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Municipal Solid Waste Treatment for the Amravati City by Vermicomposting

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Abstract: ***The extent of this study includes management of solid waste adopted in the Amravati city by vermicomposting. As generation of organic waste has become an environmental problem of public concern citywide. Management of the solid waste is totally depends upon the population , their religious rituals, living standards, degree of commercialization, industrialization and various processes done in the city generates the solid waste. In Amravati city, at sukali depot there is generation of this waste is going increased day by day and hence to dispose all the municipal waste becomes the top priority of city. The organic waste from all the vegetable markets are get collected at the depot. Hence it needs some practices for the disposal of waste. As there are many methods are available for the waste management. Out of which for MSW, Vermicomposting can be used for the recycling of waste. It is a mesophilic process utilizing micro-organisms In this method Eisenia Fetida earthworms are used for 45 days to recycle the waste. After 45 days organic matter, total oxygen demand, Ph, TP, TC, TOC, TKN, C-N tests carried out and their initial and final readings were analysed. Recovery of vermicompost and increase in earthworms were analysed. Vermicmposting can be done very easily and able to dispose the municipal waste properly. After decomposing there is a conversion of waste into manure which can be used for agriculture purpose. And also there are again a production of earthworms which we can used for further vermicomposting of organic waste. This study identifies the potential of vermicomposting for waste management.***

Keywords :. Solid Waste management, Vermicomposting, Municipal Solid waste, Disposal of Waste, Eisenia Fetida

I. INTRODUCTION

Amravati is on the path of Rapid industrialization and urbanization as it it is the 2 nd largest growing city in the vidarbha region situated at 156 Km towards west from Nagpur. Over the years the city has grown significantly both in population and density which has resulted in great pressure being forced on the resources of the city , which is turn contributed to an exponential increase in the generation of solid waste. Solid waste management is a universal problem with Amravati being no exception because of increase in the infrastructure, educational systems. So there is generation of solid waste in large quantities. Normally Amravati city generates 281.47 MT municipal solid waste per day.

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We know that the natural and aerobic process of solid waste treatment is composting. Vermicomposting is a type of composting in which certain species of earthworms are used to enhance the process of organic waste conversion and produce a better end product. It is a mesophilic process utilizing micro-organisms and earthworms, usually red-wigglers, white worms and other earthworms like Eisenia Fetida, Lumbricus Rubellus , etc. are used to create a mixture of decomposing vegetable or food waste, bedding materials and vermicast. As it is the natural process and useful for the people of any city in many ways. Generally the municipal solid waste includes waste from vegetable markets, street foods, restaurants, mess, etc. As excess moisture in these waste generate leachate, flies and foul smell causing ground pollution. So for avoiding this, vermicomposting is a best method for disposal of municipal solid waste. Containing water-soluble nutrients, vermicompost is a nutrient-rich organic fertilizer and soil conditioner in a form that is relatively easy for plants to absorb. Worm castings are sometimes used as an organic fertilizer. Because the earthworms grind and uniformly mix minerals in simple forms, plants need only minimal effort to obtain them. The worms' digestive systems create environments that allow certain species of microbes to thrive to help create a "living" soil environment for plants.

II. MATERIAL AND METHODS

i. Plastic Pots-

For the vermicomposting process, we used three plastic pots (which are used as a planters) which have a capacity of 8-9 kg. and named it as S1, S2 and S3. The arrangement of pots are as shown in the figure. I

Figure I Compost Pots

ii. Materials used for vermicomposrting-

In these pots earthworms, soil and waste were added with different proportions. The proportions were added are as following in table I.

Table I Sample Proportions

Samples	Proportions (E:S:W)
S1	1:05:05
S2	1:05:10
S3	1:10:15

For above proportion scale used as 1unit : 50 g. Means for 0:5:0, we used 250gm of material.

iii. Methods-

We took initial samples 9 th Jan 2020 and after 15 days i.e on 24 th Jan 2020 there is an addition of Eisenia Fetida earthworms in the pot according to a specific proportionas mentioned above. In this period the worms made the disposal of waste and recycycle it completely. The final sample was taken after 45 days on 10th March 2020. Then both initial and final readings were analysed.

iv. Chemical Analysis-

The test were performed initially and after 45 days. Initial parameter based on dry matter were calaculated of soil and vegetable waste. The organic matter,COD, TOC, Total Nitrogen, Carbon, Sodium, Magnesium, Potassium, C/N ratio and PH were calculated.

III. RESULT AND DISCUSSION

i. Chemical Analysis-

The chemical analysis of sample was done in which a small proportion was taken out from each sample and tests were performed including organic carbon, chemical oxygen demand, TKN, Calcium, magnesium, sodium, potassium,,C/N ratio and PH.

The readings were taken at initial stage and the final stage (after 45 days of completion). With these we calculated the mean of all the samples S1, S2 and S3 and considered it as final reading. So after 45 days there was also changes seen in the weight of earthworms added in the samples as well as weight of vermicompost also changes because of decomposition of waste occurs due to earthworms. So weight of sample at initial stage and weight of vermicompost formed after vermicomposting can be compaired which can be shown in the table II below-

Table II compost ingredients

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Reactor	WE	WS	WV	Wt. of Earthworm		Wt. of Vermicompost	
				Initial	Final	Initial	Final
S1 (1:5:5)	50	250	250	50	100.90	500	272
S2 (1:5:10)	50	250	500	50	100.45	750	422.625
S3 (1:10:15)	50	250	750	50	99.5	1250	697

The percentage changes in the vermicompost and vegetable waste can be calculated by considering initial and final readings. The following tables III shows the percentage changes in the vegetable waste and vermicompost characteristics.

From table no. III , we observed that:

i. The organic matter changes after 45 days by 45.77% Shows that there was decomposition of organic matter.

ii. The chemical oxygen demand is observed as 71% and total oxygen is 75%

iii. The percentage of TKN observed as 34%.

iv. The calcium in oranic waste is going on increase by 51.44%

v. The percentage of magnesium, sodium and potassium observed are 68.71, 75.86 and 31.4 respectively.

vi. The C/N ratio, initially it was 662.6 and after 45 days it was 44.08.

vii. The initial pH of the waste was 6.3 and after 45 days the pH again on 7.

viii. There was a higher increase in the weight of earthworms. Initiaaly it weights 50gm and after vermicomposting it weights 100.28 gm. This shows that it was increased by 2 times.

ix. Percentage in the recovery of vermicompost is 55.50 which shows the better performance of the vermicomposting.

Table III percentage changes in the vegetable waste and vermicompost characteristics

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8
Sr. No.	Name of Parameter	Final Parameter of Compost Vegetable waste				Initial Parameter of Vegetable waste	Percentage change
		S1	S2	S3	Mean		
	WE : WS	1:00:05	1:00:10	1:00:15			
1	%Organic matter	47.28	47.74	58.22	51.08	94..22	45.77
2	% Chemical Oxygen	12.8	16.2	23.3	17 16	49	71
3	% Total Oxygen	6.68	6.44	9	7.37	30.53	75
4	%TKN	0.1	0.28	0.212	0.17	0.045	34
5	%Ca	0.634	0.322	0.231	0.395	0.243	51.44
6	% Ma	0.17	0.089	0.071	0.11	0.0652	68.71
7	% Na	0.714	0.363	0.337	0.511	0.29	75.86
8	% K	0.84	0.48	0.458	0.59	0.271	31.4
9	C/N Ratio	66.8	23	42.45	44.08	662.67	
10	pH	7	7.1	7	7	6.3	
11	% Incr. in wt. of Earthworm	100.9	100.45	99.5	100.28	50	
12	% Recovery of vermicompost	45.6	43.65	44.2	44.5	100	55.5

IV. CONCLUSION

From above discussion it can be concluded that:

i. The organic matter present in the samples are disposed completely. And the residue obtained after the vermicomposting is an excellent manure for agriculture called as vermicompost.

ii. From this study we can use vermicomposting for the disposal of organic waste saturated at sukali plant. If we use this method for disposal there is higher increase in disposal of waste as well as people will get gud compost for agriculture.

iii. vermicomposting is a very easy and economical method of decomposition of solid waste management. As it requires less time ad by product can be used further for agriculture.

iv. In Amravati 65% people depends o farming as their occupation.So vermicompost can become the one side business with farming. With these farmers can used vermicompost as manure .

v. We know that there is a too much municipal waste saturated at sukali plant which becomes very hazardous for people living around that area. So it should be properly managed as prople are suffering from hazardous diseases . People are not getting pure water for drinking. So management of these waste is a very serious problem in amravati. So for overcoming this problem we can start the disposal of municipal waste saturated at sukali plant by vermicomposting.

FUTURE SCOPE AND STUDY-

There are several effects of improper management of municipal solid waste. The study has shown positive result of vermicomposting and better interaction of earthworms which may further reduce time of composting and improve the quality of compost. Vermicompost is a nutrient rich, organic fertilizer and soil conditioner. It is a excreta of earthworms which is rich in humus.

It is also used as vermicompost and vermiwash as side by-product. The measures have to be taken to maximize the efficiency of the waste management system and make the industry to realize the value of addition in terms of environmental management at the same time earn profits. Hence for management of municipal solid waste , vermicomposting is beneficial.

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Tanvi Prakash Choudhari, Tanvi Choudhari is a student who completed her engineering in Civil Engineering and currently she is pursuing M. tech II nd year in Environmental Engineering at G.H.Raisoni University Amravati.With this she is working on a study of vermicomposting in Amravati city at her native place. She is also studying for the various environmental issues in the india.. She likes to read novels and many research papers to gain knowledge . She desires to do the Ph.D in Solid Waste Management. For that she is so regular and doing her work properly. She wants to be successful Environment Engineer for her city.

Prof. Vijay Kosamkar, Prof. Vijay Kosamkar is an Assistant Professor currently working at G.H.Raisoni University Amravati. He completed his graduation in Civil Engineering and completed his Master of Engineering in Environment Engineering. Currently he is pursuing Ph. D on wastewater treatment processes. He is very gud learner as well as guide. He is always eager to make study nd give knowledge to their students. Currently he is also working on vermicomposting in Amravati city with their students. He believed in hard working and students teaches the same. He walks on the paths of ‘failure is the first key of success’.