

Reactivity of enzymes to humic substances

Y. YANAGI, K. KITAYAMA, T. SUZUKI, H. OTSUKA,
AND N. FUJITAKE

Laboratory of Soil Science, Faculty of Agriculture, Kobe
University, Rokkodai, Nada, Kobe, Hyogo, 6578501
Japan (yanagi@ans.kobe-u.ac.jp)

The dynamics of humus, which are among the most widely distributed organic materials on the terrestrial ecosystem, are important for the global carbon cycle. It was considered that humus consists of a labile fraction and a more stable fraction (namely humic substances). Nevertheless, it was reported that microorganisms have the capability of growing on humic substances, which served as the only source of carbon or nitrogen. These results suggested that stable humus was regarded as bio-available. In the foregone study, it was considered that several enzymes actually take on the microbial degradation of humic substances. Thus, in our study, we investigate the reactivity of enzymes to humic substances, that will be a key for the availability of humic substances.

Firstly, the reaction of several enzymes to humic acid from Cambisol was examined. The color changes of humic acid were measured as one of the indicators of reactivity. After 24 h of reaction, laccase and peroxidase were diminished the absorbance of humic acid by 14% and 6%, respectively. In contrast, esterase increased the absorbance of it by 10%.

Secondly, the sequential reaction of two enzymes to humic acid was demonstrated. Esterase, β -glucosidase, or tyrosinase was used for the first reaction, and laccase was used for the second reaction. The result was that esterase amplified decolorization of humic acid by laccase, however, β -glucosidase and tyrosinase showed no effect on the laccase reaction.

Thirdly, the reaction of laccase, which showed the highest reactivity, to the humic acid was discussed in detail. When the laccase was reacted to the three fractionated humic acids based on MW (>100 kDa, 100 to 30 kDa, 30 kDa>), it decreased the absorbance of all three fractions similarly. The changes in the molecular weight properties of humic acid were also monitored through the laccase reaction. After 24 h of reaction, depolymerization of humic acid was indicated.

In addition, results of fulvic acid will also be discussed.

This work (partly) was supported by the Sasakawa Scientific Research Grant from the Japan Science Society.

Sulfur isotope ratio of aerosol collected in Japan and China

FUMITAKA YANAGISAWA¹, NAOFUMI AKATA²,
AKIRA UEDA³ AND AKIKO KAWABATA³

¹Department of Earth and Environmental Sciences, Faculty of
Science, Yamagata University (yanagi@sci.kj.yamagata-
u.ac.jp)

²Graduate School of Science and Engineering, Yamagata
University (nao@ies.or.jp)

³Central Research Institute, Mitsubishi Materials Corporatio

Deposition rate of non-sea salt sulfate in wet deposition in Japan increases in winter. The sulfur isotope ratios of non-sea salt sulfate ranged from 0 to +15‰ and showed seasonal variation, with an increase in winter (December and January). This seasonal variation suggests that non-sea salt sulfate in wet deposition is derived from a source, having a higher sulfur isotope ratio in winter than in other seasons. Sulfur isotope ratios were measured for coals used in East Asia (China, Mongolia and Russia). The average sulfur isotope ratio of coals used in 30-20N is -3‰, that of coals used in 60-30N is +7.4‰, and that of northeastern Chinese coals (42-39 N) is +9.6‰. The sulfur isotope ratios of non-sea salt sulfate collected in Japan in the winter were in agreement with the sulfur isotope values for coals in northeastern China.

Sulfur isotope ratios of non-sea salt sulfate in aerosol in Japan ranged from 0 to +15‰ and showed seasonal variation, with an increase in winter.

Sulfur isotope ratios of non-sea salt sulfate in Red Snow (snow mixed with Kosa pericles) fell in January and March 2001 were measured. Sulfur isotope ratios of non-sea salt sulfate were about 10‰. Desert sand and loess were collected from an arid region in China. The sulfur isotope ratios of sulfate in sand and loess, ranged mainly from +5 to +18‰. Sulfur isotope ratios of sulfate in aerosol in Taiyuan, China, were about 10‰ in Kosa period. The sulfur isotope ratios of non-sea salt sulfate in Red Snow agree with the sulfur isotope values of sulfate in sand.

This study was partly supported by Special Coordination Funds for Promoting Science and Technology from Ministry of Education, Culture, Sports, Science and Technology, Japan.