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Short Note

Evaluation of Unprocessed Municipal Solid Waste Composition in Different Wards of Pallavaram in Pallavapuram Municipality Area in Chennai

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Abstract: A survey was conducted at different wards of Pallavaram in Pallavapuram municipality area located in Chennai for the purpose of identification of waste composition including physical and chemical characterization. The study was carried out continuously for a week in 10 different wards belonging to Pallavaram using ASTM D5231–92 (2003) standard method and RCRA Waste Draft Technical Guidance. Manual sorting was used for classifying the collected unprocessed municipal solid wastes into the following categories like food, garden, glass, metal, paper, textile, rubber, plastic and inert materials and the study was carried out at the transfer stations. Metals such as lead, cadmium, chromium and copper of composite samples of solid waste were found and reported. The compost collected from the solid waste processed site was also analysed for chemical composition. All the elements were found within the range as per CPCB Schedule.

Key words: Solid waste, Pallavaram, Pallavapuram Municipality, Chennai, compost.

Introduction

Municipal Solid Waste (MSW) is heterogeneous in nature and consists of a number of different materials derived from various types of activities. The major constituents are food waste, garden waste, glass, metals, paper, textile paper, rubber, plastic and inert materials. The only practical way to obtain physical composition data is through manual separation and it is more potentially valuable information for the researcher as well as the engineer in respect to the solid waste management system (Paul, 1972**)**. It is possible to estimate the number of vehicles required for the collection and transportation of waste each day. While per capita waste generation is a statistic, which is necessary for indicating trends in consumption and production, the total weight and volume of waste generated by the community served by the management system is of greater importance in planning and design. The high content of organic matter and macro nutrients suggests that it has the high value for the used, as the organic and organic mineral fertilizers for the sustainable environment (John 2006). Gidarakos et al. (2006) studied the physical composition of solid waste in Crete by hand sorting method as per ASTM D 5231–92(2003). For proper solid waste planning and management, the very important factor is the estimation of quantity of solid waste that has been generated (Yousuf and Rahman, 2007**)**.

The information on the nature of waste, its composition, physical and chemical characteristics and the quantities generated are the basic requirements for the planning of a Solid Waste Management system. The municipal recycling machinery, disinfecting techniques, integrated composting techniques, and organic and

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inorganic complex fertilizers, and the integrated management of MSW recycling developed in this project have significant ecological and economic benefits (Hu et al., 1998). There are different types of composting process such as aerobic composting process and anaerobic composting process. Among them anaerobic composting process provides a major energy benefit in terms of fuel gas recovery from the waste (Augenstein et al., 1996). The compost material prepared from municipal solid waste is subjected to thermophilic composting and has good humus to build up soil characteristics and plant nutrients (Elango et al., 2008). The organic matter degradation during composting follows first order kinetics (Hamoda et al., 1998). This tempted us to do such study in the Pallavapuram municipality area due to dumping of the municipal solid wastes in the Pallavaram landfill site, Ganapathipuram burial ground (Peria Eari).

Materials and Methods

Study Area

Pallavaram (12°57′21″N and 80°08′58″E) is situated at a distance of 15 km from Chennai and the area is 18 square kilometre with dry climate except the monsoon periods. It is divided into 42 wards. There are 1249 streets and 37860 households. The population is 144,000 as per the 2001 census, midyear population is 176,000 and the floating population is 16,000. The waste management in Pallavapuram municipality is entrusted with municipal sanitary staff like sanitary officer, sanitary inspector, sanitary supervisor, sanitary workers and drivers. The generated solid wastes were transported from all the 42 wards to the dump yard by the vehicles like lorry and mini-lorry. Approximately 75 metric tonnes of solid wastes are generated per day from 42 wards of Pallavapuram municipality and it is all lifted. At present there is no compost yard for Pallavapuram municipality and the municipal solid wastes are dumped in the Pallavaram landfill site, Ganapathipuram burial ground (Peria Eari) which belongs to Pallavapuram municipality area.

Sample Collection

Manual sorting method is employed for measuring the composition of unprocessed municipal solid waste. The mean composition of MSW is found based on the collection and manual sorting of a number of samples covering a minimum period of one week The weight fraction of each component in the sorting sample is calculated from the weight of the components. The mean waste composition is calculated using the results of the composition of each of the sorting samples. The compost samples collected in the Tambaram (compost 1) and Pammal municipality (compost 2) areas, nearer to Pallavaram area were obtained from the solid waste by Vermi compost process.

Procedure

The unprocessed municipal solid waste is discharged into a flat, clean and level area. The surface is swept clean and covered with a plastic sheet to discharge the load. The scale is placed on a clean, flat and level surface and is calibrated with the known weights. The unprocessed municipal solid waste is segregated and placed in the appropriate storage container. The composite items, the individual materials found in waste are separated and placed in the appropriate storage container. The weight of each waste material present in each storage container is weighed. The composite samples are prepared by combining the organic wastes and analysed for some physical and chemical parameters.

Results and Discussion

Seven wards in Pallavapuram municipality were studied for household municipal solid waste physical segregation. The domestic wastes were classified into food waste, garden waste, glass, metal, paper, textile waste, rubber, plastic and inert materials. Further, the wastes were classified into bio-degradable and non bio-degradable. Moreover, the wastes can be classified into recyclable, inert and combustible materials. The comparison of biodegradable and non-biodegradable wastes generated in different wards of Pallvapuram municipality is shown in Figure 1. The physico-chemical characteristics of solid waste and the compost were characterized and studied using different chemical techniques and instruments such as Atomic Absorption Spectrometer and are tabulated (Tables 1 and 2).

In all the wards the garden wastes such as fruits, flowers and vegetable wastes composition is higher when compared to the other wastes. In all the wards more than 55% is garden waste. The organic wastes amended with soil to persist the immobilized and total urease and phosphatase activities (Antonio Pascual et al., 2002). Hence, the major portion of the waste should not be thrown into the solid waste dumpsite as such since it affects the environment through leaching. It can be probably converted into compost and can be utilized for crop fertilization as it is a natural fertilizer. The paper waste up to 22% has been observed. The plastic waste is around 17% and the inert, textile and food wastes have

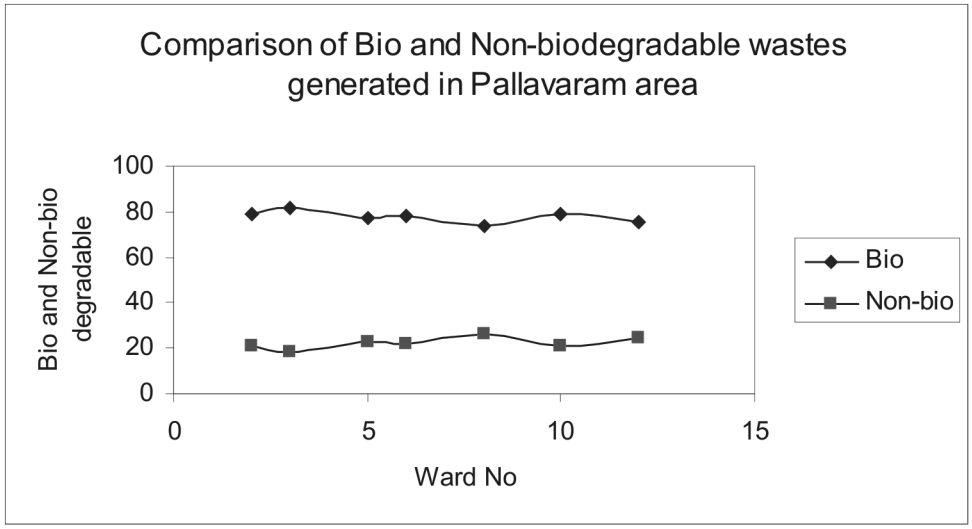

Figure 1: Comparison of bio and non-biodegradable wastes generated in different wards of Pallavaram.

Table 1: Physico-chemico characteristics of solid waste (SW)

Parameters	*SW1*	*SW2*	*SW3*	*SW4*	*SW5*
Lead, ppm	63.8	60.2	38.9	37.5	46.4
Cadmium, ppm	1.93	2.87	0.84	0.99	1.27
Copper, ppm	60.7	91.2	54.0	45.4	37.6
Nickel, ppm	87.1	56.2	302	200	156
Manganese, ppm	131	73.6	207.5	128	161
Zinc, ppm	92.8	70.8	80.9	83.0	73.2
Iron, ppm	8603	6333	7807	7970	8181
Calcium, %	8.81	12.13	2.66	3.85	5.46
Magnesium, ppm	1959	2343	2281	1647	1324
Aluminium, ppm	4502	2017	3765	3439	5438
Chromium, ppm	108	75.6	476	225	161

Table 2: Physical and chemical characteristics of compost

Parameters	*Compost 1*	*Compost 2*
pH @ 25°C	7.95	8.24
Electrical conductivity @ 25°C, µmhos/cm	2110	3210
Potassium	1.08 %	1.56%
Total phosphorous	746.8 ppm	854.3 ppm
Total sulphur	1.06 %	2.13 %
Total Kjeldhal nitrogen	510 ppm	1.82 %
C/N ratio	35	15.2
Copper	3.65 ppm	302 ppm
Antimony	Nil	11.8 ppm
Iron	296 ppm	0.85 %
Aluminium	107 ppm	5157 ppm
Lead	Nil	163.7 ppm
Cadmium	Nil	1.94 ppm
Nickel	2.30 ppm	23.8 ppm
Zinc	16.6 ppm	133.7 ppm
Calcium	1768 ppm	2.77 %
Manganese	8.03 ppm	236 ppm
Magnesium	641 ppm	2731 ppm
Cobalt	Nil	4.11 ppm

been observed up to 12%. The metal and glass wastes have been observed only less than 2%. Up to 6% of rubber wastes have been observed. In this study, the percentage of bio-degradable and non bio-degradable wastes has been given and maximum of 80%–90% of wastes are bio-degradable and 10%–20% are non-biodegradable. The recyclable, inert and combustible wastes are also classified and the percentages are also given.

Five of solid wastes samples (SW1–SW5) were collected in the Pallavaram Peria Eari dumpsite and heavy metals like Pb, Cd, Cu, Ni, Mn, Zn, Fe, Ca and Mg were analysed. The value of Pb varies between 30 and 65 ppm. Cd content is less than 3 ppm in all the samples. The value of copper is in the range of 35 to 95 ppm. The nickel content observed in the solid waste is around 300 ppm and manganese is 200 ppm. The zinc concentration is less than 100 ppm. The concentration of iron, calcium and magnesium present in the solid waste is higher as compared to that of other metals. The concentration of iron ranges from 0.6% to 0.8%, calcium ranges from 2% to 12 % and magnesium from 0.1% to 0.25%. Since the solid waste contains appreciable amounts of secondary nutrients like Ca, Mg, Fe, Zn and Cu, it can be best used as a fertilizer for crops provided the concentration of Pb, Cd and Ni are within the range. Otherwise by continuous dumping of the waste in the solid waste dumpsite, the waste gets accumulated and the nearby soil and ground water will be affected.

The compost collected from the solid waste processed site was analysed for chemical composition. In compost 1, the elements such as Cd and Pb were absent. Cu and Ni were less than 5 ppm. Zinc was less than 20 ppm and the allowable limit is 1000 ppm because it is minor nutrient of the plants. In compost 1, the copper found was upto 3 ppm and the allowable limit is 300 ppm. Nickel was only around 2 ppm. The carbon–nitrogen ratio was within the limit. All the elements were found within the range as per CPCB Schedule. The pH of the sample was also within the range with respect to CPCB Schedule. In the case of Compost 2, the pH of the sample was found to be within the range. In this sample the concentration of lead exceeded around 65 ppm as compared to that of the specifications formulated by CPCB. The concentration of cadmium was only around 2 ppm which is within the limit. The concentration of copper was nearer to the specification. The C/N ratio was not within the specification. Zinc was more than 100 ppm which is utilized by the plant for its growth. But the level is high in the case of lead; hence the level of lead should be reduced with proper actions in the field for crops.

Conclusion

The recommended system deals with maximizing recycling and minimizing land filling of the municipal solid waste, and consists of separation at source, collection, sorting, recycling, composting and sanitary landfilling (Serkan Nas and Bay Ram, 2008). The study is essential for the planning of effective solid waste management system and for effective process.

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