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Research Article

EVALUATING THE QUALITY OF COMPOST WITH MAIN CONSTITUENT AS SEWAGE SLUDGE

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ABSTRACT

Recent days the growing population is increasing the amount of wastewater generated due to which large amount of sludge is produced. The problem of managing the sludge becomes a rising issue. One of the better management for sewage sludge is composting. Composting process is an eco friendly method during which biodegradables are decayed to humus like material. Sewage Sludge consists of rich nutrients like nitrogen, phosphorus and potassium which are very essential for compost. In addition to sewage sludge many other different wastes are added in a designed proportion. The manure has formed in five weeks with weight reduction of 31.3%. The manure is tested for various parameters and mainly the addition of Nitrogen, Phosphorus and Potassium which should be more than 1.5% according to BIS standards has been satisfied.

INTRODUCTION

India ranks second in population. Growing population increases the amount of waste generated either in liquid form or in solid form. The necessity to construct new treatments or to enlarge thos*e* previously existing has become a trend. A large amount of sludge is produced during mechanical, biological and chemical operations in treatment process (Kosobucki, et al., 2000). All the municipal solid waste and sludge are being landfilled. Landfilling these days is very difficult as it leads to pollution nuisance such as leachate and landfill gases generation mainly when disposing the matter which has high moisture and organic content in them. In recent days, interest has been increased for application of sewage sludge compost on land. Significant considerations include soundness of environmental practices, energy conservation, and escalating costs of disposal by other procedure and the rising prices of chemical fertilizers (Epstein, *et al*., 1976).

Organic matter is very essential for the plant growth. As agriculture is backbone of our country, there is much need of fertilizers. Artificial fertilizers affect the soil fertility in few years. Sewage sludge which is by-product of sewage treatment plant has high moisture content and it also has rich nutrient content such as nitrogen, phosphorus and potassium. There are various industrial and non industrial methods for management of sewage sludge out of which the most preferable way is composting as shown in (Fig. 1) (Kosobucki, *et al*., 2000).

Compost production is considered as eco friendly method. Composting is an aerobic process during which biodegradables are decayed to humus like material (Farrell and Jones, 2009). During this process, a sequence of aerobic microorganisms breaks down and transforms organic material into a collection of ever more complex organic substances (CIWMB, 2004, Alan, *et al*., 1995). Microorganisms utilize organic matter as a food source and then produce heat, carbon dioxide, water vapour and a range of organic compounds. Matured composts are stable and have agreeable smell, but if composting process is ended prematurely, the resulting immature compost may have downbeat effects on soils and

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plants and have a bad odour. Hence composting of sewage sludge is much necessary instead of direct application of sewage sludge on soil. The volume of the biodegradables decreases during composting and the resultant compost is enriched with nutrients and more constant (Farrell and Jones, 2009). This can progress the soil fertility and yield as well as the sustainability of agriculture productivity. This usage of natural fertilizer on land also decreases the ill effects on human health. Compost properties vary widely depending on feedstock's and also on the compost procedure adopted. The present paper hearsay the comparative results of the quality of compost with the BIS standards.

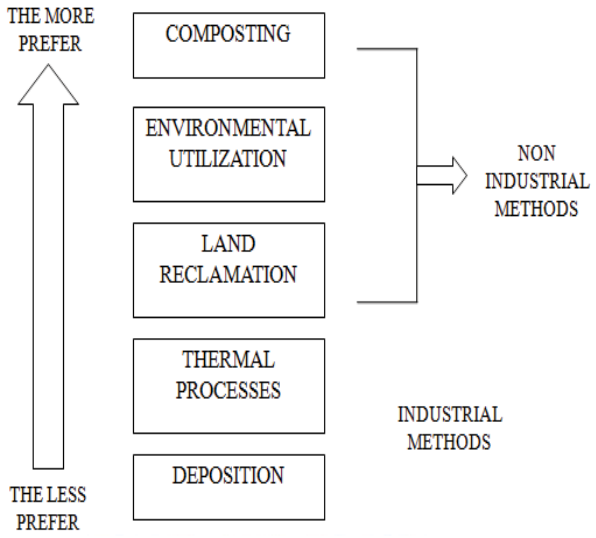

Fig. 1 Management of sewage sludge.

MATERIALS AND METHODS

The broad methodology which includes:

i. Study area

ii. Collection and initial analysis for sewage sludge

iii. Design and evaluation of composition of compost

iv. Preparation of compost

v. Quality check for compost

Study Area

Sewage sludge was drawn from one of the sewage treatment plant of SRM Institute of Science and Technology, Kattankulathur, Kancheepuram District, Tamil Nadu state. It is located with 12° 49'35.68" N latitude and 80° 2'55.84" E longitudes. The location of Sewage treatment plant in SRM University is as shown in the (Fig. 2).

The amount of wastewater treated is 13- 14 KL per day. The treated waste water is used for gardening in the campus. The sludge obtained is disposed of the nearby dumpsite. The schematic diagram in the (Fig. 3) is the process adopted in sewage treatment plant of SRM Institute of Science and Technology (Ashish and Ajay, 2015; Cuevas, *et al*., 2003).

Raw water from the college and hostel campus is collected to this plant and treated every day. MLSS of 400 mg/l is maintained in the aeration tank by recirculation of sludge from clarifier to aeration tank. The excess sludge is sent to the sludge drying beds and the treated water from clarifier is send to further

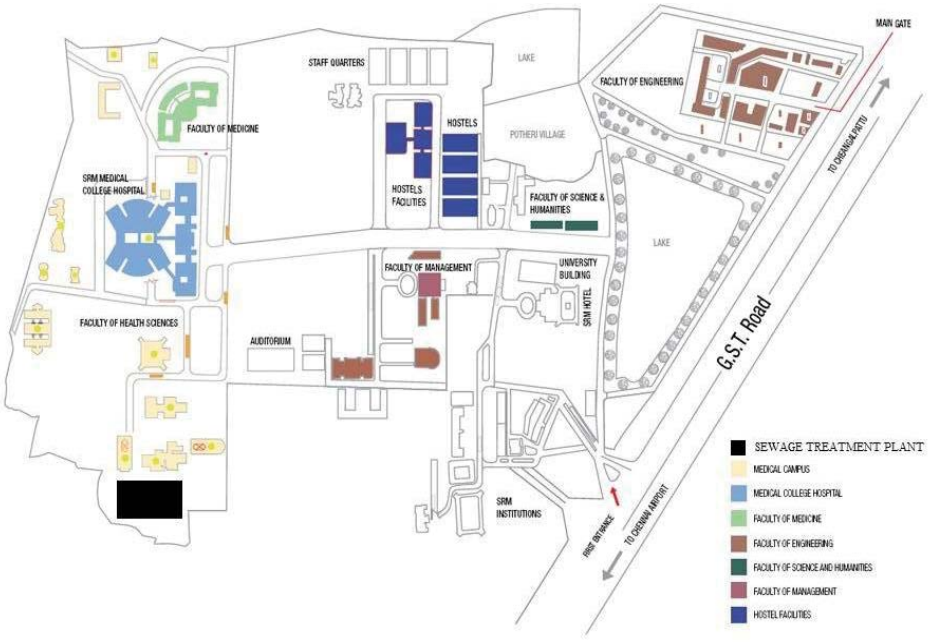

Fig. 2 Layout of SRM IST.

treatment to kill the pathogens. Chlorine is used as disinfectant and then it is also treated in sand filters and carbon filters for further purification. The treated water is in the permissible limits for discharge and hence it is used for gardening in the campus.

Collection of Sewage Sludge

Sludge was taken from sewage treatment plant of SRM Institute of Science and Technology, Kattankulathur. It is drawn from different sludge drying beds in silver foil vaccum covers. 1 kg of sludge was collected for initial tests. This collected sample was brought to be the lab to perform various initial parameters (Refer Appendix).

Analysis of Sewage Sludge

Few parameters such as pH, moisture content, nitrogen, phosphorus, potassium and total organic carbon were analysed for sludge to decide the composition of compost. The values of experiments are shown in Table 1.

Design and Evaluation of Composition of Compost

After analysing sewage sludge, it has been understood that there is very less amount of organic carbon content. After composting the C/N ratio will reduce more. So in order to increase the carbon content, browns are added in more content. The composition of compost consists of sewage sludge as main constituent, dry leaves, saw dust, wood ash, green leaves, egg shells, fruits and vegetable scrap. The composition of compost in percentages is as given in (Fig. 4).

Preparation of Compost

All the materials are collected from the nearby localities. Twenty kilograms of waste is dumped into a 55 L volume bin which has a mixer for mixing the waste and also holes for the air to pass in. Every day the reactor is given 2-3 rotations for proper mixing of waste. This process is done for five weeks. Each

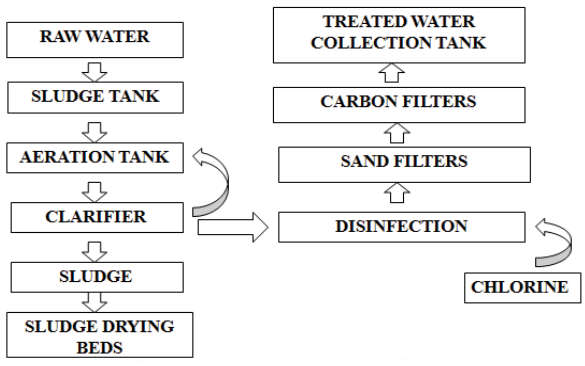

Fig. 3 Process flow chart of STP in SRM universe.

Table 1. Analysis of sewage sludge.

S. No	Tests	Results
1	Organic Carbon content	17.79%
2	Total Nitrogen content	1.45 g/100 ml
4	Moisture content	67.27%
5	pH	7.2
6	Total Phosphorus	3.42 ppm
7	Potassium	1393 ppm (1.39%)
8	C:N ratio	12.27 : 1

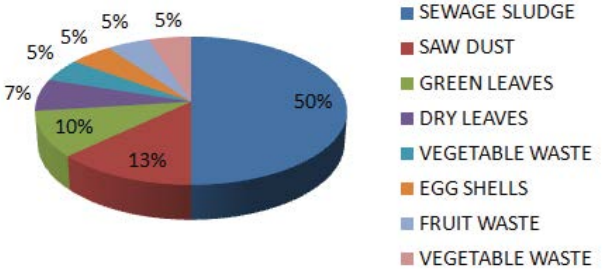

Fig. 4 Composition of compost.

week the material is weighed to know the volume reduction. The cumulative weight reduction for five weeks is as shown in Table 2. The weight reduction curve is as shown in (Fig. 5).

The weight reduction curve shows that the weight of the compost is decreased more by the end of third week. Hence it can be said that the degradation process is very high in third week. The total amount of weight reduction is 31.3%. That means only a two third of the actual waste weight added is obtained as compost. The compost is sieved with 2.36 mm sieve to get the finer size particles. The remaining coarser material can be used for next batch of compost preparation as a starter. No admixtures are added at the time of composting. Moisture content was not required as sewage sludge itself had 67.27% in it. There was neither bad odour nor the disturbance of flies/insects (Perez, *et al*., 2006; Mostafa, *et al*., 2016; Rocio, *et al*., 2011).

RESULTS AND DISCUSSION

The compost is checked for various parameters to know the quality. Fifteen parameters are analysed. The results are as shown in Table 3.

The prepared compost is having pH in normal range and heavy metals such as Iron, Copper, Manganese, and Zinc are all in the safe limits. Calcium content is in good range because egg shells are added. Moisture content is in limits though extra moisture is not added because sludge itself has lot of moisture initially which is more than sufficient for a compost. Magnesium is in the range of standards. According to BIS standards there is no limit for Sodium and

Table 2. Cumulative weight reduction.

Week No.	Amount of Compost (Kg)	Reduction of Weight (Kg)	Cumulative Weight Reduction (Kg)
1	19.303	0.697	0.697
2	17.833	1.47	2.167
3	15.713	2.12	4.287
4	14.69	1.023	5.31
5	13.74	0.95	6.26

Table 3. Results of compost.

S. No	Parameter	Test Method	Result	BIS Standards
1	pH	IS 10158:1982	6.90	6.5 - 8.5
2	Potassium as K	SMSLA/IN/SOP/095	0.55%	> 0.4%
3	Calcium as Ca	EPA Method 3050 B	3.03%	1 - 4%
4	Magnesium as Mg	EPA Method 3050 B	0.28%	0.2 - 0.4%
5	Sodium as Na	SMSLA/IN/SOP/095	0.13%	-
6	Total Organic matter	IS 2720 (Part – 22)	4.02%	> 12%
7	Sulphur as S	SMSLA/IN/SOP/132	0.05%	-
8	Iron as Fe	EPA 200.8	1495 mg/kg	-
9	Copper as Cu	EPA 200.8	30.4 mg/kg	300 mg/kg
10	Zinc as Zn	EPA 200.8	342 mg/kg	1000 mg/kg
11	Moisture	SMSLA/EN/SOP/73	40.79%	15-25%
12	Manganese as Mn	EPA 200.8	76 mg/kg	-
13	Phosphorus as P	IS 10158:1982	0.2%	>0.4%
14	Nitrogen as N	IS 10158:1982	1.32%	>0.8%
15	C:N ratio	By Calculation	12:1	<20:1

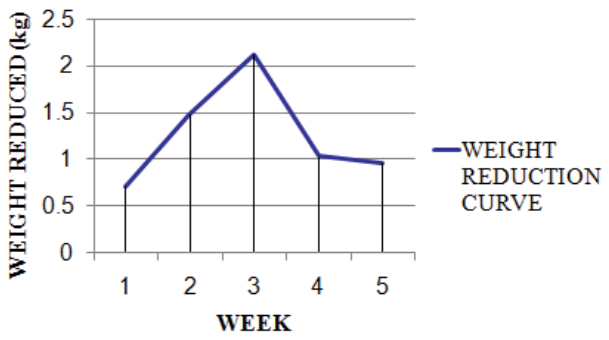

Fig. 5 Weight reduction curve.

Sulphur. But the values of them are in normal range. Total organic carbon is very less than the standard because of which the C:N ratio is lower. The addition of Nitrogen, Phosphorus and Potassium must be greater than 1.5% according to standards and the value obtained is nearly 2% which results that the compost is having a good quality (Singh and Agrawal, 2008; Sarah, *et al*., 2015; Srinath and Prashant, 2006).

CONCLUSION

The sludge is drawn from sewage treatment plant of SRM Institute of Science and Technology, Kattankulathur, Kancheepuram District, Tamil Nadu and few initial parameters are analysed. From the obtained results the composition of the compost has been decided (Duong, 2013; Duong, *et al*., 2012; Valentin, 2016; Yong, 2012). The materials are added in a reactor and rotations are given each day for 5 weeks. The reduction in weight of the compost is 31.3% by the end of fifth week. Out of 20 kg of waste taken almost 70% of the composted material has passed through 2.36 mm sieve. The manure obtained is analysed for few parameters and it indicates that it has a good quality.

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