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Enhancing Composts Added-value Through the Addition of Spent Mushroom Substrate from Pleurotus and Lentinula Mushroom Cultivation During the Mesophilic Phase

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Abstract

Composting is the thermophilic aerobic-microbial process of breaking down the organic matter of various organic materials (such as agro-industrial residues and by-products) into humus-like material, which can be beneficial for both the environment and the society (e.g., management of organic residues/wastes, sanitation, end products useful as soil amendments). The constantly increasing demand for mushroom production has resulted in huge amounts of spent mushroom substrate, an agro-industrial by-product originating from the mushroom cultivation industry, which is usually disposed of on land. Commonly cultivated mushroom species, like Pleurotus ostreatus and Lentinula edodes, belong to white-rot fungi, that can produce a variety of oxidizing and hydrolytic enzymes capable of degrading lignocellulose. Based on this, their addition to the composting process can potentially affect the duration of the maturity period as well as the humification (quality) of the produced compost. The aim of the present study was to determine how the addition of spent mushroom substrate could affect the composting process and the quality of the end product. Wheat straw, tree pruning, cotton gin, and poultry manure were mixed in order to achieve a C/N ratio of 30/1. Three identical compost piles were set up in composting boxes, with an initial moisture content of 52%. At the end of the first thermophilic phase/ beginning of the first mesophilic phase, agitation of the composts occurred which triggered a second milder and shorter duration thermophilic phase. Afterward, in the middle of the second mesophilic phase, compost piles were agitated, and spent mushroom substrate from the cultivation of the mushrooms *Pleurotus ostreatus* and *Lentinula edodes* was applied to each box separately at 10% w/w. The third box was used as the control, without the addition of spent mushroom substrate. Sampling took place at every composting phase, as a way of monitoring the process. Fourier transform infrared (FTIR) spectroscopy was also applied

for the monitoring of the composting process through the detection of peak indexes related to lignocellulosic, phenolic, aromatic, and other easily degradable compounds. Spent mushroom substrate, as a carrier of fungal strains that produce ligninolytic enzymes, accelerated the decomposition of the agricultural wastes and resulted in the production of a rich in humic acid (HA) compost. HA is an important and stable component of organic matter, as well as a significant parameter for determining compost quality. Therefore, the addition of spent mushroom substrate not only resulted in shortening and improving the composting procedures but also led to an end product of better maturity and physicochemical properties.

Keywords: spent mushroom substrate; composting; Pleurotus; Lentinula; humic acid

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