JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

EXPERIMENTAL INVESTIGATION ON RAPID ORGANIC COMPOSTING: A CASE STUDY ON KITCHEN WASTE

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Abstract: Solid waste is increasing day by day because of the increase in population and habits of people and has become a major world crisis This research work is an initiative to convert kitchen waste into manure in a 20-22 days rapid duration. Composting is a technique for the treatment of the wet waste generated by the household kitchen waste and this is an effective disposal way to convert kitchen waste into manure. It will be useful for agriculture purposes to increase soil fertility. Composting helps us to reduce the waste in landfills but this method is not used widely. The findings from the literature review are that the utilization of organic products is low because people are more using chemical fertilizers because of their fast reaction. By carefully viewing research papers it comes to identify that people are not giving the majority importance to using organic fertilizers. In the literature, factors that could slow down the composting process and affect the compost quality were notified, also the wide variety of the biological composition of composting. The main gap identified is that normally the process of composting in which some soil, cow dung, and vermicompost are used for the degradation of the waste, but this process requires some more time. As the model tested for kitchen waste, I found that increasing the microbial bacterial activity in the waste while processing for composting will help to faster the rate of decomposition of the organic matter. With the help of yogurt where its bacterial activity helps for decomposition, the composting experiment done takes about 20-22 days for the final product and whereas the other process requires 30-45 days for the final product. The result of the product obtained is used for gardening near the house.

Index Terms **– Solid Waste, Microbial Activity, Rapid Composting, Organic Manure**

1. INTRODUCTION

India faces some major environmental challenges associated with waste generation and irrelevant waste collection, transport, treatment, and disposal. The rapid increase of the population leads to an increase in solid waste generation. Solid waste management may be a major problem for several urban local bodies in India, where urbanization, industrialization, and economic process have resulted in increased municipal solid waste generation. Among them, the most solid waste comprises 60-70% of biodegradable waste. Better solid waste management may be a major challenge in cities with high population density. Disposal of biodegradable waste by landfill and incineration may cause serious environmental problems such as leachate or flue gas emissions. As the landfill has been closed due to a shortage of areas, waste disposal has become a serious problem. Since food waste has a high moisture content, a high organic to ash ratio, and a loose physical structure, composting seems to be an ideal disposal method. Household food waste receives more attention worldwide due to the environmental, economic, and social impacts it generates. This paper reports the study of Organic rapid composting with some microbial changes in it and as a result, we obtain the compost of good quality in this rapid process. The objective is to study the composting technique for wet waste along with this the preparation of compost from wet waste by laboratory investigation and reduce the organic waste sent to landfills.

❖ **Benefits of composting**

- Develops soil, helps to retain moisture, and to defeat plant diseases and pests.
- It minimizes the need for chemical fertilizers.
- Promotes the production of beneficial bacteria and fungi that decompose organic matter rich in nutrients.
- It decreases methane emissions from landfills and lowers the carbon footprint.

❖ **Conditions affecting composting**

- The concentration of carbon and nitrogen in the organic material.
- Particle size and surface area.
- The volume of material being composted.
- Oxygen required.

- Temperature.
- Moisture content for the waste

2. MATERIAL AND METHOD

2.1. COMPOSTING SETUP

The household plastic bin of 30cm x 30cm x 80cm was used. It had a composting capacity of about 20 liters, as per the waste generated by the family per day.

Fig. 1 Composting bin

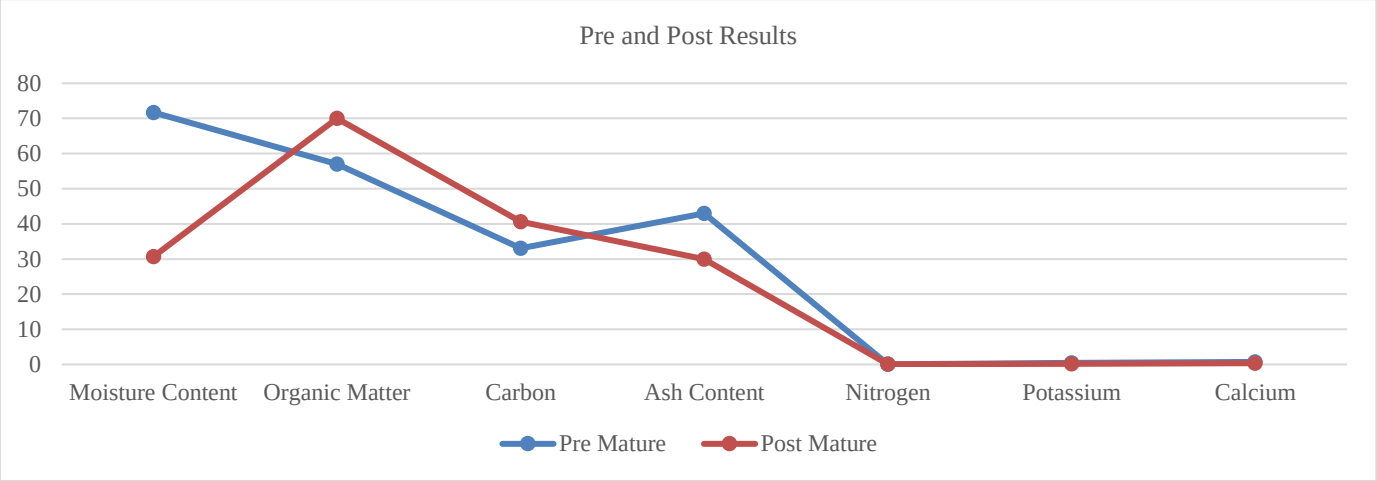
2.2. WET WASTE MATERIAL AND COMPOSTING PROCESS

The daily food waste was collected from the house. The food was mixed thoroughly to maintain homogeneity in the waste. Daily 8-10 cm of food waste was inserted into the plastic bin and some of the waste was crushed into fine particles. There was made an outlet for the collection of the leachate. A microbial additive of 50 ml for each layer was used and mixed up with the waste. This microbial agent was observed in the increase in biological activity and it leads to the rapid decomposition of organic matter.
A ready sample after 20 days was collected and kept at room temperature for further analysis.

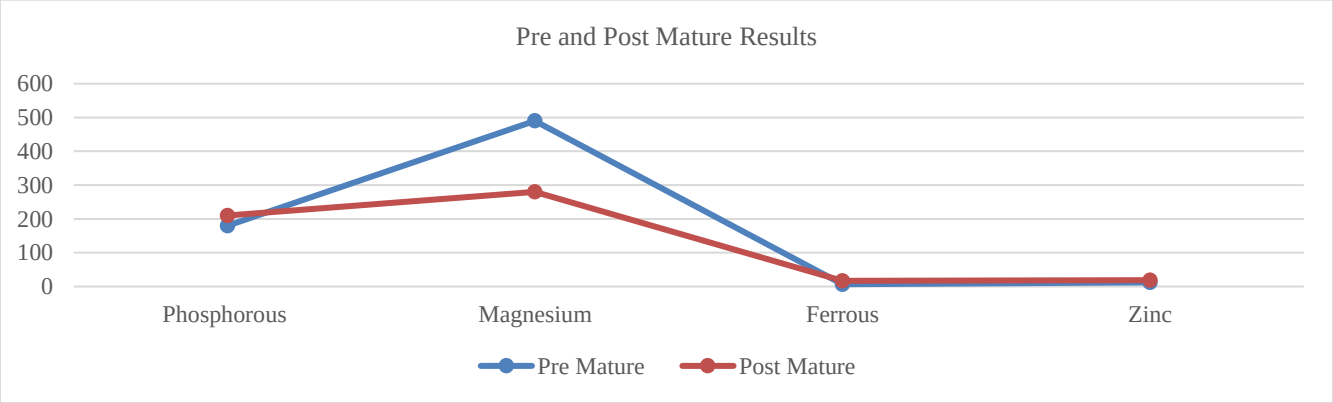
Fig. 2 Sample Collection

2.3. ANALYSIS OF PARAMETERS

The Ph and Electrical conductivity of the compost sample (wet mixture, 1:1 w/v, deionized water) was determined by the standard apparatus Ph meter and electrical conductivity meter. The total organic carbon concentration was determined by the Kjeldahl method. (Tosun et.al, 2008). The moisture content was determined after drying the sample at 105 ^{0}C for 24 hours in the hot oven.
The temperature was measured using a digital thermometer device. The nutrients copper, manganese, and Zinc were determined with the help of a spectrophotometer device. Potassium and Phosphorous metal element contents were determined by the Flame Photometer Device. The total organic carbon was determined according to the standard test methods.



Graph 1. A) Pre and Post Results



Graph 1. B) Pre and Post Results

3. Results and Discussion

3.1. Changes in the parameters during Pre and Post Maturity

The parameters Ph, the moisture content is important for composting process as shown in Graph 1 (A)Pre and (B) Post Results. The wet waste sample was having initially high moisture content above 70% and was higher than the optimal value of 65% for composting. However moisture content reduced up to 30% after the compost is being matured.
The Ph and EC observed drastic changes during composting. Ph was weakly basic during the initial stage and then increased to 8.3. the change in Ph is due to metabolic activity. The EC was observed to be higher side initially, but after decreased and suitable for the growth of plants. The calcium, Potassium, and Nitrogen, were found to be high initially but after maturity, it was found to be decreased by a small amount.

Fig. 3 Ready Compost

3.2. Changes in the parameters during Pre and Post Maturity

The mature compost should reach a certain standard limit. All the parameters of the mature compost prepared with microbial additive were compared with these standards in table no. 1. The Krushi Vidyapeeth Rahuri has established quality standard limits and some of the limits by the solid waste management rule 2016.
After 20 days of composting with microbial additive, the mature compost has an organic matter of 40%, Phosphorous 210 ppm, Calcium of 0.35%, and Electrical Conductivity of 0.32 mmhos/cm and is within the range of the standard limit for the soil improvement. So, the ready compost from the kitchen was prepared in the plastic bin and met the required standard guidelines, and was suitable for the plantation.

Table no.1 Quality of Mature compost

Sr no.	Parameters	Unit	Mature compost	Krushi Vidyapeeth Rahuri Standards
1.	Moisture content	%	30.7	12-20
2.	Organic Matter	%	70	>80
3.	Organic Carbon	%	40.6	>16
4.	PH	scale	8.3	5-7
5.	Electrical Conductivity	Mmhos/cm	0.32	<1
6.	Sodium (NA)	Ppm	690	<500
7.	Nitrogen	-	0.08	-
8.	Phosphorous	Ppm	210	>50
9.	Potassium	%	0.21	>0.06
10.	Calcium	%	0.35	>0.05
11.	Magnesium	%	0.28	0.0025-0.01
12.	Ferrous	Ppm	16.9	14-72
13.	Zinc	Ppm	18.8	29-89
14.	Manganese	Ppm	29.8	29-72
15.	Copper	ppm	38.5	1-200
16.	Color		Dark Brown	Dark Brown to Black
17.	odor		Absence	Absence

4. Conclusion

This present investigation shows that the use of the additive in the compost helps for the rapid microbial change in it for the decomposition of the organic matter. The use of an additive is effective for mineral change in the compost where it increases the content of the potassium, copper, and zinc which is useful for better development in the plant and also increases the fertility of the soil. Therefore, this process is suitable ideally for treating waste food or kitchen waste in the house.

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