Eco-friendly practice of utilization of food wastes

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ABSTRACT: Solid waste generated in developing countries disposed in open dumps, is a threat to public health and environment. Food wastes produce methane gas that results in 21 times’ greater impact on global warming than carbon dioxide. The composting technology is one of the alternatives, as it is the highest form of recycling of biodegradable solid waste. The study was undertaken to utilize food waste generated, into organic manure using effective micro organism. A total of 250 kg of food wastes were collected from 150 households at Trichy Satellite Township and 20 foodservice institutions of Tamilnadu over 15 days. Two pits were dug for comparing composting using Effective Microorganisms (EM) and natural composting for remediation of organic contaminants. Both the compost was analyzed for manurial value and microorganisms. And the effectiveness of compost was studied through cultivation of vegetables at households and selected institutions. Results revealed that EM compost had fast decomposition rate, rich in nutrients, more microbial activities, good germination and more yields compared with natural compost. Thus the study paves way for effective management of food waste in order to minimize potential human and environment risks and composting using effective microorganisms as an option of waste management operation that is cheap, eco-friendly, wealth creating and sustainable.

Keywords— Food waste, global warming, effective microorganisms, remediation, compost, eco-friendly.

I. INTRODUCTION

Today, the cry of environmental pollution is heard from all nooks and corners of the globe and pollution has become a major threat to the very existence of mankind on earth (Das, 2008), and has become an international concern (Sharma, 2003). Garbage or organic wastes produced by every home make up the municipal or corporation garbage which today results in environmental problem. India produces about 36.5 million tones of municipal waste every year. About 60 - 70 percent of this amount is spent on collection, 20 - 30 percent on transportation and less than five percent on final disposal (Disha et al. 2001). Waste generation per capita per day in India ranges from 100 to 500 grams points (Arrifa and Jayalakshmi (2005), Sarkhel and Banerjee, 2009).

Food waste has become a hot issue in recent years. The food waste includes uneaten food and food preparation from residences, commercial establishments such as restaurants, institutional industrial sources like school cafeteria and factory lunchrooms. Most foodservice operation throw out a massive amount of garbage, most of which could be diverted. Seventy five percent of material in today's landfill is recyclable or compostable, while 50-70 percent of the weight of a foodservice operation's garbage consists of compostable food items. Food waste is a growing issue, and the disposal of it is controversial, causing increased food prices and the resources required (Mashad and Zhang 2010; Alvarez et al. 2000; Wang et al. 2005). Composting, an age old process is ideal technology for waste management in India. Studies have suggested that use of effective microorganisms may have a number of applications, including agriculture, livestock, gardening and landscaping, composting, bioremediation, cleaning septic tanks, algal control and household uses as a safe method and can treat the leachate coming out form the garbage and remove the foul smell form decomposed garbage(Khalilq,2006). With these facts in mind the study was undertaken to utilize food waste generated into organic manure using effective micro organism and to study the effectiveness of compost.

II. MATERIALS AND METHODS

2.1. Selection of Area

Trichy Satellite Township a fast developing township in 100 acres, situated at JJ Coloby, Beem nagar, Trichy CR road presently having a residence of 250 was selected for the purpose of collection of waste and for establishment of compost unit based on purposive sampling technique. A total of five medium sized restaurants and five hostels including four private and one government aided hostel providing boarding were selected from...
2.2. Establishment and analysis of compost

For the ease of identify of the type of waste three different colored recycled plastic bags were used. The kitchen waste that included vegetable peels, plate waste, leftover foods, fruit peels and egg shells from residential areas were collected in black bags, the leftover rice were collected in white bags and similarly the kitchen waste from restaurants and hostels were collected using red colored bags. Dry leaves were collected from the college using black bags. The waste was collected for a period of 15 days personally and was weighed separately.

2.3. Selection of Plot

A pit I of 2x2x2 feet was dug for composting with addition of effective microorganisms and in other pit II of same measure was dug for the purpose of natural composting.

2.3.1 Preparation of compost

For the preparation of compost the following procedure was adopted. Collect the (biodegradable) wet waste from the house hold and selected institution. Add dry leaves on the pit I and II before putting new wet waste to provide minimum aeration and to absorb the moisture to accelerate the microbial activities in the initial stage. Add activated EM1 solution on top of the pit I to develop the microbial growth. The microbial activities digest and decompose the bio degradable wastes from complex to simple structure under an aerobic condition (Natarajan et al., 2006). Turn pile after 10 days to heat it up. To mix, move the decomposing materials at the middle towards the outside and the outside materials towards the centre of the pile. If the compost has a strong odor, turn it more often as the pile may be tightly packed and is poorly aerated. At least five times the compost pile has to be turned up during the process time. The level of 40 percent moisture content should be there in pile to enhance the microbial activity. The moisture level in pit I and II was felt using bare hand and when found dry adequate amount of water was added. The compost is finished when the pile is no longer heating up and the original materials turn earthy and black. The dried compost were collected from both the pits separately was sieved and kept in shade.

2.3.2 Analysis of the manurial value of the compost

Nutrient analysis and microbial activities of the compost was carried out with the help of the Department of Agriculture, Agricultural complex (LUP&QC), tested at Trichy.

2.4 Effectiveness of the compost through cultivation

2.4.1 Selection and cultivation of plants

The seed of ornamental plants such as jasmine and crossandra and vegetables such as brinjal, lady’s finger, tomato and ponnakani keerai were collected from Pondicherry Agro services and Industries Corporation Limited (PASIC) and Perunthalaivar Kamaraj Krishi Vigyan Kendra (KVK) Trichy and the effect of EM compost supply soil on the growth and yield using the manures from pit I and pit II was found.

III. RESULTS AND DISCUSSION

3.1 Type of waste generated

Type of waste generated by selected institutions and households is given in table I.

3.2 Method of Disposal

The variety and quantity of waste products to be disposed off has increased tremendously with the improvement in the standard of living. This waste needs prompt disposal because it gives rise to foul odors and encoiring the growth of micro-organisms and pests (Roday, 1999). Table II shows the method adopted for disposal of waste by selected institutions.

It was heartening to observe that 30 percent of commercial restaurants had been disposing the waste merely throwing away in wasteland either after collecting in plastic bags or as solid wastes. Incineration was adopted by four of the restaurants and one government hostel after careful segregation of dry waste. Among households, 100 percent took the help of non-commercial municipality on daily basis, as hygienic was ensured in and around the township area. Solid waste management is important from the point of view of safeguarding public health and keeping the environment clean and hygienic.

3.3 Quantity of Waste Collected For Composting

The kitchen wastes generated from the various institutions and households at township were collected everyday for a period of 15 days. Waste collected was computed, and it was observed that the quantity of waste generated ranged between four kg and 64 kg per day. The quantity of waste generated everyday depend on the items prepared based on the menu.
3.4 Duration for Composting

The rate of conversion of food waste into manure was accelerated quickly within 45 days due to the inoculation of effective microorganisms when compared to natural process of aerobic digestion which took two months for the formation of compost. The appearance of the compost as dark brown color and strong agricultural soil odor with 40 percent moisture was considered as end point for the bio conversion in both the pits.

3.5 Manurial Value of Compost

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Type of Compost</th>
<th>Natural compost</th>
<th>EM. Compost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen (%)</td>
<td>0.9</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Phosphorous (%)</td>
<td>1.2</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Potassium (%)</td>
<td>0.32</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>Organic carbon (%)</td>
<td>5</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>pH levels</td>
<td>6.8</td>
<td>6.6</td>
<td></td>
</tr>
</tbody>
</table>

It is clear from the table that the entire nutrient analyzed were enriched in the manure obtained through inoculation of EM.1 (pit I) as against the natural compost. The effective microorganisms enrich the compost by means of producing enzymes which act on the organic wastes and enrich the nutrients on the composting process. Enzyme such as amylase, rubisco and melibiase are produced by lacto bacillus, photosynthetic bacteria and yeast respectively. The waste can be utilized to obtain useful rich nutrient compost through composting as it ensures good, hygienic environmental conditions and helps to lead a better quality of life.

3.6 Microbial Activities in Compost

Microbial succession may provide important information for the effective management of the composting process and the appearance of certain groups of microorganisms is believed to reflect the degree of stabilization of the organic matter during the process (Ryckeboer et al., 2003). EM was effective in suppressing malodors during composting and finished compost was shown to be an excellent soil conditioner and organic fertilizer for crop production as yeast and lactobacillus was founded to be 54 x 10^4 cfu/g and 72 x 10^4 cfu/g respectively whereas the natural compost had 54 x 10^5 cfu/g and 54 x 10^4 cfu/g of total bacterial count and actinomycetes respectively.

3.7 Cultivation and Yield of Selected Vegetable Crops and Ornamental Plants

Based upon the motivation created among women in households and kitchen personnel’s of selected food service institution, 12 women and one each of hostel and restaurant exhibited their interest in cultivation of crops. The selected 12 households were grouped equally into for the purpose of cultivation of crops using EM.1 compost and natural compost and had equal size of plots (10x 10 feet) for the cultivation.

3.8 Yield of Vegetables in Households

The maximum yield of 5.4 kg of tomato and 68 kg of lady’s finger was yielded from use of EM.1 compost as against natural compost. With regard to the yield of ornamental plants also, a maximum of ½ kg was obtained through EM.1 compost in case of crossandra.

3.9 Yields of Vegetables in Hostel and Restaurant

Within month a yield of 250 g of vegetables was obtained. In case of hostel, 4x5 feet size plot was taken and soil mixed with EM compost and with regular monitoring by student volunteers, a yield within a range of 250 – 500 g were obtained. Due to the tedious work schedule of both kitchen personnel, they were not willing to use natural compost.
3.10 Germination Seed

The numbers of leaves from lady’s finger were counted during the germination days of 7, 10 and 20 and result showed that EM compost had 4, 9 and 13 leaves respectively. The ability of seeds to germinate readily when conditions are suitable for successful growth and the ability to avoid germination at inappropriate times are thus essential to the survival of a species (Johnson, 2000).

3.11 Cost Incurred towards Establishment

The total cost for establishment of pit I for the EM composting was Rs. 880 which included the cost of preparation of effective micro-organisms, digging of pit, transportation and labor fee.

IV. CONCLUSION

Thus it is important to improve solid waste management in order to minimize potential human and environment risks. Almost 60 percent of solid waste contains biodegradable waste which could easily converted into manure. EM composting could be as an option of waste management operation that is cheap, eco-friendly, wealth creating and sustainable. This action will lead to waste reduction at landfill, job creation and production of organically produced food crops.

REFERENCES