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EFFECT OF BULKING AGENTS ON IN-VESSEL COMPOSTING OF KITCHEN WASTE

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ABSTRACT

Management of biodegradable organic waste is a big challenge for developing countries like India. Composting is an economical and viable option to manage and treat an organic waste. However, efficient compost production requires nature of materials involved, process understanding and physics behind the process. From the study, it is inferred that the kitchen wastes have good biodegradable characteristics that are well exploited by the In-Vessel composting technique to produce a quality compost material in quick pace. The optimum C/N Ratio to be present in the kitchen wastes for achieving high quality compost is also identified in this study. During the investigation physico-chemical parameters were investigated and variation in parameters was analyzed. Among both the reactors used were found to be very effective and results were found according to FCO (2009).

Keywords - *Kitchen waste, In-Vessel composting, C/N ratio*

I. INTRODUCTION

According to CPHEEO manual 2016, Solid Waste Management has been one of the most neglected areas of urban management activities in India. It has been observed that in cities as well as in towns only 50% of the solid waste generated is being collected, transported and disposed off which gives rise to harmful diseases and insanitary conditions. Therefore it is necessary to bring awareness among the people about the safest collection of solid waste and its proper disposal followed by treatment. While collecting solid waste one should keep in mind that all the safety measures should be used such as hand gloves, face mask and shoes. It has been estimated that India has a potential of producing around 4.3 million tons of compost every year from Municipal Solid Waste (MSW), which can help in reducing the broad gap between accessible and demand of organic manure for soils in India. More than 1, 00,000 MSW is being generated in India every day.
Composting is a natural process of recycling decomposed organic material such as dry leaves**,** cow dung etc. into a rich soil fertilizer known as compost. Since compost is rich in nutrients, composting of organic waste returns the nutrients back to the soil. Compost is very beneficial for the land in many ways for an example it acts as a soil conditioner, fertilizer and also as a pesticide for soil.

In-vessel composting is accomplished inside an enclosed container or vessel. Mechanical systems are designed to minimize odour and process time by controlling environmental conditions such as airflow, temperature, and oxygen concentration.. Mainly composting can be categorized into two types, which are discussed below

a. Aerobic Composting

The decomposition of organic matter which takes place in the presence of oxygen with the help of micro organisms is known as aerobic composting. Naturally occurring microbes which lives in the moisture which surrounds the organic matter occurs naturally.

b. Anaerobic Composting

The decomposition that occurs in the absence of oxygen with the help of microorganisms is known as anaerobic composting. During this process, methane is the major chemical energy which is released. This process followed by

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extremely strong odors and a very small amount of heat is generated which means that it takes long time for the decomposition.

II. MATERIALS

a) Kitchen Waste

The kitchen waste used in this study was collected from sarojini naidu girls hostel as shown in Fig.2.1. Unwanted material such as paper, plastic, rubber etc. was segregated from the collected waste and was sun dried for 1day as to adjust the moisture content.

b) Saw Dust

Saw dust was used as a first bulking agent as shown in Fig.2.2. in this study and was feeded inside the reactor no. 1. It was collected free of cost from the carpenters shop located near rasoma square in Indore (M.P.).

c) Dry Leaves

Dry leaves were used as a second bulking agent as shown in Fig.2.3 in this study and was feeded inside the reactor no. 2. It was collected from the garden of S.G.S.I.T.S. Indore (M.P.)

d) Activated sludge

Activated sludge was used as an inoculum was common in both the reactors as shown in Fig 2.4. It was collected from a Kabitkhedi sewage treatment plant without any cost, situated in Indore (M.P.)

Fig.2.1
(Kitchen Waste)

Fig.2.2
(Saw Dust)

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Fig.2.3
(Dry Leaves)

Fig.2.4
(Activated Sludge)

III. METHOD

3.1 Preparation of Sample

2 reactors were taken in which vegetable waste, bulking agent i.e. saw dust and dry leaves and inoculum i.e. activated sludge was feeded inside the reactor in 1:1.5:3 and 1:2:3 in respective reactors and various parameters were tested in the laboratory as shown in Table 3.1.

S.NO.	PARAMETERS	STANDARD
1.	pH	FCO (2009)
2.	Moisture Content	FCO (2009)
3.	Total Carbon	FCO (2009)
4.	Total Nitrogen	FCO (2009)
5.	Total Potassium	FCO (2009)
6.	Total Phosphate	FCO (2009)
7.	C/N ratio	FCO (2009)

3.2 Experimental Setup

a) Laboratory test (pH, Moisture content, Total carbon, Total nitrogen, Total potassium and Total phosphate) were conducted on kitchen waste sample to determine its various physico-chemical properties.
b) After this kitchen waste was blended with saw dust and activated sludge in 1:1.5:3 and feeded inside the reactor no. 1.
c) Also the kitchen waste was blended with dry leaves and activated sludge in 1:2:3 and feeded inside the reactor no. 2.
d) Then all the laboratory test were conducted on the samples of both the reactors in every 10 days interval.
e) Analyzed the results and find the better compost prepared between both the reactors.

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IV. RESULT & DISCUSSION

4.1 Effect of Saw Dust on In-Vessel Composting When Used as a Bulking Agent

From the results shown in Table 4.1. saw dust when used as a bulking agent was observed as a good bulking agents as it helps in increasing the pH from 6.3 to 7.3 which shows the alkaline nature of compost.. It has been also observed that neutral and partial alkaline pH values are usually indicator of stable compost. According to some authors, an alkaline value of pH indicates that the process is finished and the products have reached the maturity. Moisture content of the compost is found to be fluctuating in nature from 64.33% to 46.29% due to the reactions takes place inside the reactor. Total organic carbon was found to be varying from 46.52% to 33.40% by weight. Lower value of organic carbon indicates oxidation of carbon into co2 during decomposition process. Total nitrogen was found to be varying from 0.9%1 to 1.51% by weight and it shows that the nitrogen profile of In-vessel compost was enhanced by the microorganism present in the inoculum . Total potassium was found to be varying from 0.79% to 1.1% by weight. Total phosphate was found to be varying from 0.89% to 1.15% this is due to acid formation during organic matter decomposition. C/N ratio was found to be decreasing which is a good indicator of good quality compost.

Table 4.1 Effect of saw dust as a bulking agent on In-vessel composting

PARAMETERS	DAY 1	DAY 15	DAY 30	DAY 45	DAY 60
pH	6.3	6.5	6.8	7.1	7.3
Moisture Content	64.33	55.69	50.12	42.66	46.29
Total Carbon	46.52	41.15	38.12	35.64	33.40
Total Nitrogen	0.91	0.97	1.13	1.37	1.51
Total Potassium	0.79	0.86	0.90	0.95	1.1
Total Phosphate	0.89	0.90	0.93	0.98	1.15
C/N ratio	51.12	42.42	33.73	26.01	22.11

4.2 Effect of Dry Leaves on In-Vessel Composting When Used as a Bulking Agent

From the results shown in Table 4.2 dry leaves when used as a bulking agent was observed as a better bulking agents. While the process of composting the pH increases from 5.9 to 7.1 which shows the alkaline nature of compost.. Moisture content of the compost is found to be fluctuating in nature from 55.43% to 43.26% due to the dryness inside the reactor. Total organic carbon was found to be varying from 49.80% to 34.30% by weight. .Total nitrogen was found to be varying from 0.95%1 to 1.5% by weight and it shows that the nitrogen was increased during the process. Total potassium was found to be varying from 0.81% to 1.2% by weight. Total phosphate was found to be varying from 0.93% to 1.21% .C/N ratio was found to be decreasing which is a again a indicator of good quality compost.

Table 4.2 Effect of dry leaves as a bulking agent on In-vessel composting

PARAMETERS	DAY 1	DAY 15	DAY 30	DAY 45	DAY 60
pH	5.9	6.1	6.4	6.8	7.1
Moisture Content	55.43	52.47	59.16	53.14	43.26
Total Carbon	49.80	46.10	41.54	38.60	34.30

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Total Nitrogen	0.95	0.99	1.29	1.56	1.50
Total Potassium	0.81	0.88	0.94	1.13	1.2
Total Phosphate	0.93	0.94	0.97	1.05	1.21
C/N ratio	52.42	46.56	32.20	24.74	22.86

V. CONCLUSIONS

a) Addition of bulking agents and inoculum reduces the time period of composting by enhancing the process of degradation.
b) Problem of leachate was solved by the addition of bulking agent as it reduces the water content inside the reactor.
c) Weight reduction in reactor (1) was found to be 46.12% and in reactor (2) 51.56% weight reduction was achieved.
d) In-Vessel Composting was more efficient in terms of composting cycle time. Composts in this method was matured in 60 days in comparison with other conventional methods which takes more than 90 days.

VI. SCOPE FOR FURTHER STUDIES

a) To utilize some other locally available bulking agent like rice husk, coconut coirfibre etc to decrease the composting period.
b) Drip Irrigation can be used for maintaining moisture content and to reduce water Consumption.
c) Microbial analysis may be done to know more about various other properties of the Compost.
d) Some other inoculum should be used to enhance the process of biodegradation.

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