Geophysical Research Abstracts,
Vol. 11, EGU2009-12110, 2009
EGU General Assembly 2009

Humification Processes of Different Pure Organic Sunstances in the Soil

F. Alianiello, M. G. Mascia, M. Valentini, and S. Cozzolino

CRA, Centro di Ricerca per lo Studio delle Relazioni tra Pianta e Suolo, Roma, Italy (francesco.alianiello@entecra.it, +396700541)

The chemical composition and the structure of humic substances are not yet well known, due to the heterogeneity of their components. Different models have been proposed on their composition, but many doubts still exist on their chemical characteristics and their general structure.
Different theories have been suggested also on the origins of humic substances and on the humification processes, and no one of them has been still universally accepted. Experimental results hardly can be generalised, since differences of soils, of the organic materials added to soil and of climate conditions provide heterogeneous results.
Aim of this study was to follow the changes occurring to the chemical composition of organic substances added to soil and incubated under controlled conditions in a laboratory experiment, tracking the effects occurring to singular pure compounds, representative of the most abundant classes of compounds present in the organic matter.
4 pure compounds were added to two different soils and incubated for an year under controlled conditions of temperature and moisture (27°C, 2.5 pF). They were: lignin, cellulose, casein and tripalmitin. Lignin was chosen because it has been considered for long time the precursor of humic substances, while the others represent the most abundant classes of natural organic substances, i.e. proteins, carbohydrates and lipids.
The material was added in the quantity necessary to double the organic C already present in the soil.
Sub-samples were collected immediately after mixing, after 3 weeks, 3 months, 6 months and 1 year.
The organic matter of the samples has been characterised by determination of total organic carbon, total extractable carbon, humic plus fulvic acids and calculation of humification parameters. Soil microbial biomass was determined immediately after sampling.
Total organic carbon decreased in all the treated soils, as expected, but differences were detected among the different mixtures. Casein seemed to be immediately mineralised: after 3 weeks the content in organic C was almost the same as the one of the untreated soil. In the tripalmitin treated soil the organic C decreased within an year constantly. In the lignin treated soil the organic C content diminished very slowly, with almost the same trend as the soil untreated. Cellulose treated soil showed the highest decrease of organic C between 3 weeks and 3 months incubation.
The general result of all the samples of the humification parameters shows an increase, although not perfectly linear, of degree of humification and humification rate, and a decrease of the humification index, indicating that that the incubation conditions are favourable to soil organic matter humification.
At start only the lignin treated soil showed very high values of degree of humification and humification rate, and low values of humification index, signifying the chemical similarity of lignin to humic substances, but this result was changed after the first incubation times. After 3 months the values of the humification parameters started to show the humification progress again.
Organic matter of collected samples was extracted by NaOH plus Na4P2O7 0.1M and analysed by CP-MAS 13C NMR and isoelectric focusing.
CP-MAS 13C NMR data show that after 3 weeks the 13C NMR spectrum of cellulose treated soils is impossible to distinguish from the one of the untreated soil, demonstrating how cellulose is fast degraded. The same happens to the casein characteristics in the spectrum of the relative treated soils.
The characteristics of lignin, in the spectra of the lignin treated soils, after 1 year are still possible to be recognised.
The spectra of tripalmitin treated soils show that an year is necessary for the compound to be mineralised or to be converted to compounds similar to those of the original composition of soil organic matter.
The results demonstrate that all the natural substances tend to be almost completely mineralised or to be converted to substances similar to those of the treated soil, excluded lignin which after an year incubation is still analytically

recognisable in the soil.