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Stability and maturity of a green waste and biowaste composts assessed on the basis of a molecular study

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In France, the annual production of municipal wastes, more particularly solid green wastes and biowastes actually grows of 1% each year. Consequently waste management has became a major priority for municipalities. Furthermore since incinerating is prohibited and rubbish dump is very expensive, an alternative is valorisation by composting.

Compost maturity [1] is assessed on the basis of several more or less reliable parameters as for example, plant growth, respiration rates, humification index (AH/AF), and C/total N ratio but studies concerning the nature and the changes in structure of compost organic matter are very scarce [2]. However the evolution of compost organic matter during aerobic composting can help us to understand the biochemical processes leading to compost stability and maturity. Moreover, from an agricultural point of view, the molecular characterization of the final compost is essential to identify the exogenous organic matter introduced into the soil environment through compost application, as well as the impact on plant–soil systems. In this context the present work aims to correlate compost maturity as determined using classical parameters (i.e. Dewar test) with changes in molecular structure.

The evolution of physico-chemical parameters (pH, TOC, C/N, temperature) corroborates the Dewar test which indicates that the compost is mature after 2 months. Thermo Differential analysis (TDA) provides an interesting indicator of humification since with composting, the signals associated with the increase of aromatics whereas the signals associated with aliphatics decrease. Pyrolysates (TMAH) are mainly consti-

tuted of lignin moieties and fatty acids (as methyl esters). The ratios between branched (bacterial origin) to linear (plant origin) acids and between aliphatic mono- to diacids evolve with maturity.

After a separation according to IHSS protocol, lipids were analysed using gas chromatography coupled with mass spectrometry whereas humic substances were studied using thermochemolysis (TMAH). The molecular composition of lipids indicates that the bacterial activity increases until maturity. The ratio humic acids to fulvic acids is an indicator of humification.

[1] Dignac, M.-F., Houot, S., Francou, C., et Derenne, S., (2005). Organic Geochemistry, 36, 1054-1071

[2] Francou, C., Poitrenaud, M., et Houot, S., (2005). Compost science & utilization, 13, 72-83.