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Changes in chemical and microbiological properties of rabbit manure in a continuous-feeding vermicomposting system

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HIGHLIGHTS

- *Eisenia fetida* had a great impact on microbial community phospholipid fatty acid (PLFA) profiles.
- Reduction in bacterial and fungal PLFA biomarkers occurred throughout the process of vermicomposting.
- High degree of stabilisation from a microbial viewpoint after maturation for 200 d.
- High levels of dissolved organic carbon were maintained until the end of the process.
- Continuous-feeding system is an environmentally sound management option.

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ABSTRACT

In the present study the potential of the earthworm *Eisenia fetida* to process large amounts of waste was evaluated through continuous feeding reactors in which new layers of rabbit manure were added sequentially to form an age gradient inside the reactors. An optimal moisture level, ranging from 66% to 76%, was maintained throughout the process using an automatic watering system. The pH was close to 8.3, but decreased to 7.6 after 200 d of vermicomposting. No changes in electrical conductivity through the profile of layers were detected. Based on comparisons of phospholipid fatty acid (PLFA) profiles and microbial activity measurements (basal respiration), a decrease in the levels of bacteria and fungi in layers corresponding to vermicomposting times of more than 200 d occurred. This points to a higher degree of stabilisation in the final product, which is of utmost importance for its safe use as an organic amendment.

1. Introduction

Appropriate management techniques can mitigate the health and environmental risks associated with the overproduction of animal manure by stabilising it prior to its use or disposal (Lazcano et al., 2008). Stabilisation involves the decomposition of an organic material to an extent that eliminates the hazards and is normally reflected in decreases in the microbial biomass and its activity and in the concentrations of labile compounds (Bernal et al., 2009). Vermicomposting, a process involving the bio-stabilisation of organic wastes under aerobic and mesophilic conditions through the joint action of earthworms and microorganisms, is a low-cost and rapid technique for the management of hazardous and worthless organic wastes of different natures, transforming them into safe and valuable products, called vermicomposts (Domínguez and Edwards, 2010a).

Vermicomposting systems sustain a complex food web (Sampedro and Domínguez, 2008), in which detritivore earthworms interact intensively with microorganisms and other fauna within the decomposer community, accelerating the stabilisation of organic matter and greatly modifying its physical and biochemical properties (Domínguez et al., 2010). The biochemical decomposition of the organic matter is primarily accomplished by microbes, but earthworms are crucial drivers of the process as they may affect microbial decomposer activity by grazing directly on microorganisms (Aira et al., 2009; Monroy et al., 2009; Gómez-Brandón et al., 2011a), and by increasing the surface area available for microbial attack after comminution of the organic matter (Domínguez et al., 2010). Recent studies related to the impact of

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