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A Study on Current Status of Municipal Solid Waste in Karur District, India

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Abstract:- The intention of this study was taken upon to view the current status of MSW in eleven Town Panchayat of Karur District, through the estimation of Physico-Chemical characteristics. Solid waste causes a serious problem since it alters soil quality & ground water quality. The amount of solid waste production is rising day by day. Improper handling, segregation, transportation, dumping, treating can cause adverse environmental impacts, public health hazards and other socio-economic problem. The city administration is carrying out collection, transportation and open dumping. The Physico-chemical parameters and heavy metals were analysed. The present study investigation will revealed a data of estimation about the nature and amount of solid waste and also suggest composting is the best way to treat the solid waste which could reduce the quantity of solid waste at maximum and used as manure. Perhaps this study may raise the social consciousness amongst the people.

Keywords:- *Solid Waste, Pollution, Physico-Chemical Characteristics, Compost, Heavy metals, Ohai-EPA Standards, Karur.*

I. INTRODUCTION

Treating Solid Waste is one of the challenging issues in India and it has developed as a notable pressure on the environment. According to World Health Organization (WHO), Municipal Solid Waste (MSW) contains all the wastes it normally termed as “garbage” or “trash” is an unavoidable byproduct of human and animal activities. Garbage is highly put risible and trash is rubbish that contains old refrigerators parts, couches and large tree stumps. Solid waste is the undesirable or futile solid materials comes from Residential, Commercial, Construction, Institutional and Industrial and its contents Organic material, Paper, Plastic, Cloth, Silt, Metal, Glass, Polythene and Rubber. Making arrangements for and actualizing an exhaustive program for waste collection, transport, and disposal alongside exercises to prevent or recycle waste can terminate these issues [1].

Owing to the population growth, impressed life style and social status, the alteration in consumption habits and communities pattern of population in urban centers [2].

In the year 2025, As per world bank study, urban per capita waste management rate for most of the low income countries will expand by roughly 0.2 kg/day [2].The amount of solid waste quantity is enlarging in developed and developing countries due to increasing population and rapid urbanization and 90% of the MSW produced in India is specifically arranged ashore in an appropriate way [3].

The MSW is managing by monitoring, collection, transport, processing, recycling & disposal. The wastes hierarchy includes preventing the generation of waste, reducing by reuse, recycling and composting and finally dispose to landfills and incineration. The direct dumping of solid waste in open area spread diseases and affects environment. MSW management is often given low priority, mainly because disruptions and deficiencies effect on public health, the uncollected waste deposited in drainage either by natural or human activities. Improper disposal & handling of solid waste in open areas causes serious health problems as well as pollute the environment (Air, Soil and Water) [1]. While dumping the wastes raise the heavy metals level due to batteries of hazardous waste. [4].

Many countries have succeeded in effective SWM through strict environmental regulations and minimizing generation with Refuse, Reuse, Recycling and Recovery. Organic waste can be treated the soil and after that utilized as a manure [5].

This study involves Segregation, Physico - chemical and Heavy metal analysis of the different stages of solid waste dumped in the Karur District. The aim of the study is to understand how the changes in Physico – chemical parameters and heavy metal concentration take place in different stages and brings manure.

II. MATERIAL AND METHODS

A. Study Area

Karur is a city in the Kongunadu region of India in state of Tamil Nadu. It is located on the banks of river Amaravathi, Kaveri. It is Heart of TamilNadu state. Karur is spread over an area of about 30.96 Km^2 with the growing population (0.85 millions in 1991 to 1.06 million in 2011) at fastes rate because of many industrial activities. This city is located at 10.95°N, 78.08°E and has an average elevation of 101met. The temperature ranges from a maximum 39°C to a minimum of 17°C. It has average annual rainfall of 590-600nm.

B. Sample Collection

The municipal solid waste samples used in this study were collected from various sampling area in eleven town panchayat in summer season. Cone and quadrant method was adopted for sample collection, a net quantity of 10 kg of sample was collected at each Town panchayats and then samples were segregated into constituents like organic waste, Plastic, Paper, Rubber, Glass, Silt, Metals and Cloth. The

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segregated components were then weighed using a rough balance after that the samples were covered by using black wrappers and then analysed of chemical parameters (Bulk density, Moisture content, pH, Loss of Ignition, Ash content, Total Organic Carbon, Calcium, Magnesium, Sodium, Potassium, Sulphate, Phosphate, and Total Nitrogen) for all the samples based on Indian Standard Methods. Compost samples were collected from each dump yard from composting bed, was then brought to the laboratory for characterization analysis.

C. Analysis of Samples

The analyses were done in triplicates. The collected solid waste samples were analyzed for various Physico-chemical characteristics such as Bulk density (Pycnometric method), Moisture content (dried at 105ºC to constant weight by gravimetric method), pH (1:5 water extract by pH meter), Ash Content (dried at 550ºC to constant weight by gravimetric method), Total organic carbon (cold oxidation with potassium dichromate Walkey and Black method), Calcium and Magnesium (1N ammonium acetate, EDTA method), Sodium and Potassium (1N ammonium acetate extract using flame photometer method), Sulphate (1:5 water extract for Barium Chloride method); Phosphorus (tri acid mixture with a aqua digestion), Total Nitrogen (Kjeldhal method) using standard procedures for analysis [6] [7] [8].

III. DISCUSSION

A. Physical Parameters

Characterization of solid waste for physical and chemical constituents was analysed as per NEERI methods. It can be observed that approximately 68.66 percent waste comprises organic waste, such as households commercial shop, hotel & restaurants, markets and mass storage units, institutions and offices etc.

Samples were collected from different sectors of municipality and analyzed. The results were given in the Figure 1-3. From the segregation it was clear that most of the waste contained biodegradable waste within the range of 56-80%**.** Silt was found to be the second most common waste which was in 13%**.** The rest were found below 10% and least was rubber, metal and cloth (below 1%) in minor quantities. All the physical parameters were found to be within the standard range which proves that the waste causes only minimal impact to the surrounding environment. Similar study was carried out which shows that the solid waste type was observed to comprise of glass (1.1%), metal (0.58%), paper (3.9%) and other waste (0.27%).

B. Chemical Parameters

Colour- In prima facie, the colour shade of the solid waste is earthy dark when days have been expanded there is no significant colour changes noted. Infect, the shade of compost samples changed from brown to dark brown or almost black over 90 days. The change in colour code is brought by humus present in the sample.

The mass of soil sample in a given volume is measured as Bulk Density. Between 600 and 700 kg per cubic meter of bulk density should be present in the solid waste material [9]. Moisture content is a measure of the quantity of dampness or water contained in a solid waste sample. Fresh waste contained 11.6-36.8% of moisture. During thermophilic phase, there is decline in the moisture content percentage has been recorded [9]. Bacteria, fungi, actinomycetes that do composting require hydroscopic water around the organic particles to survive. If the moisture content is below 45%, there is insufficient water around the particles for the microorganisms to live. Loss of Ignition (LOI) is a simple method for determining ash content, and by reciprocation, organic matter content of solid waste. Organic matter is nothing but carbon based materials in the solid waste [10]. Organic matter is an important component of solid waste, which influences maintaining soil structure, nutrient availability and water holding capacity. High quality compost will usually have a minimum of 50 % organic content based on dry weight. Part of the carbon in the decomposing residues evolved as CO_2 and a part was assimilated by the microbial biomass [11].

pH (IS: 10158, 1982) is a measure of acidic or alkaline nature of the sample. The pH of the fresh sample was estimated for the all samples in comparison with recommended standards [12]. In general the pH of compost lies between 6 and 8 with compost made from home (municipal/residential solid waste) showing a mean pH of 7.0 to 7.5 (neutral). Calcium and magnesium act as bases if they exist as oxides, hydroxides and carbonates. During the analysis, calcium concentrations of solid samples varied from 0.16 to 27.89%, in comparison with recommended standards [13] [14].

The observation on sulphate varied from 0.21 to 2.38 %. The dissimilarity of sulphate concentrations depends on the decomposition of organic matter present in the solid wastes. In anaerobic decomposition of solid wastes, hydrogen sulphide is reduced from sulphate, causing odious olfaction and nurture corrosion [14]. Phosphorous is further notable nutrient for normal plant growth, photosynthesis and maturity. Total phosphorous (P) is expressed most often in terms of percentage concentration per dry weight. The total phosphorous concentration varied from 0.12 to 1.21 %, in comparison with recommended standards [12].

Both Sodium and Potassium have high source in nature during decomposition which get solublised and gets readied for leaching. High concentration of sodium may alter the soil composition and make soil more alkaline ultimately become infertile. The desirable effect of potassium is similar to sodium. The adverse effects on human beings by potassium are unidentified.

The chance of Lead (as Pb) contamination in solid waste is from usage of lead batteries, paints, agricultural runoff that contains pesticide. A small amount of lead exposure is still of concern due to health and environmental effects. The Arsenic (as As) concentration is 0 mg/kg in the result. There are tens of thousands of arsenic contaminated sites worldwide, with arsenic concentrations as high as 26.5 mg/kg (Hingston, 2001). Iron (as Fe) is essential part of nitrogen-fixing in legume crops. The concentration of iron was found to be within the range 91.15 mg/kg. Excessive iron availability at lower soil pH may limit phosphorus availability (James W. Travis et al, 2003). From the compost

sample, Zinc (as Zn) was estimated 60.34 mg/kg. The Chromium (as Cr^{6+}) may be carcinogenic while crossing the standard limits (Raman). The cadmium is very dangerous if it is chronically exposure causes kidney damage, lungs, bone damage and others health aliments. Cadmium (as Cd) is of particular concern in plants, since it accumulates in leaves at very high levels. It may affect the animal feeding on crops grown on solid waste treated soil. The concentration of Copper (as Cu) is 20.01 mg/kg with maximum at 90 days compost sample. Copper is integral part of many enzymes in human beings, Copper toxicity in humans results in abnormalities of kidney functions (Sharma and Gupta, 2006). In the present investigation, the mercury concentration was found to be from 0 mg/kg in the compost samples.

Locations	Biodegradable	Plastic	Paper	Rubber	Glass	Silt	Metal	Cloth
1	72.34	8.03	2.87	0.26	0.49	13.63	0.35	2
2	74.11	5.98	2.64	0.94	0.62	14.7	0.24	0.74
3	77.14	2.02	2.73	0.76	0.89	14.46	0.55	1.42
4	70.09	10.07	1.91	0.90	0.35	14.1	0.06	2.50
5	80.03	2.03	1.24	0.2	0.97	14.16	0.41	0.94
6	63.59	24.70	4.11	0.7	0.97	0.07	0.34	5.5
7	56.48	8.33	8.86	3.83	2.46	14.36	1.41	4.23
8	64.66	11.14	4.56	0.37	1.56	14.18	0.43	3.07
9	66.88	10.04	4.28	0.53	0.79	13.83	0.60	3.02
10	67.77	7.78	3.97	1.23	1.1	14.34	1.44	2.34
11	62.24	11.07	5.57	0.37	1.54	14.6	0.57	4.02

Table 1. Table shows segregation details in percentage (%).

1. Aravakurichy, 2. Marudur, 3. Krishnarayapuram, 4. Nangavaram, 5. P.J.Cholapuram, 6. Pallapatti, 7. Puliyur, 8. Punjai Thottakurichy, 9. PunjaiPugalur, 10. TNPL Pugalur, 11. Uppidamangalam

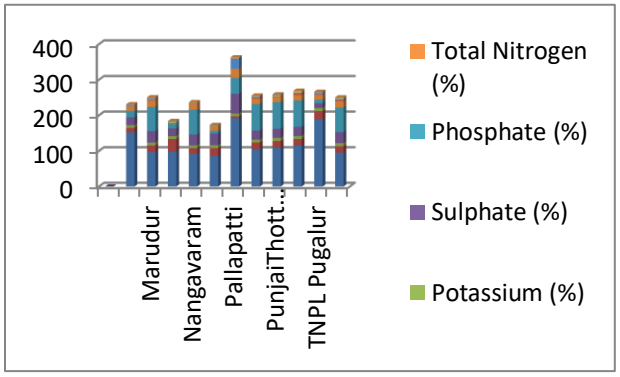

Fig 1:- Shows physico-chemical characteristics in residential area

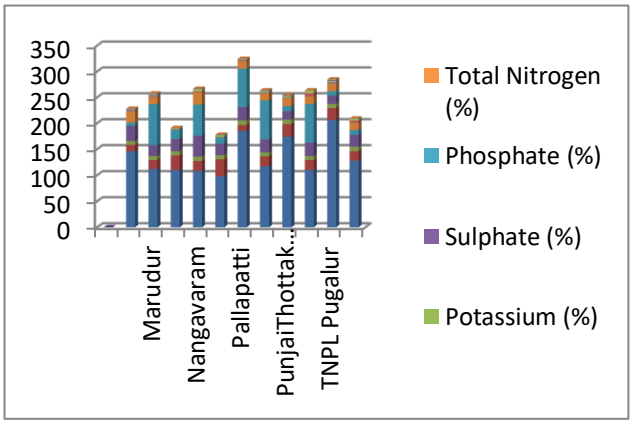

Fig 2:- Shows Physico-chemical characteristics in Commercial area

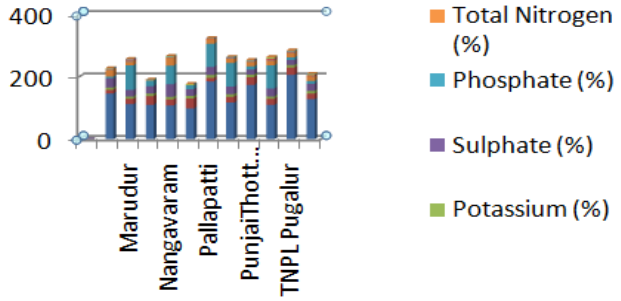

Fig 3:- Shows Physico-chemical characteristics in Dump Yard

IV. COMPOST

S.No	Parameters	Unit	Results
1.	pH	-	7.44
2.	Moisture	%	20.36
3.	Total Organic Carbon	%	10.84
4.	Ash Content	%	7.80
5.	Bulk Density	Kg/m3	0.81
6.	Loss on Ignition	%	2.28
7.	Sulphate as SO_4	mg/kg	590
8.	Calcium as Ca	mg/kg	19120
9.	Magnesium as Mg	mg/kg	2420
10.	Total Nitrogen as N	%	1.18
11.	Phosphorous as PO_4	mg/kg	8.86
12.	Sodium as Na	%	0.35
13.	Potassium as K	%	1.0
14.	C:N Ratio	-	12:1
15.	Lead as Pb	mg/kg	3.14
16.	Nickel as Ni	mg/kg	9.01
17.	Arsenic as As	mg/kg	BDL (DL:0.001)
18.	Iron as Fe	mg/kg	91.15
19.	Zinc as Zn	mg/kg	60.34
20.	Cadmium as Cd	mg/kg	BDL (DL:0.01)
21.	Manganese as Mn	mg/kg	119.1
22.	Copper as Cu	mg/kg	20.01
23.	Chromium as Cr	mg/kg	BDL (DL:0.1)
24.	Mercury as Hg	mg/kg	BDL (DL:0.1)

Table 2. Shows compost over 90 days collected from dumpyard.

V. CONCLUSION

From elucubration, the Physico-chemical parameters such as Bulk Density, pH, Moisture, Loss of Ignition, Total Organic Carbon, Calcium, Magnesium, Sodium, Potassium, Sulphate, Phosphate, Total Nitrogen were agreed with Ohai-EPA standards. There was hardly any impact on environment was noticed. All kind of wastes are being dumped at dump yard without any segregation which make treatment process more complicate than actual. Hence the municipality instantly needs to improve public awareness on Municipal Solid Waste generation especially the concept of 5r's such as Refuse, Reduce, Reuse, Replace & Recycle at all levels of society. As far as plastic management is concern, nothing is done. It is simply dumped as such. In few places Municipal Solid Waste is ablaze along with plastic bags, rubber which causes air contamination in nearby areas. So eco friendly plastic management plan must also be implemented forthwith like "Green Shopping".

Compost sample can be applied to agricultural land as it contains essential micro and macro nutrients which facilitate plant growth, enriches soil, retain moisture, increase soil texture and suppress plant diseases, pests and reduces methane emissions from landfills. It is worth noting that compost is highly recommended to use as manure for agricultural land since it contains essential micro and macro nutrients sufficiently.

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