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STUDY ON BIODEGRADABILITY OF VEGETABLE AND FLOWER WASTES BY VERMICOMPOSTING

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ABSTRACT

An experimental study was conducted to determine the efficiency of vermicomposting process of various types of organic wastes such as vegetable, fruit and flower wastes. Various characteristics like pH, electrical conductivity, moisture content, total solids, volatile solids and ash content were monitored continuously to ascertain the stability of the compost. The vermicomposting process for flower waste and fruit-vegetable waste mixture was compared. Both the processes were found to be effective with significant nutrient enrichment.

INTRODUCTION

Solid waste management is essential to maintain healthy environment. The problems of environmental degradation have assumed critical dimensions in many parts of India due to resource exploitation, rapid urbanization, industrialization, unplanned population growth, and misuse and abuse of environment. In India about 0.1 million tonnes of municipal solid waste is generated every day, which is approximately 36.5 million tonnes annually. The organic fraction of this waste is 40% and expected to rise to 60% by 2025. Per capita waste generation in major Indian cities ranges from 0.2 kg to 0.6 kg. Out of the total municipal waste collected, on an average 94% is dumped on land and 5% is composted (CPCB 2000).

Instead of effective utilization of the organic manure, the excessive use of synthetic fertilizers during the green revolution has lead to many problems such as low productivity soils and nutrient depletion in the farm sector. Since, India's 35 largest cities alone can provide 5.7 million tonnes a year of organic manure, it could be better utilized in the farm sector. In this context many research works have been carried out. The objective of this study is to determine the biodegradation levels of various mixtures and to determine the efficiency of the process for different types of organic wastes.

MATERIALS AND METHODS

The wastes to be composted were selected as vegetable waste mixed with fruit waste and flower waste. The vegetable waste and fruit waste were obtained from Pazhamudir Solai in Coimbatore city. Flower wastes were collected from flower markets in Coimbatore city.

Rectangular wooden boxes were selected as vermi bins for the process. Sufficient number of holes was provided at the bottom for circulation of air and drainage. The standard size of the bin should be such that the depth of the bin should be lesser than the length and breadth. The inner dimension of the box was 49 × 36 × 18.7 cm with the thickness of 2 cm. Empty weight of the bin was 2.15 kg. The seeding agent used for the process was goat dung, which was filled up to a depth of

10 cm. The weight of goat dung loaded was 7.85 kg. The bins were named as reactor 1 consisting of vegetable and fruit wastes, and reactor 2 consisting of flower waste. The amount of waste loaded in each reactor was 1 kg.

The type of earthworm species selected for the decomposition process was *Eisenia fetida* and about 320 numbers were inoculated into each reactor. The reactors were kept in a cool dark place. The vermi beds were covered at the top by jute bags to prevent the entry of centipedes, toads, rats and cats. An empty space of 2 cm was left at the top to collect the castings. The water level was maintained between 60 and 70% in all the reactors to supply necessary moisture and to reduce the processing time.

The physical and chemical characteristics such as pH, electrical conductivity, moisture content, total solids, volatile solids, ash content and nutrient levels were measured once in four days using standard methods as per IS: 10158-1982, till a stabilized compost were obtained (Sharma et al. 2002). The process required a completion period of 40 days.

RESULTS AND DISCUSSION

The initial characteristics of the seeding and composting material are given in Table 1. The flower, fruit and vegetable wastes were easily degraded by earthworms. The presence of aerobic bacteria harboured by the earthworms ensures rapid decomposition of the biodegradable waste at a higher rate. The earthworm feeding activity assimilates only 5-10% for their growth and the rest is excreted as vermicast (Hemalatha & Meenambal 2005).

The routes of stabilisation of the organic wastes are presented in Tables 2 and 3. The initial pH value in reactor 1 was acidic due to the presence of organic acids such as citric acid from fruit and vegetable waste. It has been found that the decomposition process turned to alkaline conditions after 20 days and stabilized around pH 8 after 40 days. It is evident that all the values are in the preferred range of the pH 7 to 8 (Kamilaki & Stentiford 2001). The electrical conductivity in reactors 1 and 2 stabilized to 0.32 mS/cm indicating its suitability to be used as compost .

The biodegradation was faster in reactors 1 and 2 and the final values of volatile solids were below 35% at the end of 40 days. Reduction in total solids and volatile solids is indicator of amount of biodegradation of organic matter (Sharma et al. 2002). The nutrient values for the reactors are given in Table 4. The final C/N ratio reduction is found to be optimum in reactor 1 (Gajalakshmi et al. 2005). The phosphorus and potassium levels were also found to be within standard values. Along

Table1: Initial characteristics of composting materials.

Parameters	Goat dung	Vegetable waste	Fruit waste	Flower waste
C (%)	11.22	42.4	56.4	54.2
N (%)	3.0	2.8	1.4	1.8
P (%)	0.30	0.46	0.27	0.14
K (%)	0.56	0.79	0.64	0.26
pH	9.0	5.1	5.2	7.6
E.C (mS)	0.56	0.9	1.06	0.6
T.S (%)	19.4	54.5	87.0	46.0
V.S (%)	60.0	90.5	89.0	80.0
Ash content	40.0	8.7	10.0	19.0

Table 2: Biodegradation levels of Reactor 1.

Days	0	4	8	12	16	20	24	28	32	36	40
pH	5.0	5.6	5.8	6.02	7.06	7.2	7.4	7.6	7.8	7.8	7.8
E.C (mS)	1.2	0.94	0.86	0.74	0.69	0.66	0.58	0.33	0.323	0.321	0.32
T.S (%)	60	57.4	54	51.3	48	48	46	45	43.5	40	38
V.S (%)	80	78.3	75.2	68.9	51.3	43.5	35.7	33.4	33.29	33.19	33.1
Ash (%)	20	21.7	24.8	31.1	48.7	56.5	64.3	66.6	66.7	66.8	66.9

Table 3: Biodegradation levels of Reactor 2.

Days	0	4	8	12	16	20	24	28	32	36	40
pH	6.8	7.1	7.3	7.4	7.6	7.8	7.9	7.9	8.0	8.0	8.0
E.C (mS)	0.7	0.66	0.64	0.61	0.51	0.49	0.44	0.42	0.38	0.32	0.32
T.S (%)	57	56	56	55	54	48	46	46	45	44	40
V.S (%)	75	74.4	69.4	62.7	56.1	48.07	40	38.9	36	35.68	34.1
Ash (%)	25	25.6	30.6	37.3	43.9	51.93	60	61.1	64	64.32	66

Table 4: Final nutrient values in the reactors.

Parameter	Reactor 1	Reactor 2
C (%)	16.7	14.8
N (%)	1.2	0.9
C/N ratio	13.9	16.4
P (%)	0.52	0.26
K (%)	0.52	0.4
pH	7.8	8.0
E.C (mS)	0.32	0.32

with nutrient enrichment and biodegradation, the population of the earthworms also increased by 100%.

Plant growth from seeds of fruits and vegetables were also observed in reactors 1 and 2 at the end of the process indicating that the compost can be efficiently used for plant growth. The results indicate that vermicomposting process can be effectively used in the treatment of organic wastes.

CONCLUSION

Organic waste generated from India at present comes to around 14.6 million tonnes annually and it is projected that its generation by 2025 will be around 21.9 million tonnes. This much amount of organic waste disposal will pose a severe environmental problem and it has to be effectively managed. The vermicomposting method was found to be simple, effective and economical among the other solid waste disposal methods.

REFERENCES

Kamilaki, Areti and Stentiford, Ed. 2001. Assessing Compost Stability and Determining Levels of *Aspergillus fumigatus* Resulting from Different Composting Operations. Project Report, Project No.0651.

Sharma, R., Sharma, D., Rao, K.S and Jain, R.C. 2002. Experimental studies on waste paper pulp biodegradation. Indian Journal of Environmental Health, 44(3): 181-188.

Hemalatha, B. and Meenambal, T. 2005. Experimental study on biodegradability of yard and fruit wastes with industrial effluents by vermicomposting. Nature Environment and Pollution Technology, 4(2): 189-193.

CPCB 2000. Status of Municipal Solid Waste: Generation, Collection, Treatment and Disposal in Class I cities. Central Pollution Control Board, New Delhi.

Gajalakshmi, S., Ramasamy, E.V. and Abbasi, S.A. 2005. Composting-Vermicomposting of leaf litter ensuing from the trees of mango (*Magnifera indica*). Bioresource Technology, 96(9): 1057-1061.