Evaluation of Physical and Chemical Parameters of different types of Compost

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***Abstract*- Economic growth, urbanization and rising standards of living in cities have led to an increase in the quantity of waste generated. These factors along with inefficient waste management and disposal practices, have detrimentally affected the urban environment.**
Composting organic waste keeps the majority of waste out of water bodies and landfills, which would have otherwise decomposed and emitted poisonous greenhouse gases.
This study aims to explore an alternative approach to the management of wet waste to produce high quality manure. Our study is focused on converting different samples of wet waste to compost and to check the stability and maturity of the compost by analysing some of the physical and chemical properties. The results of these properties were found to be within the range of standard values.

***Key Words*: composting, waste management, wet waste.**

INTRODUCTION

Composting of wet waste has become important because of pollution caused by dumping of these wastes. Open dumping is a major environmental and health hazard. The land filling of biodegradable waste causes environmental degradation due to highly polluting methane gas "[1]".
Composting of agricultural waste and municipal solid waste is commonly employed to recycle organic matter back into the soil to maintain soil fertility. It is an environmentally acceptable method of waste treatment. It is an aerobic biological process which uses naturally occurring microorganisms to convert biodegradable organic matter into a humus like product. The composting destroys pathogens and reduces the volume of waste.
Municipal solid waste also includes flower waste which is generated from religious places and during festivals. These get mixed with wet waste or they decay naturally. They are sometimes dumped in water bodies leading to water pollution. The composting process can also be applied to flower waste which will convert them into organic manure "[2, 3]".
Compost stability and maturity can be assessed using different physical and chemical parameters. In the present study, bulk density, specific gravity, moisture content and total organic matter of the different compost samples were determined. These factors affect the composting process and can be easily determined in the laboratory to check the quality of the compost "[4]".

MATERIALS AND METHODS

Preparation of Compost: The wet waste from the college canteen, dry leaves from college garden and flower waste obtained during festivals were collected for preparing the following samples.

Table 1 Types of waste samples

Sample	Type of Waste
1	Kitchen waste and dry leaves
2	Kitchen waste and flower waste
3	Flower waste

Aerobic composting was carried out in separate compost pits for the different samples. A ferro-cement pit of the size 5*3*2 with a mesh on the top was used for composting flower waste and barrels were used for composting kitchen waste.

The base of the pits was layered with dry leaves and above this layer bacterial inoculum was added. Further on this layer, wet waste was added. It was churned regularly so that the bacteria receive sufficient amount of oxygen. Water was sprinkled as and when required. The final compost of all the three samples were obtained in 2-3 months and were sun dried and powdered for analysis.
Bulk density, specific gravity, moisture content and total organic matter of the different compost samples were determined "[5, 6, 7]".

Bulk Density

Compost was dried at (110^0C) for 1 & half hours until measured weight become constant. Weighed compost was transferred in a measuring cylinder & the level occupied by the compost was noted. Values for compost were substituted in the formula and the bulk density was calculated from the equation:

$$\text{Bulk Density} = \frac{\text{Weight of compost (gm)}}{\text{Volume of compost (cm}^3\text{)}}$$

Specific gravity

Compost was dried at 110^0C in oven till constant reading is obtained. The weight of an empty measuring cylinder was determined. Dry compost was transferred into the measuring cylinder and the reading was noted. The same measuring cylinder was filled with equal volume of double distilled water. The values were substituted in the formula and the specific gravity was calculated from the equation:

$$\text{Specific gravity of compost} = \frac{\text{Weight of known compost value (gm)}}{\text{Weight of known water value (cm}^3\text{)}}$$

Moisture Content

A weighed amount of compost was taken. The compost was dried in oven at 110^0C till constant reading was obtained. The compost was cooled in a desiccator. The compost was weighed and the reading was noted down. The values were substituted in the given formula and the moisture content was determined.

$$\text{Moisture content} = \frac{\text{loss of water}}{\text{Weight of compost before drying}} \times 100$$

Total organic matter

A weighed amount of compost sample was taken in a crucible and dried in an oven at 110^0C. The crucible was placed above a Bunsen burner and heated till the sample was converted to ash. The crucible ash was weighed. The percentage of total organic matter was calculated from the equation:

$$\text{Total Organic matter:} \frac{\text{Weight of compost after heating}}{\text{Weight of compost before heating}} \times 100$$

STATISTICAL ANALYSIS

The different samples were analyzed in triplicates and the mean standard deviation was reported by using Microsoft Excel 2020. Further for finding significant values, Graph Pad Prism 11.0 version was used.

RESULTS

The compost obtained from sample 1(Kitchen wet and dry leaves) was brown in color and had a granular texture (Figure 1 B). The compost obtained from sample 2 (Kitchen wet and flower waste) was brown black in color and had a thick granular texture (Fig.1 D). The compost obtained from sample 3 (Flower waste) was dark brown in color and had a thick granular texture (Fig. 1 F). None of the compost had foul smell "[8]".

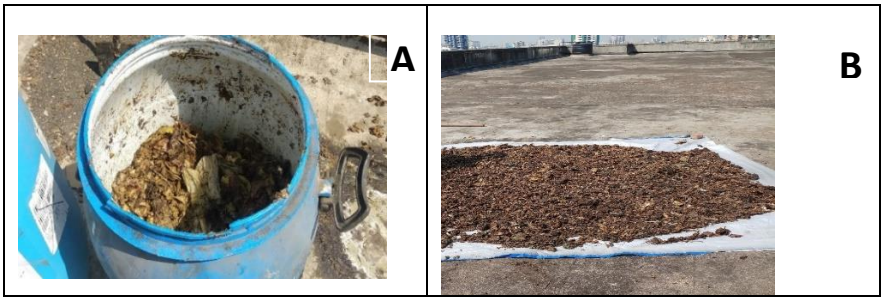

Figure 1: Preparation of different types of Compost.
A: Initial stage of Kitchen waste and dry leaves
B: Final stage of Kitchen waste and dry leaves
C: Initial stage of Kitchen waste and flower waste
D: Final stage of Kitchen waste and flower waste
E: Initial stage of Flower waste
F: Final stage of Flower waste

The results of bulk density, specific gravity, moisture content and total organic matter of the different compost samples are as follows.

Table 2 Results of bulk density, specific gravity, moisture content and total organic matter of the different compost samples

Sample	Type of waste	Bulk Density g/cm^3	Specific gravity g/cm^3	Moisture Content %	Total Organic matter %
1	Kitchen waste and dry leaves	0.952 ± 0.01	0.480 ± 0.01	41.2 ±0.02	14.8* ±0.01
2	Kitchen waste and flower waste	0.934± 0.01	0.474* ±0.02	42.3 ±0.01	15.2 ±0.01
3	Flower waste	0.901* ±0.01	0.482 ± 0.03	38.2*± 0.01	15.6 ±0.02

(* indicates significant difference in the values at p = 0.05% level of significance)

The above results indicate that the bulk density value ranges from 0.901 to 0.952 g/cm^3 which agrees with the standard value [9]. Sample 3 shows significantly less bulk density compared to the other samples. It is also observed that the bulk density of compost decreases with increase in total organic matter (Figure 2).

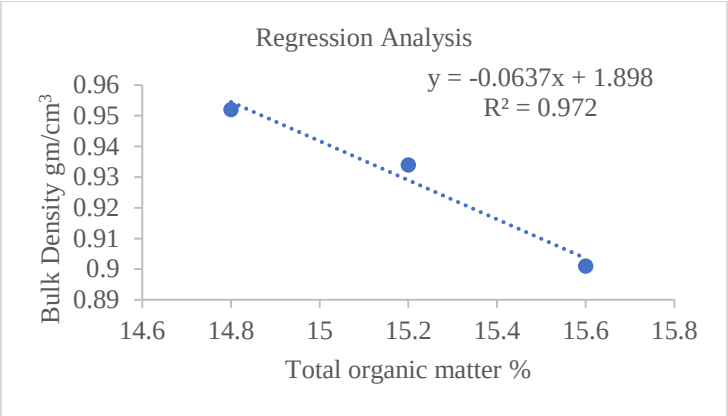

Figure 2. The relationship between the bulk density and the total organic matter of the compost.

Figure 2 shows the relationship between the bulk density and the total organic matter of the compost. The regression value obtained between the bulk density of compost and total organic matter is R^2 =0.972, y = -0.0637x + 1.898 which indicates a strong co- relation between the two parameters "[5]".

The values of total organic matter are in the range of 14.8 to 15.6 %. These results are in agreement with the results obtained by "[7]" who stated that in a mature compost, the total organic matter must be below 30 % indicating that the breakdown of organic matter and humification index is high.

The values of specific gravity are in the range of 0.474 to 0.482 g/cm^3. There was a marginal difference in the values of specific gravity of the samples.

The moisture content values of the samples ranged from 38.2 to 42.3 %. Sample 3 shows significantly less value compared to the other samples. Since all the values of moisture content are less than 50%, it agrees with the standard value "[9, 10,11]".

CONCLUSION

This study focused on converting different types of waste to compost and evaluate their physical and chemical properties. The results revealed that matured compost was obtained from all the samples and the values of bulk density, specific gravity, moisture content and total organic matter were in agreement with the standard range of values "[9, 10,11]".

Thus, the compost generated in the college is of good quality and can be used as a very good soil conditioner and fertilizer. This composting process can be carried out at an individual level (home composting), in an office or organization (at a large scale). This will reduce the overall waste being sent to landfills and reduce greenhouse emissions. Also, it is the most environment friendly way of dealing with kitchen and garden waste.

ACKNOWLEDGMENT

The authors are thankful to the University of Mumbai for financial support for the research work.

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