



## Recovery of humic-like substances from low quality composts

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### ABSTRACT

The quality of four commercial composts produced from poultry litter and municipal solid wastes was assessed based on their physic-chemical, stability and maturity parameters. These properties varied among the analysed composts; it was found that electric conductivity, heavy metals content and maturity were the parameters that limited the composts quality. Therefore, the feasibility of using them to obtain liquid fertilisers rich in humic-like substances (HS) was assessed. The HS yield, phytotoxicity, heavy metals co-extraction and chemical characterization were carried out. The linkage of the HS chemical composition with the compost properties was assessed by multivariate analysis. Among the compost properties, germination indices, Cr and Cu contents were the parameters that correlated most with the HS chemical composition. The low levels of metals and absence of phytotoxicity in all the analysed HS extracts indicate that composts with low quality may be used to produce liquid organic fertilisers, substituting those from natural resources.

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### 1. Introduction

Composting represents a strategy of organic waste treatment that is fully compatible with sustainable agriculture given compost term application may counteract depletion of organic matter in soils (Albrecht et al., 2011). Indeed, the utilisation of compost in agriculture management is expected to enrich the soil in mature organic material rich in humic-like substances (HS), which contributes to the health and fertility of soils (Senesi et al., 1996). However, to assure that the introduction of compost in the agriculture soils does not have harmful effects, composts must have high quality.

Compost quality refers to the overall state of compost in regard to physical, chemical and biological characteristics (Lasaridi et al., 2006). Parameters as electrical conductivity, ammonium nitrogen and the presence of heavy metals in composts are among the factors that can reduce their quality and may limit their application to soil. Therefore, in an attempt to avoid negative impacts due to the utilisation of low quality composts, the upper limits of these parameters are regulated by national (Anonymous, 2008) and international (DG ENV.A.2, 2001) quality proposal guidelines.

The utilisation of composts with low quality, i.e., those not following the national and/or international quality proposal guidelines, namely in heavy metals content, as a source of HS may be a sustainable alternative to their usage as soil conditioners. Indeed, nowadays there is a growing tendency to use humic substances as liquid organic amendment, produced from natural resources such as leonardite, peat, and lignite (IHSS, 2008; Tahir et al., 2011) but their use can contribute to the extinction of these natural resources. The most common method to extract HS from these natural resources involves alkaline extraction (e.g., NaOH) followed by precipitation at low pH. Salts are further removed by procedures such as cation exchange or dialysis. With this methodology, all the extracted organic acids are expected to be present in either the humic acid or fulvic acid fraction (IHSS, 2008). Pyrophosphate (e.g., Na<sub>4</sub>P<sub>2</sub>O<sub>7</sub>) is also efficient on HS extraction (e.g., Donisa et al., 2003), although lower HS yields are obtained than with strong alkaline extraction (Stevenson, 1982). Nevertheless, the utilisation of mild reagents such as Na<sub>4</sub>P<sub>2</sub>O<sub>7</sub> over strong alkali reagents may be advantageous since the latter may alter the chemical composition of HS constituents (Prentice and Webb, 2010). Inevitably, heavy metals present in the raw material are co-extracted with HS, predominantly with the fulvic acids (Borůvka and Drábek, 2004; Donisa et al., 2003; Hsu and Lo, 2001).

In the present study, the quality of four Portuguese commercial composts was assessed based on their physic-chemical, stability and maturity parameters. The feasibility of using these composts to obtain liquid fertilisers rich in humic-like substances was also

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