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Original Research Paper

Bioconversion of Mango Waste Blended with Poultry Waste and Cow Dung into Useful Manure by Aerobic Composting

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ABSTRACT

Solid waste can be disposed off either by diluting or by making it into useful manure. Since most of the land, water and atmosphere have been polluted largely, the only way to prevent pollution is to make the waste into a useful product. The present study investigates feasibility of blending the fruit waste (mango waste) with poultry waste and cow dung to produce a value added compost. Mango waste usually creates nuisance when compared to other fruit and vegetable waste as it gives foul smell. To achieve good composting mango waste was blended with poultry waste and cow dung at six different weight proportions. Chemical properties of compost like pH, nitrogen, carbon, phosphorus and potassium were observed at different periods, i.e., on the days 1, 21 and 35. Finally, the carbon to nitrogen ratio was compared with all the five samples to identify the best compost. The samples with ratio 1:1:1 and 2:1:1 without mango seeds were considered to be more reliable and efficient to be used as compost.

INTRODUCTION

Composting is an age-old waste management practice that allows transformation of organic waste into a stabilized product, which can be used beneficially for agricultural or land reclamation purposes (Zucconi & de Bertoldi 1987). Before the introduction of inorganic fertilizers, resource-poor farmers used composts to fertilize their soil. However, the technique of preparation of compost is laborious and the process is practically slow taking about 5 ot 6 months. There is an increasing number of compost operations due to increasing landfill tipping fees and legislation to protect the environment (He 1995). Thus, the attention has been drawn to the need to increase composting efficiency, reduce processing time, and achieve better quality products, all of which are key aspects to compost marketing.

During the composting period, labile carbon compounds are lost, while more complex substances, such as humic acids, are synthesized (Riffaldi et al. 1992). Once the microbial degradation has been stimulated to a certain level, the faunal effect will become quantitatively important (Tian et al. 1995). Adequate knowledge of microbial succession is, therefore, very important in any chosen composting method. Various biological studies have been carried out to identify major microbiological agents responsible for biodegradation. Mac Donald et al. (1981) noted that several organisms such as bacteria, fungi, actinomycetes and protozoa, brought about the composting process and it might also involve invertebrates such as nematodes, potworms, earthworms, mites and various other

1. Sample 1: 1/2 kg dry waste (without mango seed) + 1/2 kg poultry + 1/2 kg cow dung (1:1:1)
2. Sample 2: 1/2 kg dry waste (with mango seed) + 1/2 kg poultry + 1/ 2 kg cow dung (1:1:1)
3. Sample 3: 1 kg dry waste (without mango seed) + 1/2 kg poultry + 1/2 kg cowdung (2:1:1)
4. Sample 4: 1 kg dry waste (with mango seed) + 1/2 kg poultry + 1/2 kg cow dung (2:1:1)
5. Sample 5: 3 kg dry waste (without mango seed) + 1 kg poultry + 1 kg cow dung (3:1:1)
6. Sample 6: 3 kg dry waste (with mango seed) + 1 kg poultry + 1 kg cow dung (3:1:1)

Mango waste, cow dung and poultry waste were crushed manually. 750 mL of water was added to maintain the moisture content and it was well mixed. All six samples were taken to do initial chemical characterization before dumping into waste pits. The six different ratios of samples were dumped into six different compost pits and later covered with gunny bags. The materials in pits were turned once in a week to supply air for microorganisms. Every week, 750 mL of water was added into compost pits to maintain moisture content. After the end of 21 and 35 days, the samples were taken from each pits and analysed for C, N, P, K and pH.

RESULTS AND DISCUSSION

The results of the study are given in Tables 1-4 and Figs. 1-5. The composting process has often been divided into phases (Zucconi & de Bertoli 1987, Adani et al. 1997, Sullivan & Miller 2001, Brewer & Sullivan 2003, Tremier 2005). The first phase, or active phase, is characterized by the availability of readily decomposable C, intense microbial activity, rapid rates of organic carbon decomposition, and high temperature. The second phase, curing or stabilization, begins when the supply of readily available organic carbon becomes limiting. To obtain best results, mango waste was mixed with cow dung and poultry waste in six different weight proportions. A management practice often used to optimize the process and improve product quality is Co-composting materials with complementary characteristics (Wilson 1991, Vallini 1992, Cooperband 2000, Young 2000).

There is no literature regarding composting of mango fruit. The results represented in Tables

Table 1: Chemical composition of the mango waste mixed with cow dung and poultry waste on the 1st day.

Samples	Carbon %	Nitrogen %	Phosphorus %	Potassium %	pH
Sample 1	67.62	2.60	1.50	1.30	3.00
Sample 2	72.48	2.40	1.50	1.30	2.80
Sample 3	70.40	2.20	1.30	1.20	3.20
Sample 4	72.80	2.60	1.30	1.20	3.20
Sample 5	73.69	2.80	1.70	1.50	2.40
Sample 6	70.41	2.10	1.70	1.50	2.40

Table 2: Chemical composition of the mango waste mixed with cow dung and poultry waste on the 21st day.

Samples	Carbon%	Nitrogen %	Phosphorus %	Potassium %	pH
Sample 1	40.01	1.80	1.10	0.90	5.00
Sample 2	55.69	2.10	1.20	1.10	4.50
Sample 3	51.78	1.90	0.90	0.80	5.20
Sample 4	48.30	2.10	1.20	1.00	5.00
Sample 5	48.07	2.15	1.10	1.00	4.90
Sample 6	46.73	1.80	1.30	1.20	4.30

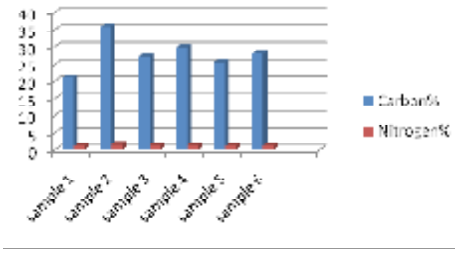

Fig. 3: Carbon % and nitrogen % on 35th day of composting.

21 and 35 days reaching nearer to pH 7 (Fig. 4). This shows that the compost formed is suitable for application on land and for pot cultures. Apparently, pH increase is due to degradation of short-chained fatty acids and ammonification of organic N (Michel & Reddy 1998).

As composting leads to production of minerals (Zucconi & De Bertoldi 1987), the concentration of N, P and K were determined at the three different time intervals, which showed that there is significant in-

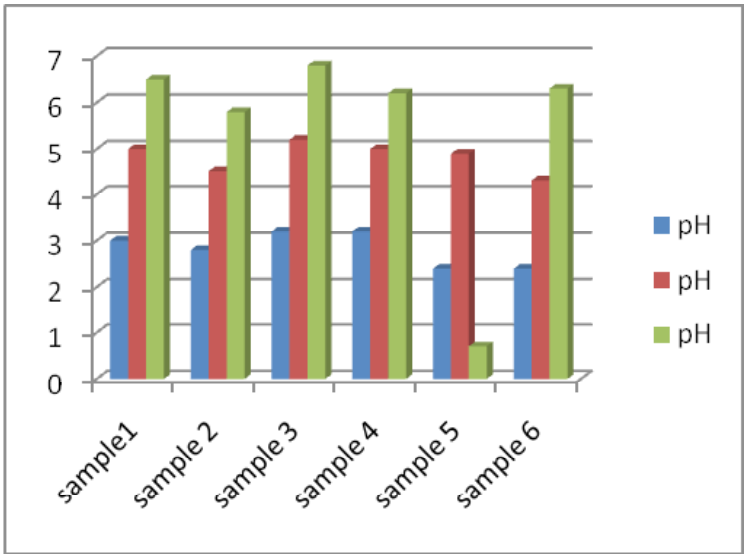

Fig. 4: The change of pH values of the samples from the initial to final stage.

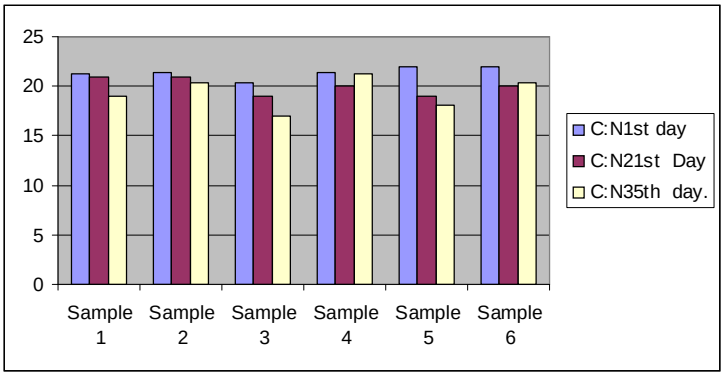

Fig. 5: C:N ratios of the samples at different time (1 , 21 and 35 days) intervals of composting.