International Journal of Research In Earth & Environmental Sciences

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ELIMINATION OF PHYTOTOXICITY DURING CO-COMPOSTING OF ANIMAL CASING WASTE AND SAWDUST

Bilal El Fassi, Mohamed Idaomar

Laboratory of Biology and Health, Faculty of Science, Abdelmalek Essaâdi University, Tetouan, Morocco
Corresponding author: E-mail: bilalelfassi@gmail.com

ABSTRACT

In this study, the plant seed germination technique was used to assess the phytotoxicity of animal casing waste and sawdust during composting process on the relative seed germination, relative root elongation, and germination index of Cress (Lepidium sativum L.). The composting process was carried out using barrel system. The compost was prepared by mixing animal casing waste (ACW) and sawdust (S). At the end of the composting period, the germination percentage was 81 % which indicates the elimination of phytotoxicity and a compost maturity.

Keywords: phytotoxicity, Lepidium sativum L., zucconi test, animal casing waste, compost.

1. INTRODUCTION

Huge quantities of organic byproducts are produce by food industries. In Morocco the animal by-products (ABPs) from abattoir were till now rarely valued or used as component in composting (Hicham et al., 2006). Animal casings are well commercialized products with multitudes uses worldwide. However, if not treated before disposal, animal casings waste (ACW) causes serious environmental problems either during it collection, transport and storage.

Economically, ACW seems to be priceless. The management of this organic waste could be a very important option to minimize severe environmental pollution. Compost can be used to reduce the volume of this organic fraction. During the composting process conditions are controlled so that materials decompose faster.

Several studies investigating the use of animal by-products as raw materials for compost have been carried out (Hicham et al., 2006, Gobec, 2005, Barrena et al., 2009, Sanabria-León et al., 2007, Price et al., 2013). A review of composting animal by-products was carried out before conducting this study using multidisciplinary databases.

2. MATERIAL AND METHODS

Experiments were undertaken on a small-scale composting system using three similar perforated barrels with a cover on the top and 120 L total volume. The ACW was delivered the same day of initiating the experiments. The ratio of ACW and sawdust was chosen based on our previous essays to achieve optimal homogenization and non-compacted structure to ensure aeration. After loading the barrels, additional managements (aeration, moisture adjustment) were applied. The moisture content was approximately 80% at the start of composting and each barrel was rolled on 0, 7, 15, 30, 60 and 120 days after the start of the study. The treatment was repeated thrice and started simultaneously. The presented results are the average of the triplicates.

The phytotoxicity assay is based on a germinated seeds count and on the measurement of the length of the Lepidium sativum L. radicle that had grown in the compost extracts. Ten Petri dishes were used for each compost sample, each one containing a filter paper, 8 cress seeds and 1 mL of extract. To check seed viability, 10 additional Petri plates were used and 1 mL of distilled water was added on the filter paper. To maintain humidity, all the Petri dishes were sealed with parafilm and they were incubated under dark conditions for 48 h at 28 °C. Afterward, the number of germinated seeds was counted and radicle length was measured. The results are expressed as the

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percentage of relative seed germination (RSG), relative radicle growth (RRG) and the germination index (GI), in accordance with (Walter et al., 2006, Hoekstra et al., 2002, Boluda et al., 2011):

$$\text{RSG (\%)} = \frac{\text{Number of seeds germinated in extract}}{\text{N. of seeds germinated in distilled water}} * 100$$

$$\text{RRG (\%)} = \frac{\text{Mean radicle length in extract}}{\text{Mean radicle length in distilled water}} * 100$$

$$\text{GI (\%)} = \frac{\text{RSG} * \text{RRG}}{100}$$

3. RESULTS AND DISCUSSION

The compost was rolled periodically. Monitoring temperature parameter during the composting process showed the existence of the four characteristic phases (Figure 1); Initial phase, thermophilic phase, mesophilic phase and cooling phase. The treatment combination is well composted and exhibited thermophilic temperatures after three days of composting.

The experiment had an initial temperature of 26 °C, then increased above 47.1 °C on second day and reached its peak value of 63 °C on day 5. Seven day after loading of the barrels by ACW and S mixture, they were rolled for the first time, which cause a temperature decrease to 37 °C, then entered the second temperature increasing phase, during which the temperature increased to 58.3 °C. After day 19, the barrels temperature decreased gradually, to finally reach 28.2 °C on day 65.

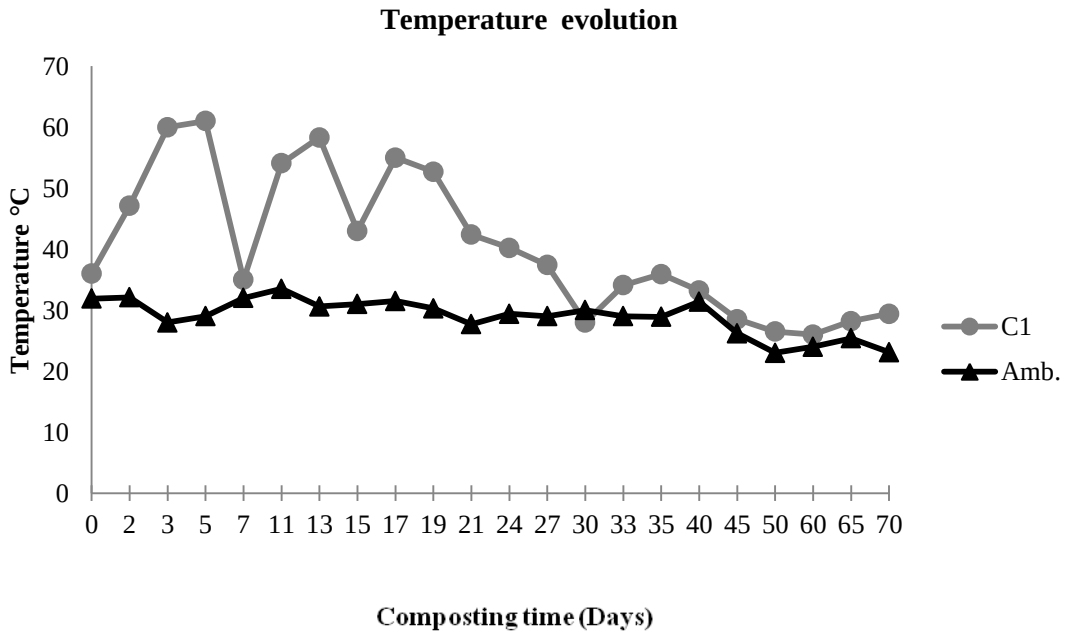

Figure 1. The temperature variation with time.

The GI is used to assess phytotoxicity. If GI value goes below 50%, the compost presents high phytotoxicity (Solano et al., 2001, Zucconi et al., 1981). The germination index at the first day of composting process was 0 %. The results obtained at the end of composting process reveal that germination

percentage was 81 % which indicates the elimination of phytotoxicity during the co-composting process and a compost maturity.

4. CONCLUSION

This study analyzed a mixture of animal casing waste and sawdust; the composting period was 6 months. The maturity test result indicated that the GI of the produced compost fall within the range mentioned in literature (Zucconi et al., 1981) with 81 %, illustrating the maturity of the final product and confirming the potential value of animal casings waste to be used as compost raw material.

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