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Characterisation of Green- and Bio-Composts for Horticultural Growing Media

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Abstract

There is an increasing demand for recycling of organic materials from domestic and industrial uses, as it reduces landfill volumes and disposal costs. Decomposed organic matter (OM) can then be used in agriculture (to enhance fertility), horticulture (as growing media), or local energy plants (for energy production). However, a wise and effective use of OM is determined mainly by the respective physical, chemical and microbiological properties. Organic matter for energy purpose, for instance, should contain high calorific value or carbon content, whereas OM for growing media should have stable carbon and nitrogen balances.

In this paper, we present a method that characterises six green- and bio-composts by fractionating their OM into four distinct components varying with particle size, density and stability to decomposition. These OM fractionates were: **(i)** dissolved (DOM; <0.45 μm), **(ii)** light fraction (LFOM; <1 g cm^{-3}), **(iii)** medium fraction (MFOM; between 1 and 1.37 g cm^{-3}), and **(iv)** heavy fraction (HFOM; >1.37 g cm^{-3}). The correlations between these fractionates and large arrays of physicochemical and microbiological properties (i.e., activity and biomass) were evaluated by a linear regression model to find out a simple parameter that predicts the stability of carbon and nitrogen balances of composts chosen for growing media.

Since microorganisms are only active at the solid-liquid interphase, DOM content was strongly correlated with microbial activity as measured by evolved CO_2 ($r^2 > 0.67$) and biomass as estimated by the fumigation extraction method ($r^2 > 0.53$). Similarly, the correlation between C-to-N ratio of the DOM and microbial activity or other physicochemical properties (e.g., total carbon, nitrogen, bulk density) was relatively good ($r^2 \geq 0.45$). Therefore, the higher carbon or lower nitrogen content in the DOM fraction may cause immobilisation unless compensated by fertilisation. LFOM also showed a similar trend although the computed r-values were small ($r^2 \leq 0.36$). MFOM and HFOM, however, had no clear pattern. Since the separation of DOM is relatively simple (i.e., add water and remove the filtrate by applying suction), it can be used, but in a due connection with other physicochemical properties, as a quality criterion for selecting green- and bio-composts for horticultural purposes.

Keywords: Carbon, fumigation extraction, microbial activity, microbial biomass, nitrogen, organic matter fractions

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