A RESEARCH ON DISPOSAL OF INSTITUTIONAL SOLID WASTE BY THE APPLICATION OF VARIOUS COMPOSTING AND LANDFILL METHODOLOGIES

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Abstract: Solid waste is one of the third pollutions which is next to air pollution and water pollution. Now a days, civil engineers who are working under municipal sanitation departments, are facing lot of problems, to manage the municipal solid waste (MSW).Generation of municipal solid waste continues to rise, which leads to loss of resources and increased Environmental risks. The improper collection, transportation, separation and handling will increase the risk caused by the solid waste. The conventional treatment of wastes such as open dumping and land filling cause environmental Degradation. Municipal Solid Waste consists of more than 40 percent of organic waste, so composting most of this waste would be the best way to reduce the quantity to one fourth resulting in nutrient rich soil amendment. Since the major fraction of wastes generated in India is organic wastes, composting has emerged as one of the Best methods for treatment of wastes. Composting, besides reducing the volume of waste generated and providing nutrients for plants, also helps in segregation of waste at source. As a CIVIL Engineering role point of view, to dispose the waste is not only permanent solution but also collection of the valuable nutrients present in the solid waste, by the disposal of composting and land filling methods which converts the useless waste to useful product which strengthen the soil stability if we used an alternative to chemical fertilizer. In this experimentation, we have summarized the different treatments of MSW and factors affecting composting. Municipal solid waste compost is increasingly used in agriculture as a soil conditioner but also as a fertilizer.

Key Words: Municipal Solid Waste, Collection, Handling, Composting, Land filling, Nutrients Testing.

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1. Introduction

Rapid increase in population and change in life style in India have resulted in a dramatic increase in municipal solid waste (MSW). MSW includes both domestic and commercial waste account for a relatively small part of the total solid waste stream in developed countries. It includes household garbage and rubbish, street sweeping, construction and demolition debris, sanitation residues, trade and non-hazardous industrial refuse and treated biomedical solid waste. Quantity of MSW is increasing due to increase in population and rapid urbanization and thus, safe treatment of MSW is becoming an increasingly important issue in most industrialized countries due to the desire to move towards a more sustainable society. The quality and quantity of MSW generated by a particular community varies according to their socioeconomic status, cultural habits, urban structure, population and commercial activities etc. Solid waste (SW) generation and its impact is an emerging issue for public health aspects in the developing countries. A waste management approach and government initiatives are coincided with partial developing factor practice which is a reflection of per capita solid waste generation rate. However, solid waste generation is lower in the developing county than the developed county in relation to per capita income owing to less purchasing and consumption rate. In the growing world, population growth and its fundamental demands attribute to environmental pollution while it is characterized by management system with individual governance power. The urban pollution growth and solid waste generation is a concerning issues in the developed and developing countries. Their results have negatively impacted on environment, resilience and socioeconomic condition. In the developing countries, solid waste generation and its poor management has become a more challenging issue for the impending days.

1.1. Population Growth

Due to population growth, industrialization, urbanization and economic growth, a trend of significant increase in MSW generation has been recorded worldwide. MSW generation, in terms of kg/capita/day, has shown a positive correlation with economic development at world scale. Due to rapid industrial growth and migration of people from villages to cities, the urban population is increasing rapidly. Table.1 and Figure.1 illustrates that the growth of urban population (according to census data 2011) is at a much faster rate than the growth of rural population in India. The very high rate of urbanization coupled with improper planning and poor financial condition has made MSW management in Indian cities a herculean task.

Table.1.Population Growth in Indian Cities

Cities	Population
Mumbai	12442373
Delhi	11034555
Kolkata	4496694
Chennai	4646732
Bangalore	8443675
Hyderabad	6993262
Vijayawada	1034358
Visakhapatnam	2035922
Ahmadabad	5577940
Varanasi	1201815

Table.2.Rate of Solid Waste in Indian States

State	Waste Generated(TPD)
Maharashtra	19204
West Bengal	12557
Tamil Nadu	12504
Uttar Pradesh	11585
Andhra Pradesh	11500
Kerala	8338
Delhi	7384

According to CPCB survey, the generation of municipal solid waste is about one lakh tons per day throughout India. The generation of municipal solid waste in major states of India is given in Table.2, and plotted in Figure.2.

1.2. Study Area: MVR COLLEGE OF ENGINEERING AND TECHNOLOGY

MVR College of Engineering and Technology, one of the top ranking engineering colleges in India, has achieved global identity through its involvement in research in recent technology. The accomplishments of MVR College of Engineering and Technology are contributed to the never ending saga of its success. Our students have not only been proving their mettle in academics but also in placing themselves in reputed MNCs. It has a student and Staff volume of 1550. Due to daily activities of these, there is a lump sum generation of solid waste in various forms in the institute. Solid waste has generated into the following types of sources from the institute due to various activities like sweeping, stationary, canteen and departmental waste.

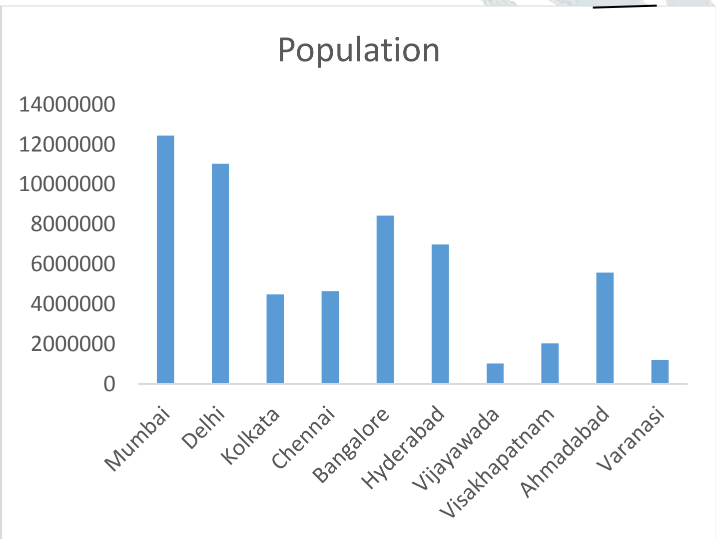

Figure.1. Population Growth in India

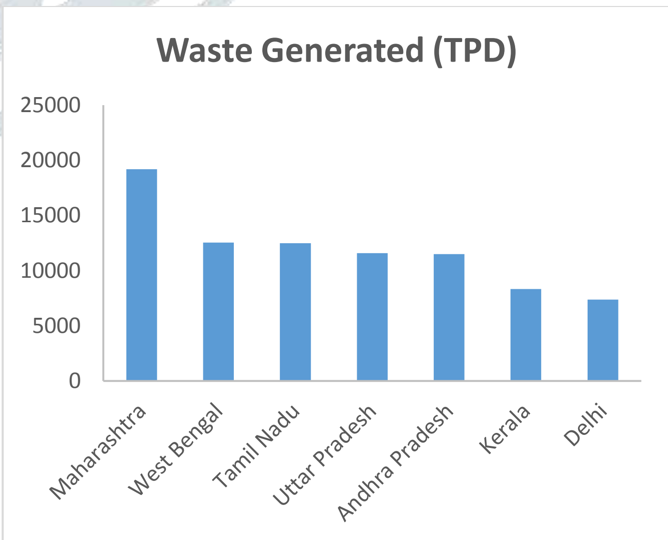

Figure.2. Waste Generation in India

2. Materials and Methods

The amount of generation of Solid waste in the institute are shown in Table.3.In the current project the institutional solid waste was majorly disposed in seven ways, six Composting processes (Bangalore Process, Indore Process, Buhler Process, Dano Process, Nusoli Process and Tollmache Process) and one Sanitary Land Fill method.

Hence from the institute 118 Kg's of solid waste was generating in a day. We are collected two days waste (236 Kg). Total released waste in a first day is used to fill the land by Sanitary Landfill process and the other day waste was divided into six parts and each part was composted with respect to selective composting methods as described above.

The above total waste (two day waste – 236 Kg) contains 85% of decomposable matter (in the form of dry and wet) and the remaining 15% of waste was non-decomposable waste. The decomposable waste given as input to composting and land fill processes and non-decomposable materials disposed with the help of incineration process. The obtained quantity of decomposable material is 200.6 Kg (236*0.85=200.6).

The decomposable material contains various ingredients like papers, vegetables, dry leaves, wet leaves and food waste. The one day decomposable waste (100.3 Kg) was composted by six different processes as described above. Each process takes a solid waste volume of 16.71 Kg. so, the amounts of various materials present in every process is tabulated in Table.4.

In the land fill process, we selected one square meter area and digged it to a depth of 1.2 meter in the form of trapezoidal shape with base of 0.8 meters. From the base 15cm is filled with coarse aggregates and 5cm are with fine aggregate as a bottom layer. Then the remaining one meter depth was divided into four layers with each layer of depth 235cm and filled with solid waste, in between two layers 15cm fine aggregate layer was placed up to complete filling of pit. At the top 20cm of final cover was placed with locally available soil. A vent pipe was inserted from the depth of 0.2m and a drain pipe was connected to collect the leachate formed in the bottom.

Table.3 Solid Waste Generation rate in the Institute

Source	**Average Generation Rate(Kg/Day)**
Sweeping Waste	11.5
Stationary Waste	3
Canteen Waste	73
Departmental Waste	14.5
Gardening Waste	16
Total	**118**

Table.4. Quantity of materials present in each sample

S.No	**Material**	**Quantity used in Kg**	**Percentage (%)**
1	Paper	2.81	17
2	Dry leaves	2	12
3	Wood waste	0.4	2
4	Vegetables	4.2	25
5	Food waste	6.5	39
6	Wet leaves	0.8	5
7	**Total**	**16.71**	**100**

3. Results and Discussions

The generated solid waste disposed and digested to a time period of three months by six composting processes and one land filling method. The digested samples are collected and analysed for the parameters of pH, Moisture, Magnesium, Calcium, Sodium, Carbon, Nitrogen, Potassium, Phosphorous, Organic Matter and C/N Ratio according to respective laboratory methods. The obtained results are compared with standard data. The results are presented in Table.5.

Table.5. Results of all the Samples

SAMPLE NAME	**SAMPLE CODE**	**P^H**	**N**	**C**	**C/N**	**OM**	**MOIS**	**P**	**K**	**Ca**	**Na**	**Mg**
Indore	**C1**	**6.4**	**0.71**	**29**	**40/1**	**32**	**38**	**1.35**	**0.57**	**1.5**	**0.48**	**0.2**
Banglore	**C2**	**7.2**	**0.82**	**22**	**27/1**	**36**	**22**	**1.85**	**0.45**	**2.1**	**0.82**	**0.42**
Nusoil	**C3**	**6.2**	**0.69**	**22**	**32/1**	**57**	**15**	**1.35**	**0.29**	**2.7**	**0.17**	**0.48**
Tollmache	**C4**	**6.5**	**0.52**	**25**	**48/1**	**62**	**18**	**1.3**	**0.6**	**3.5**	**0.16**	**0.27**
Dano	**C5**	**6.1**	**0.81**	**21**	**25/1**	**40**	**27**	**1.7**	**0.32**	**4.2**	**0.31**	**0.31**
Buhler	**C6**	**5.7**	**0.97**	**38**	**39/1**	**21**	**39**	**0.7**	**1.8**	**1.8**	**1.2**	**0.38**
Land Fill	**L7**	**8.2**	**0.9**	**39**	**43/1**	**28**	**42**	**0.52**	**1.2**	**4.5**	**2.5**	**0.4**
STANDARD DATA	**S1**	**6.75**	**0.6**	**---**	**37.5**	**20**	**50**	**0.75**	**1.15**	**2.5**	**---**	**3**

The digested samples are tested and the obtained values are compared (Table 6 values are compared with Table 5 values). Samples C1 and C2 are compared with standard data, presented in Figure .3, similarly C3 and C4 in Figure.4, C5 and C6 in Figure.5 and L7 in Figure.6.

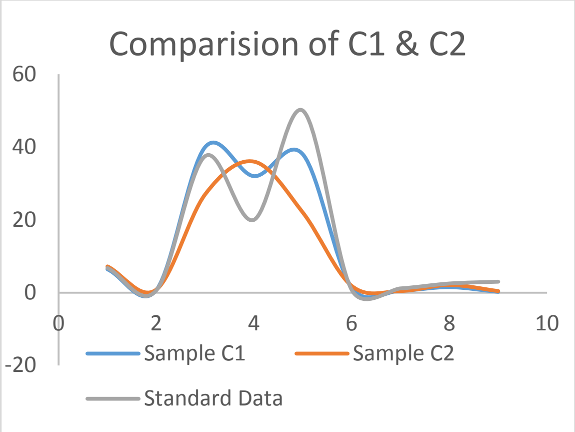

Figure.3. Comparison of C1 and C2 samples

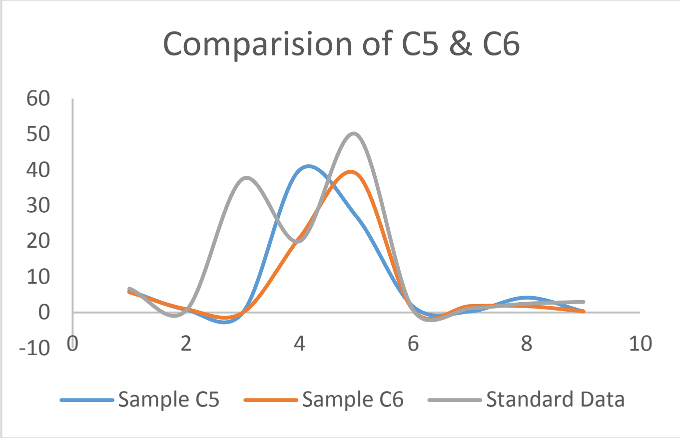

Figure.5. Comparison of C5 and C6 samples

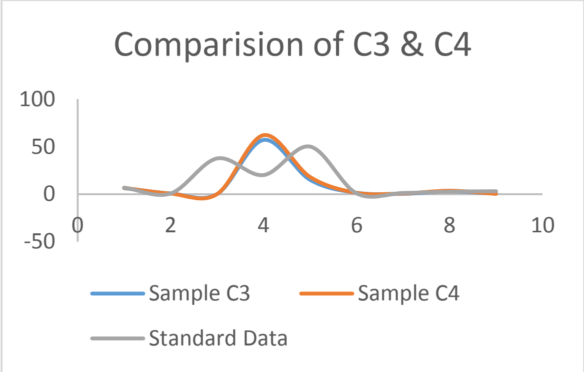

Figure.4. Comparison of C3 and C4 samples

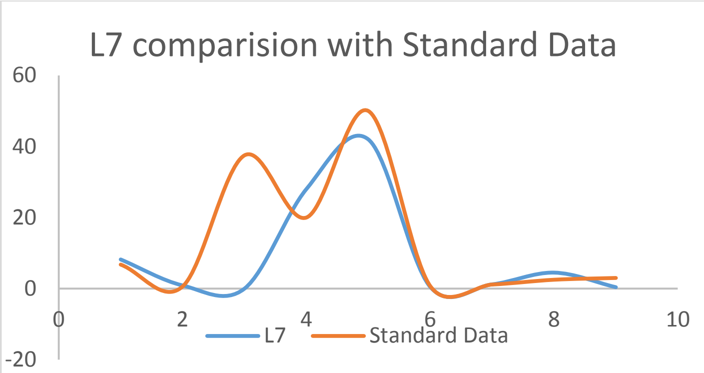

Figure.6. Comparison of L7 sample

Figure.3. Comparison of C1 and C2 samples with standard data are plotted on graph. The potassium obtained in C1 and C2 samples are too low when compared with standard data, which is 0.57 and 0.45 respectively. In C1 sample, C/N Ratio is higher than C2. In C2 sample, C/N Ratio is too low when compared to standard data.

Figure.4. Comparison of C3 and C4 samples with standard data are plotted on graph. The moisture obtained in C1 and C2 samples are too low when compared with standard data, which is 15% and 18% respectively. In C1 sample, only the parameters pH and nitrogen, calcium are nearly equal to standard data. Other parameters are observed that they are fluctuating. In C1 and C2 samples, organic matter is too high when compared with standard data, which is 57 and 62 respectively.

Figure.5. Comparison of C5 and C6 samples with standard data are plotted on graph. The magnesium obtained in C1 and C2 samples are too low when compared with standard data, which is 0.31% and 0.38% respectively. In C1 sample, phosphorous is too high but in C2 sample is equal to standard data. In C2 sample, organic matter is equal with standard data but in C1 sample organic matter is too high, which is 21 and 40 respectively.

Figure.6. Comparison of L7 sample with standard data are plotted on graph. Here is only one sample but the graph lines shows almost equal to standard data line. Magnesium is only one parameter which is too low i.e. 0.4. All the other samples are approximate to standard data values.

4. Conclusions

This analysis explicitly shows that recycling impact plays main role in the prediction of solid waste production. The degree of accuracy of this study is determined by the estimation of solid waste generation is crucial for the subsequent system planning of solid waste management in the institute regions from both short and long term perspective. The central idea of disposal of solid waste by COMPOST and LANDFILL is not only to manage the solid waste system but also to save the environment from pollution and also gives strength to the existing soil. From this process we can earn money from the waste composted fertilizer. In our study we conclude that we can convert the useless waste to useful product which contains, all the soil samples are nutrient rich products and the soil obtained from Buhler process is richer than all other processes. The manual methods of Bangalore and Indore Processes are more reliable than Mechanical methods. From the results, the waste can be processed into eco-friendly organic manure, which nourishes the soil fertility, increases the soil aeration and also minimizes environmental pollution.

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