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Composition of the amino acid and amino sugar for molecular weight fractions of hot-water extractable soil organic matters from soils with plant residue compost or mineral fertilization

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The hot-water extractable organic nitrogen is well known as a laboratory index of mineralizable nitrogen. This available nitrogen is indispensable for growth of plants because of being absorbed in crops. We measured the composition of the amino acid and amino sugar for molecular weight fractions in hot-water extractable organic matters to understand the source of the available nitrogen in soils inserted a compost. Two soil samples were collected from fields (Soil Type; Andosol) in National Agricultural Research Center in Tsukuba, Japan. A plant residue compost of 2 $kga^{-1}y^{-1}$ during 25 year has been applied to a soil and another soil was under the mineral fertilization. Organic matters were extracted from the soils of 3 g in the water of 50 ml at 80 degree centigrade for16 hours. The molecular size distribution of the hot-water extractable organic matters was analyzed by HPSCE (column YMC Diol-120, elution; 50mM phosphate buffer under pH=7.0, flow rate 1 $mlmin^{-1}$), and 20 fractions were collected at regular intervals in the retention time. The chromatograms were monitored under the absorbance at 280 nm and fluorescence intensity at Ex.280 nm: Em.330nm. The concentrations of the 15 amino acids and three amino sugars (muramic acid, glucosamine, and galactosamine) for the molecule weight fractions were measured by HPLC as o-phthaldialdehyde (OPA) derivatives after the vapor HCl hydrolysis. Organic nitrogen concentrations of the hot-water extractable organic matters in the soil inserted the compost (C-soil) and the mineral fertilization soil (M-soil) were 133 and 35 $mgkg^{-1}$, respectively. The extracted organic matters had the variable molecule weight (10^3- 10^4 Da). The concentrations of the amino acid and amino sugar of organic nitrogen in the C-soil were higher than those in the M-soil in all fractions. The fractions were classified into 3 groups (LW, MW, and SW) based on the molecule weight and spectroscopic characteristics. Each group had unique composition of the amino acid and amino sugar, regardless of fertilization. The LW with the largest molecule weight was characterized from the low UV absorbance and the highest concentration of glucosamine and galactosamine. Thus, the LW must be originated mainly from the microbial products, because glucosamine and galactosamine are the biomarkers of the fungi chitin and bacterial products, respectively. The MW was characterized from the high UV absorbance, low fluorescence, and the highest concentration of total amino acids nitrogen. The percentages of the aspartic and gultamic acids to the total amino acids in the MW were higher than those of the other groups. The concentration of the muramic acid, which is a biomarker of peptideglycan, was also highest in the MW. Thus, the MW includes an organic matter originated from the cell wall of bacteria. SW showed the less UV absorbance and strong fluorescence. The percentage of alanine, glysine, and valine in the SW were higher than in the LW and MW. Amino sugars did not existed in the SW. Thus, the SW may consist of some refractory organic matters. The above things reveal that the hot-water extractable organic matters had variable composition of the amino acids and amino sugars resulting from the different microbial origin of the soil organic nitrogen.