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Aerobic Composting of Solid Waste Generated from Aurangabad city (MS), India

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ABSTRACT: The exponential growth of urbanization leads to increase in severity of environmental problems especially assonated with disposal of solid waste. With considering the increasing rate of solid waste generation in urban area, the problem of availability of space required to dispose it off is become a concern for planners and administrators of urban local bodies (ULB). In order to cope up with the urge of availability of dumping space to adopt the aerobic composting technique for the degradable fraction of solid waste is become unavoidable. The present paper is an attempt to study the feasibility of aerobic composting technique by using metallic container for waste generated from Aurangabad city of Maharashtra state. The study was carried out for a period of one year with monitoring of selected parameters. The results reveals that for conversion of waste into compost of better quality requires 40-45 days. Whereas the NPK value of prepared compost resemble with international standards.

Key words: Aerobic composting, Solid waste, Metallic container, Aurangabad, NPK

INTRODUCTION

The urban development directly and indirectly responsible for the increasing the quantity of solid waste in city area. Solid waste of each municipal corporation is diversified in nature and highly dependent on the type of area from where it has collected. The quantity and characteristics of solid waste vary from place to place; factors that influence the quantity and composition are the average income level, the sources, the population, social behavior, climate, industrial production and the market for waste materials (Yadav & Linthoingambi, 2009).

The inadequate methods adopted for disposal of solid waste are responsible for the serious health concern. The poorly maintained landfill sites are prone to groundwater contamination because of leachate production. Open dumping of garbage facilitates the breeding for disease vectors such as flies, mosquitoes, cockroaches, rats, and other pests (CPCB, 2000).

The composting is the microbial decomposition of biodegradable solid waste under aerobic condition where microorganism convert waste into a stable end product i.e. Compost.The main objectives of composting are to decompose organic fraction of waste to reduce its volume, weight and moisture content; minimize potential odour; decrease pathogenic and increase potential nutrients for agricultural application (Muyeed, 2007).

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Aurangabad city is one of the rapidly expanding metropolitan city from Marathwada region of Maharashtra state. The expanding industrial area is directly responsible for increasing population of Aurangabad city and ultimately resulted in the increase in quantity of solid waste generation. The present investigation was carried out at Naregaon waste dumping site of Aurangabad city of Maharashtra state for a period of one year. In order to process the collected waste from city area the commonly used method for waste disposal is land filling. The present study is an effort to assess the feasibility of aerobic composting technique for degradable fraction of solid waste from city area (AMC, 2006 ; Late, 2011).

MATERIALS & METHODS

About two-hundred liter capacity perforated metallic container, covered on top and an open at the bottom was used as aerobic composting unit for solid waste collected from Naregaon waste dumping ground. The height and diameter of the container was 34 inch and 21 inch respectively. In order to maintain aerobic conditions the holes of half inch diameter were made in the surrounding of the container and the plastic pipe of one inch diameter hole was inserted. The cone shape lid was provided to protect the container from sunlight and rainfall. To picked out the

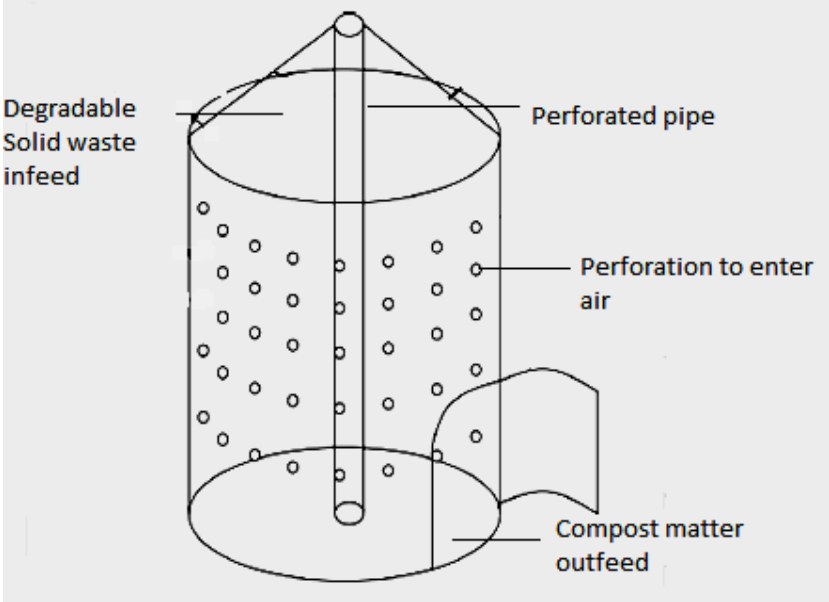

Fig.1. Schematic diagram of metallic container used for aerobic composting

compost from the container the 10 inch by 12 inch opening was provided. The experimental design of the unit was illustrated with schematic diagram in Fig.(1).

The biodegradable portion of waste was kept in container for composting by maintaining optimum moisture content and the parameters such as temperature, moisture content and pH were monitored at regular time interval. The temperature of the composting waste was monitored at the interval of 10, 20, 30, 40, and 45 days till the completion of composting process. The moisture content of compost was monitored in various stages at the interval of 5, 15, 25, 35 and 45 days. The pH was monitored at the interval 5 days.

The composting of organic portion of the waste was carried out during January-March; April-June; July-September and October-December and labeled them as sample – A, B, C & D. The harvested compost was subject to nutrient content analysis viz. Nitrogen, Phosphorus (as P_2O_5) and Potassium (as K_2O) and compared them with international market standards (CPHERI, 1974; APHA, 1998; Kaul & Gautam, 2002; Trivedy & Goel, 1986).

RESULTS & DISCUSSION

In the present study the monitoring of parameters such as temperature, moisture content and pH was carried out and the results are summarized in Table . 1, Table . 2 and Table 3. The temperature were ranged between 30.8 ^{0}C – 54.5 ^{0}C sample-A during 10 to 45 days. The maximum and minimum temperature was 51.3 ^{0}C and 31.4 ^{0}C in sample-B after 30 and 45 days respectively. The minimum and maximum and minimum temperature was 36.3 ^{0}C and 50.3^{0}C in sample-C after 10 and 20 days respectively. The temperature ranged between 31.7 ^{0}C to 54.2 ^{0}C in sample-D during 10 to 45 days time period.

Table 1. Monitoring of Temperature (^{0}C) during aerobic composting of organic solid waste in metallic container

Days Interval	Sample			
	Sample-A	Sample-B	Sample-C	Sample-D
After 10 days	35.4	32.1	36.3	31.7
After 20 days	47.6	48.4	47.1	47.3
After 30 days	49.1	48.8	48.2	48.1
After 40 days	33.7	38.4	41.4	49.1
After 45 days	30.8	31.4	38.3	45.4

Table 2. Monitoring of total moisture content (%) during aerobic composting of organic solid waste in metallic container

Days Interval	Sample			
	Sample-A	Sample-B	Sample-C	Sample-D
After 5 days	0.52	0.55	0.50	0.46
After 15 days	0.60	0.61	0.52	0.53
After 25 days	0.60	0.66	0.63	0.57
After 35 Days	0.57	0.58	0.57	0.52
After 45 days	0.55	0.51	0.54	0.51

Table 3. Monitoring of pH during aerobic composting of organic solid waste in metallic container

Days Interval	Sample			
	Sample-A	Sample-B	Sample-C	Sample-D
After 5 days	6.2	6.3	6.2	5.9
After 10 days	6.5	6.6	6.3	6.2
After 15 days	7.6	7.5	7.7	7.6
After 20 Days	7.7	7.6	7.6	7.9
After 25 days	7.8	7.6	7.8	7.8
After 30 days	7.8	7.7	7.7	7.7

Table 4. Percent (%) nutrients (NPK) study of the compost prepared by using aerobic composting technique in metallic container

Samples	Nutrients		
	Nitrogen (N)	Phosphorus (P)	Potassium (K)
Sample -A	0.84	0.20	0.82
Sample -B	0.91	0.21	0.85
Sample -C	1.04	0.23	0.76
Sample -D	1.18	0.49	0.84
International market standards for nutrients	1.10	0.40	0.50

The variations in moisture content were ranged between 0.52 – 0.60 % in sample-A during 5 to 45 days. The maximum moisture content was 0.66 % and 0.51 % in sample-B after 25 and 45 days respectively. The minimum and maximum pH values were 0.46 and 0.57 in sample-C after 5 and 10 days respectively. The moisture content ranged between 0.46 % – 0.57 % in sample-D after 10 to 25 days time period.

The variations in pH value were ranged between 6.2 – 7.8 in aerobic composting process in metallic container in sample during 5 to 30 days time interval in sample-A. The minimum pH was 6.3 after 5 days maximum pH was 7.7 after 30 respectively in sample-B. The seasonal variations in pH value were ranged between 6.2 – 7.8 in aerobic composting process in metallic container in sample-C during 5 to 30 days time interval. The minimum and maximum pH values were 5.9 and 7. 9 observed after 5 and 20 days respectively in sample-D.

The temperature undergoes considerable changes during composting due to a calorific effect, resulting from oxidative cleavage of covalent bonds in the substances degraded (Guanzon, & Holmer, 2003; Tuomela, *et al.*, 2000).

The pH of the waste is one of the important parameter for composting efficiency. The pH values are closely related to the activity of microorganisms participating in the process of compost formation (Neklyudov & Ivankin, 2003).

The nutrient contents such as total nitrogen, phosphorus as P_2O_5 and potassium content as K_2O were analyzed of harvested compost and the results were summarized in Table 4. The nitrogen content values of the compost prepared during the normal aerobic composting in metallic container were 0.84 %, 0.91 %, 1.04 % and 1.18 % for sample -A, sample – B, sample – C and sample – D respectively.

The maximum phosphorus content was found 0.49 % in the sample – D and minimum 0.20 % in sample – A in the prepared compost following aerobic composting process.

The maximum potassium content was 0.85 % and minimum were 0.76 % in the sample - B and sample – C respectively in the prepared compost.

CONCLUSIONS

The results of aerobic decomposition of degradable portion of waste collected at Naregaon dumping site reveals that, about 40 – 45 days were required to convert waste to compost. In addition to that the NPK value of harvested compost resembles the international standards of compost.

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