EVALUATION OF COMPOSTING CPU BIOMASS WASTES USING THE WIRE MESH CIRCULAR COMPOST BIN WITH COMPOST ACTIVATOR

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ABSTRACT

The aim of the study was to evaluate the composting of biomass wastes generated within the campus of CPU using a wire circular compost bin with the addition of compost activator. Three test runs were conducted wherein the shredded biomass wastes were mixed with poultry manure and sawdust at a 3:1 ratio while being sprayed with compost activator until the desired moisture was attained. The mixed materials were then loaded in the bin and were covered completely with plastic sheets except at the bottom to preserve the heat needed for decomposition. Results of the evaluation show that composting of CPU biomass wastes using the circular bin can produce an average of 276.33 kg of compost after the 60-day operation. Further analysis revealed that the compost material has an average composting rate of 0.828 cm/day and the volume of the compost material in the bin was reduced to an average of 55.79%. Furthermore, the average amount of nitrogen and phosphorus, and pH analyzed were 1.20 and 1.28% and 8.4, respectively.

INTRODUCTION

Background and Rationale

The use of composting to turn organic wastes into a valuable resource is expanding rapidly in the country as landfill space becomes scarce and expensive, and people are becoming aware of the impact they have on the environment. This is also due to the government's efforts in promoting sustainable crop production to meet the country's current food demand and at the same time protecting the environment (10 Steps in Compost Production, 2001). The need to practice composting is also declared in the policies of RA 9003 which set guidelines and targets for solid waste avoidance and volume reduction through composting and encourage the participation of the private sectors in solid waste management (from http://www.chanrobles.com/republicact9003.htm).

However, few adopted the technology because it takes a long time to produce composts, it requires large quantities of raw materials, it is laborious, and the beneficial effects on the soil are not easily seen or felt. But now, composting technology has considerably improved. Before, it takes months for compost to be harvested but because of the availability of compost activators in the market, it can now be made in just 3 to 4 weeks (10 Steps in Compost Production, 2001).

Objectives of the Study

The general objective of the study was to evaluate the composting of CPU biomass wastes using the wire mesh circular compost bin with the use of an activator. Specifically, it aimed to obtain the temperature, moisture content, and pH recorded from the pile, the length of time composting will be finished, and the average rate of composting; and to know the quality of compost based on the analysis done by the Regional Soils Laboratory of the Department of Agriculture.

MATERIALS AND METHODS

Preparation of the Samples and Compost Bin

Biomass wastes generated by the University such as grass clippings, garden wastes and other suitable biodegradable wastes for composting were used during the evaluation of this study. Poultry manure used was taken from the College of Agriculture Poultry and some were bought from Egger Farm in Sta. Barbara, Iloilo while the sawdust used was also obtained from the College Poultry. A bio-compost activator (BCA) manufactured by Christian Multi-Purpose Cooperative (CMPC) of Northern Iloilo in Sara, Iloilo was used as activator due to its market availability. In addition to that, BCA is organic based derived from helpful microorganism (HMO) through special fermentation process.

An axial flow-type biomass shedder was used to reduce the size of biomass wastes for faster decomposition before they were mixed with other materials for composting. A sixteen tbsp. of BCA were diluted in a 14-liter capacity knapsack sprayer before it was sprayed in the compost materials.

Plastic sheets and used plastic sacks were wrapped around inside the three 1.2-m diameter x 1.0-m high wire mesh bin in order to maintain the temperature inside once composting started. A 1.0-m diameter gauge # 22 BI sheet cover was provided for every bin.

Procedure for Compost Making

The biomass wastes gathered from the university dump site were soaked first in the pan before it underwent shredding operation. After shredding, the materials were laid in a concrete pavement together with poultry manure and sawdust. The proportion used was 3 parts grass clippings and dried leaves and 1 part poultry manure and sawdust. All these materials were mixed thoroughly while being sprayed with BCA. After a moist feel was attained, the shredded materials were loaded manually to fill the three bins and were covered to keep the insects and other small animals from entering the compost pile. The compost pile was initially turned every 4 days for the first two weeks and only once in the succeeding weeks of composting.

Testing and Evaluation

Three wire mesh circular compost bins were used in composting CPU wastes. Each bin was provided with a cover for protection from insects and other small animals from entering the pile.

Moisture content in the pile was maintained at 40 to 60% so as not to deprive the microorganisms of the water needed for their metabolism. Moisture content was obtained using the oven-dry method. Daily temperature and weekly pH were also monitored using a bimetallic thermometer and pH meter, respectively. Once heat was maintained at around 50°C or above, the pile was turned weekly to provide adequate aeration and even decomposition of substrates in all layers of the pile. The compost was considered ripe when: the temperature in the pile drops to 33 to 35°C; individual substrates were no longer recognizable; compost is dark brown to black and soil-like in appearance; and does not have a foul odor.

Average Weekly Temperature of the Compost Pile

During the experiment, daily temperature was measured early in the morning, at noon, and late in the afternoon. Then the average daily temperature was taken to get the average weekly temperature for 9 weeks. As shown in Table 1, average temperature in Bins 1, 2 and 3 were 52.08, 53.07, and 53.86°C, respectively.

Temperature indicates how well the composting process is working and what stage of the process is reached (Figure 1). The first four weeks of composting were considered as the break-down phase as shown by the gradually increasing temperature in the pile. The data show that in the first three weeks, the temperature was increasing until it reached a peak of 64.94°C as

recorded from Bin 3. During the fourth week, the temperatures in the three bins were almost equal at 58.57°C, 58.53°C, and 60.09°C for bins 1 to 3, respectively. In the build-up phase, the temperature started to decrease gradually until it leveled off to 45.27°C, 46.22°C, and 45.83°C for bins 1 to 3, respectively. The temperature in the three bins started to decline during the fourth week for Bin 1 and during the fifth week for Bins 2 and 3.

Table 1. Average Weekly Temperature of the Compost Pile

Week	Temperature (°C)		
	Bin 1	Bin 2	Bin 3
1	59.25	48.51	51.13
2	46.29	49.00	51.00
3	53.66	60.27	64.94
4	58.57	58.53	60.09
5	56.29	61.63	60.67
6	53.74	53.77	54.39
7	49.69	51.69	51.34
8	45.94	48.05	45.32
9	45.27	46.22	45.83
Average	52.08	53.07	53.86

Average Moisture Content of the Compost Pile During Turning

The results gathered for moisture content are shown in Table 2. Moisture content was taken during the first day and in the succeeding days every time the compost materials were turned. The data show that the moisture content varied from a minimum of 40% to a maximum of 69%. This is still within the recommended moisture content range of 40 to 70% for composts as indicated in http://www.cyber-north.com/gardening/compost.html.

Table 2. Average Results of Moisture Content of the Compost Pile During Turning

Day	Moisture Content (%)		
	Bin 1	Bin 2	Bin 3
1	39.52	40.11	40.65
4	53.24	48.47	44.95
7	55.44	54.70	51.74
12	57.73	48.54	52.75
18	61.62	69.00	61.46
23	64.77	55.20	59.45
30	63.58	58.15	58.62
37	61.41	65.17	61.26
44	67.72	66.39	64.60
51	64.65	65.55	61.40
59	65.52	63.44	60.60
Average	59.47	57.70	56.13

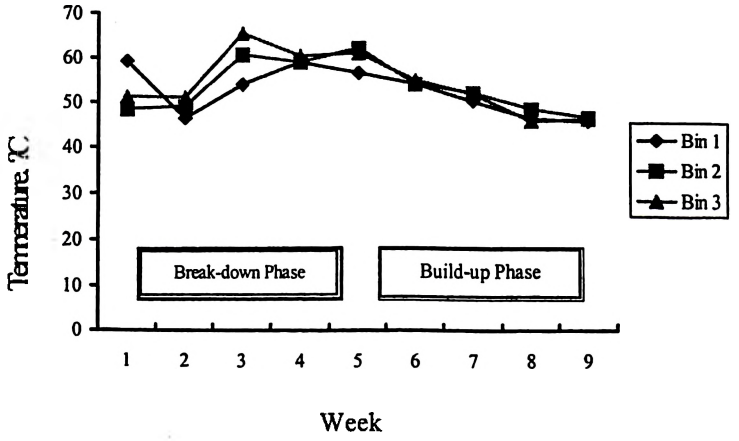

Figure 1. Average Weekly Temperature of the Compost Pile

Results of Compost Analysis

Analysis of the compost material include percentage of total nitrogen and total phosphorus, and pH. Results of the analysis conducted by the Regional Soils Laboratory of the Department of Agriculture are shown Table 3. The average total concentration of nitrogen and phosphorus was 1.20 and 1.28%, respectively.

Composts in Bins 1 and 2 had a pH of 8.4 while composts in Bin 3 had 8.5 giving an average of 8.4. Results showed that the average pH at 8.4 was higher than the normal pH of compost which is 8.0 (Using Quality Compost Build Humus in Soil, 1990)

Table 3. Results of Compost Analysis

Bin	Total Nitrogen %N	Total Phosphorus %PO	pH
1	1.25	1.32	8.4
2	1.13	1.06	8.4
3	1.22	1.28	8.5
Average	1.20	1.28	8.4

CONCLUSION AND RECOMMENDATION

Based on the results of the study, it can be concluded that the biomass wastes like fallen leaves and grass clippings of CPU can be turned into useful product. Instead if letting these kind of refuse rot in the controlled dumpsite, these wastes can be processed in an environmental-friendly way through composting.

The following are recommended in this study:

1. In composting biomass wastes using the wire mesh circular bin, aeration should be improved by placing perforated bamboo trunks or pipes horizontally and vertically at regular intervals to carry air through the heap.
2. For a fully aerated decomposition process and a less labor intensive procedure, other methods like windrow composting may also be tested.

3. Soils should be added by as much as 10% by volume in the com posting materials because microorganisms need the clay materials of the soil in order to build the clay humus complex and to hold the nutrient cations mineralized during the composting process.
4. Composting of CPU biomass wastes is one alternative that can be adopted by the University in trying to reduce the volume of wastes generated daily which are just disposed of in the dump site.
5. To limit thee sources of error, the height of the composting materials should be the same if another research study on com posting using the wire mesh bin is desired.

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