. From a series of studies on the mechanisms of the formation of humic acids, we have assumed that charred plants produced during the burning of vegetation are an important source of Type A humic acids in Japanese volcanic ash soils². In this study, to gain more information on the role of charred plants in the formation of soil humus, the qualitative and quantitative contribution of charred and buried plant fragments to humic and fulvic acids in 3 volcanic ash soil samples was investigated. Microscopic observation showed that charred plant fragments, which are black or blackish brown, were the main components in the fractions of less than s.g. 1.6 g cm^{-3} (< 1.6 fractions), which were isolated after the direct HCl-HF treatment of the soil samples. The percentage contribution of organic carbon content of the < 1.6 fractions to that of the whole soils ranged from 14 to 32%, indicating that the charred plant fragments are an important organic constitute in these soils. Humic and fulvic acids were extracted successively with 0.1 M NaOH and 0.1 M $\text{Na}_4\text{P}_2\text{O}_7$. In all the whole soils and < 1.6 fractions, the amounts of NaOH-soluble humic acids (a_1) and fulvic acids (b_1) were much larger than those of $\text{Na}_4\text{P}_2\text{O}_7$ -soluble humic acids (a_2) and fulvic acids (b_2), respectively. The a_1 and a_2 values were substantially larger than the b_1 and b_2 values, respectively. Although all the humic acids obtained from the whole soils and < 1.6 fractions were classified into Type A, the following differences were found on their optical properties: in the NaOH-soluble humic acids, the *RF* (relative color intensity) values of the < 1.6 fractions were higher than those of the whole soils, although there were no remarkable differences for the $\Delta \log K$ (color

coefficient) values. In the quantitative contribution of NaOH-soluble humic and fulvic acids of the < 1.6 fractions to those of the whole soils, the percentage contribution of the < 1.6 fractions in the a_1 , ranging from 12 to 44%, was much larger than that of the < 1.6 fractions in the b_1 , ranging from 3.8 to 9.6%. These findings suggest that in Japanese volcanic ash soils, charred plants produced during the burning of vegetation by human activity and wildfires can be an important source of humic substances.

References

1. Kumada, K. 1987: Chemistry of Soil Organic Matter. Elsevier, Amsterdam
2. Shindo, H., Honna, T., Yamamoto, S. and Honma, H. 2004: Contribution of charred plant fragments to soil organic carbon in Japanese volcanic ash soils containing black humic acids. *Organic Geochemistry* 35, 235-241