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Review article

MARKET WASTE MANAGEMENT USING COMPOST TECHNOLOGY

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ABSTRACT: The utilization of Human and Animal solid wastes is of greater importance both from public health and environmental point of view. Currently the majority of solid waste generated in developing countries is disposed in open dumps, which pose a threat to public health and environmental quality. Across the country, many communities, businesses, and individuals have found creative ways to reduce and manage Municipal Solid Waste (MSW)- More commonly known as trash or garbage-through a coordinated mix of practices that includes Source reduction, Recycling (includes Composting) and Disposal. The decomposition of organic matter is brought about by microorganisms which utilize Carbon and Nitrogen in the waste for synthesizing cellular constituents. The C/N ratio is therefore an important factor determining the rate and extent of decomposition .When excess of carbon is available the C/N ratio is high and the rate of decomposition is slow. Generally a C/N ratio of from Market (VW) amended with cow dung (CD) into compost. VW was mixed with Bulky material CD in different ratios to produce two different combinations for laboratory screening of wastes for about 15 days. The initial and final values of carbon (2.59%, 3.54%), Nitrogen (1.06%, 1.25%), Phosphorus (0.34%, 0.28%) & exchangeable K (1.94%, 1.68%) has been recorded. The suitability of using the compost as manure was checked. The results indicate the possibility of converting negligible Vegetable-market solid wastes into compost if mixed with bulking materials in appropriate ratios.
Key words: Municipal solid waste, Composting, Vegetable Waste, Cow dung.

INTRODUCTION

Composting is not a new technology [22]. Compost, a nutrient-rich, organic fertilizer and soil conditioner, is a product of humification of organic matter. This process is aided by a combination of living organisms including bacteria, fungi and worms which transform and enhance lignocellulosic waste into humic-like substances [8]. The microorganisms consume oxygen while feeding on the Organic matter and in the process generate carbon dioxide (CO_2), heat and water vapour. Compost contains higher percentage of available nutrients [7] humic acids [24], plant growth promoting substances such as auxins, gibberellins and cytokinins [14] N-fixing and P-solubilizing bacteria, enzymes and vitamins [11]. During the composting period, labile carbon (C) compounds are lost, while more complex substances, such as humic acids, are synthesized [23]. Nowadays Composting has gained increased attention as a means of reducing the environmental impact of livestock manure [12, 13].The present investigation, therefore, was carried out to assess the impact of composting on microbial succession in market wastes.Chemical, physical and biological properties of fresh manure are also highly variable, making its use in cropping systems more of a challenge than commercial fertilizers [15].

MATERIALS AND METHODS

The field experiment was conducted at the Bharathidasan University, Trichy during November to February, 2009. The market waste needed for the experiment was mainly the Vegetable Waste collected from the Market area of Trichy. After collecting the vegetable waste, fibrous material, metals, or any substances apart from that are separated and the vegetable waste was subjected for chopping, further the shredded waste was subjected for composting.

Experimental Set up

The experiment was carried out in a circular plastic container (diameter 40 cm, depth 9cm) with the capacity of 1kg waste .Which were labelled as MWCD contain 500g of vegetable waste + 500g of cow dung. The container was left for pre decomposition so that the wastes become suitable bed for the earthworm. After 15 days (n=15) earthworms were inoculated into MWCD. During the vermicomposting process, the moisture was maintained at about 60 -65%. Samples triplicates were prepared from the container for further analysis.

Chemical analysis

The experiment was conducted for 90 days; Sample was taken for the initial and mature compost and were air dried to monitor the changes for the analysis. pH was determined by the digital pH meter (ELICO- L1162) and Electrical conductivity (EC) was studied by conductivity meter (ELICO-180). Total organic carbon (TOC) was analysed by Walkely and Black (1934) method and Total nitrogen (TKN) by micro kjeldahl method Singh and Pradhan. Potassium, Phosphorous, Total organic matter and C: N ration was also analysed.The composted samples were analyzed and results were averaged.

RESULTSAND DISCUSSION

Table.1: Initial & Final values of compost

S.No	Name of Parameter	Sample Details	
		1	2
1	pH	8.10	8.41
2	Electrical conductivity(dms-^{1})	1.52	1.18
3	Organic carbon (%)	2.59	3.54
4	Total nitrogen (%)	1.06	1.25
5	Total phosphorus (%)	0.34	0.28
6	Total potassium (%)	1.94	1.68
7	Total sodium (%)	0.64	0.58
8	Total calcium (%)	4.67	4.58
9	Total magnesium (%)	2.15	2.05
10	Total sulphur (%)	0.59	0.64

DISCUSSION

pH: The PH for this experiment was measured using digital pH meter in 1/10 (W/V) aqueous solution. The pH values of Market wastes during the Composting process were between 8-9 falls within the alkaline range for the initial and the mature compost.The shift in pH during the study could be due to microbial decomposition during the process of composting [6].The increase ranged from 40 to 70% and the final value was between 8 & 9, which represents that the obtained compost was stable compost.

Moisture Content: Moisture plays an important role in the metabolism of microorganisms and indirectly in the supply of oxygen. A moisture content of 40-60% provides adequate moisture without limiting aeration. If moisture falls below 40%, bacterial activity slows down, and when moisture exceeds 60%, nutrients leached, air volume reduced, odors produced, and decomposition is slowed.

Organic Carbon: The Organic carbon content for market waste was analyzed. Mulongoy and Bedoret [16] reported that organic carbon and total N contents were significantly higher in drillosphere than those of adjacent soil. Here the total organiccarbon (TOC) of the samples was determined by the empirical method followed by Nelson and Sommer [20]. The initial value for organic carbon was 2.59% and for the mature compost was 3.59%.

Total Nitrogen: Total amount of nutrient in the soil may increase therate of nutrient cycling, and thereby increasing the quantity of nutrients available (Sharpley and Syers, 1997).In this experiment nitrogen content was estimated by Kjeldahl method [2] the initial value for total nitrogen was 1.06% and for the mature compost was 1.25%. Results clearly suggested that the nitrogen could be made available to plants for utilization by using this Market waste compost.

In general nitrogen exists in 2 forms, Organic Nitrogen and Inorganic nitrogen. Most of Nitrogen in soils is in organic form and only a small fraction is present in inorganic form [3]. Organic nitrogen serves as a reservoir and inorganic nitrogen mainly Nitrate and ammonia are available nitrogen forms that are used by plants [27]. The increase in nitrogen may be due to the starting C:N ratio is <15 and nitrogen is lost during the composting process. Composts with C:N> 30 will likely immobilize nitrogen if applied to soil, while those with C:N ratio < 20 will mineralize organic nitrogen to inorganic (plant-available nitrogen).

The C: N ratio: Carbon and nitrogen compounds are the components most likely to seriously limit the composting process if present in either excessive or insufficient amounts, or when the carbon to nitrogen (C:N) ratio is incorrect. Microbes in compost digest carbon as an energy source and ingest nitrogen for protein synthesis. The proportion of these 2 elements should approximate 30 parts carbon to 1 part nitrogen by weight. C: N ratios within the range of 25:1 to 40:1 result in an efficient process. According to Morais and Queda [17], a C:N ratio below 20 is an acceptable maturity level, while a ratio of 15 or lower is highly preferable for agronomic purpose, therefore, the present result obtained from market wastes showed the C:Nratio within the acceptable limit for agricultural usage.

Total Phosphorus: The progressive rise in Total phosphorus was observed throughout the process of vermicomposting. Muthu kumaravel et al. [18] reported that vermicomposted vegetable waste contain more phosphorous than untreated fresh vegetable waste. Zularisam et al. [29] maintain that vermicomposted municipal sewage sludge contains more TP than untreated sewage sludge. Increase in P content during vermicomposting is probably through mineralization and mobilization of phosphorus by bacterial and faecal phosphatase activity of earthworms. For the initial and final compost the available total phosphorus values were found to be 0.34% and 0.28%. The reduction in value may be due to nonbacterial and faecal phosphatase activity. Ndegwa and Thompson [19] reported considerable reduction of TP in vermicompost produced from biosolids.

Total Potassium: Similarly, there was a consecutive increment in total potassium during the vermicomposting process. Suthar [25] have reported that earthworm processed waste material contains higher concentration of exchangeable K due to enhanced microbial activity during the vermicomposting process, which consequently enhances the rate of mineralization. The initial and final values for total potassium were found to be 1.94% and 1.68%. The decrease in value shows the lower concentration of total potassium in the processed market waste.

Total Calcium: Total calcium for the market waste composting was determined following the procedure described by Simard [26]. The initial and final values for total calcium were found to be 4.67% and 4.58%. The decrease in value shows the lower concentration of total calcium in the processed market waste. In vermicomposting kitchen wastes, observed lower amount of calcium than the initial substrate value. The decline might be the result of leaching of this soluble element by the excess water that is drained through.

Total Sodium: Sodium is one of the essential nutrients for plant growth.The initial and final values for total sodium were found to be 0.64% and 0.58%.

Total Magnesium: Magnesium is one of the essential macronutrient for plant growth. It is an essential constituent of chlorophyll, vital for photosynthesis and also involved in enzyme reaction. After the analysis, the values for total magnesium were found to be 2.15% to 2.05%.Magnesium affects the translocation of phosphorus and has been reported to increase sugar, vitamins, starches in root crops [9].

Total Sulphur: To measure total organic and inorganic sulfur contents, compost samples were dried at 70°C and milled to pass through a 5-mm (aperture diameter) sieve. For total-sulfur analysis, samples were degraded as described by Tabatabaiand Bremner(1970). For inorganic sulfur analysis, samples were treated in the same way after being ashed at 550°C. The values for total sulphur were found to be 0.59% and 0.64% in the analyzed composting process.

CONCLUSION

The increase in temperature during the composting process was caused by the heat generated from the respiration and decomposition of sugar, starch and protein by the population of microorganisms. The increment in temperature is a good indicator that there is microbial activity in the compost pile, as a higher temperature denotes greater microbial activity that kills pathogen according to Haug.RT [10].The compost produced has many chemical and physical characteristics that allow it to be used in different ways. The primary reasons for testing compost are 1) worker safety, 2) avoidance of environmental degradation, 3) maintenance of the composting process, and 4) verification of product attributes. Product attributes are those attributes that relate to safety requirements and to the marketing and use of the compost. Sometimes the compost can be detrimental to the soil environment. Consequently, since characteristics of compost can vary greatly, tests have been developed to measure various important parameters of the compost that are typically measured as shown in Table 1.

The parameters for the temperature and pH show that the decomposition of organic matter occurs during the 90-day period. The decrease in TOC values and C/N ratio also shows that an organic compound is being consumed by microorganisms. Therefore, the main purpose of testing compost is to determine the concentrations of components and characteristics of the compost so that an evaluation of its quality can be made. Knowledge of compost's quality enables it to be used responsibly

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