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Kitchen Waste Characterization and Treatment Options

Bharath N P[1*], Lokeshappa B[2]
[1] PG Student, University BDT College of Engineering and Technology, Davanagere, Karnataka
[2] Associate Professor, University BDT College of Engineering and Technology, Davanagere, Karnataka
Corresponding Author: *Bharath N P

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ABSTRACT: The research highlights the effects in the context of Indian developing cities. Implication is these simple steps can be extended to further the development and development of a national waste management system (Anmol.et.al 2017). The trial evaluation of future waste-generating features can really help government has developed a sustainable waste management policy (Alok.et.al 2010) Study is conducted to evaluate and comparison between the Physico-chemical paramerters of Kitchen waste, Composting of kitchen waste by using Bio-compost, Vermicompost, Composting Culture, and Waste decomposer. The experimental setup was divided into four groups (Fertilizer, Vermicompost using Eisenia-fetida, Compost using Composting Culture, Fertilizer using Waste decomposer). Garbage from one kilogram of kitchen waste from the source collected from each clay pot and there were 12 clay pots 20 cm wide and 30 cm height used. After laboratory and statistical analysis of various physico-chemical compost variants prepared from kitchen waste (Group I to Group IV), From the research study concluded that compost was prepared with the help of Composting culture i,e Group IV, has been shown most relevant bio-enhancer in the current study.

KEYWORDS: Kitchen waste, Vermicompost, Culture, Decomposer, Bio-enhancer.

I. INTRODUCTION

Today as India population continues to grow steadily, changing lifestyles and population growth have increased natural waste, and existing landfills are overcrowded, leading to water pollution, infectious diseases, polluting odours etc. India is the second most crowded country on the earth producing more than 100 tonnes of solid.waste. per day.. It is a combination of both natural food waste and unconventional waste. The development of infrastructures has not been able to keep waste flowing within cities and Municipalities have reduced their service delivery. Solid municipal waste is slowly increasing. Solid waste has been a major environmental problem in India (Guardia.et.al 2008). MSW cities are grouped by relevant municipalities and distributed on the outskirts of the city. There is a need of knowledge with inhabitants about the proper allocation of resources. Solid waste disposal can be done in a variety of ways, such as landfill, burning, recycling, biogas conversion, sea dumping and composting (Jitendra.et.al 2017). Composting is biological decay and bacterial stability. The inescapable utilization of substance composts has added to ecological corruption, particularly in soil richness by lessening the regular supplements in the dirt. Although weighty utilization of compound manures in agribusiness builds yields vermicomposting is one of the reusing developments that will work on the type of Products. Current research was done to convert Kitchen waste into an additional vermicompost (Anmol.et.al 2017).

Manure is important for farming. The composting process requires a liquid substance called raw waste (leaves, food waste). Modern composting is a multi-step process, a process that is limited to a limited amount of rich chemicals, carbon, air, and nitrogen(Gupta.et.al 2015). The deterioration cycle is completed by pounding plant material, adding the perfect measure of water and guaranteeing legitimate ventilation by changing the blend consistently. Manure is rich in nutrients. It was used for small gardens, agriculture and roofing, etc. Manure is vital on the planet from various perspectives, for example, soil cooling frameworks, composts, and the expansion of fundamental supplements to the dirt and normal pesticides. In normal conditions, manure is significant in controlling soil recovery, restoration of streams,

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development of wetlands and trash unloading. Manure is well known to gold miners. Anaerobic fertilizer leads to a darker soil colour due to the presence of methane. Aerobic compost leads to dark brown /brown soil after composting. Perhaps the most acceptable way would be to separate the waste from the source and pass it on directly to users. However, natural waste from rural and urban areas will need to be managed differently. Small recyclable landfills can be maintained throughout the municipality (Guardia.et.al 2008). Every year it consumes 1.3 billion tons of land and causes 55.20 billion economic losses and environmental caucuses. The widespread food shortage is the result of negligence on the part of individuals, communities, nations and the world (Mamta.et.al 2013).

II. METHEDOLOGY

Study Area

The Davanagere city situated in western part of South India, under city's municipal group Davanagere City Municipal Corporation, Average annual rainfall of Davanagere is 644 mm. As of 2011 Census, Davanagere has a population of 4,27128 (Yaseen.et.al 2017). Out of the 100 cities Davanagere has been selected as one in India to be built as a smart city comes under the Smart Cities Mission. Originally selected in the top 20 cities, Davanagere is one of them.

Per Capita Waste Generation Of Kitchen Waste

Total Solid Waste Generation. =Population.x Per Capita Solid waste Generation.

By using the geometrical increase method Calculation of the Solid Waste (SW) for the Davanagere City:

- $P_{2021} = P_{2011}\ [1+(r/100)]^{n}\ P_{2021}$
  $= 427128[1 + (17.17/100)]^{1} =$ **500485.**
- Increase in population = **73357.**
- % of increase in population in decade = **17.17%**
- Therefore as of the above. result the % raise in population for each year is
  = 17.17/10 =**1.717.**

- Hence, the current population (2021) = P_{2011} + (1.717% × 73357 × 3)
  = 427128 + 3779 = **430907**

- Davanagere City overall amount of wastes generated = Population.x Average. Per. Capita. Solid waste. generate per. Person. Per. day.
  = 430907.×.0.35 Kgs **=.150817 kg/day**
  =**.150.817 tonnes./day**(Yaseen.et.al 2017)

- Physical characterization of Solid waste generated in Davanagere city ,Kitchen waste composition was found to be **51%** (Shravan.et.al 2018)

- Therefore Total Kitchen waste generated = 150.817 X (51/100) = **76.916 tonnes./day**.

The. statistics collected. from. .Davanagere. city Municipal.Corporation. is **76.916 TPD.** of kitchen waste.

Regression analysis on MSW generation of Metro-politian cities.

Demographics say that population speculation in big cities is a very challenging task where migration is a major driver of demographic change (Bagat.et.al 2012). This document has used both measurement and measurement methods to accurately determine the population of the Metropolitan population in Indian cities. He then used these demographics to measure MSW per capita and the practice in the cities in question. In cases where measurement errors were significant, a log modification technique was used to reduce measurement error. As a result of this, the number of Metropolitan peoples in Indian cities in the years 2000,2005,2015 and 2020 is estimated beyond the census years(CPCB of India).

The size of the urban population among two census times is premeditated using the formula below:

$$P_{estimate} = P_1 nNnN\ (P_2 - P_1)$$

Where

$P_{estimate}$ = Estimation of population for a given year.

n = Total number of months from the date of the estimate to P_1 census.

N = Total number of months between successful census periods.

P_2 = Census taken during last period.

P_1 = Census taken during second last period.

With regard to generation data of MSW, the study area and the obtained collected data from various secondary sources and are compared by the same to obtain its precision prior to actual use.

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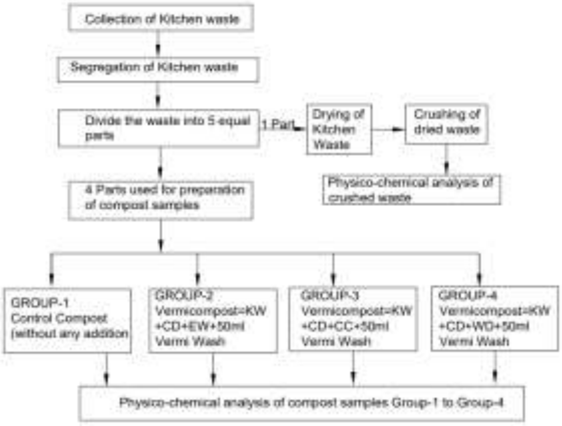

Methodology works with a variety of methods used in collecting, sorting, processing and analysing kitchen waste samples and different vermicompost samples. Kitchen waste disposal and analysis includes various steps such as garbage collection, Segregation, waste disposal and physico-chemical analysis of dry kitchen waste(Phiri.et.al 2013).

The collected waste is divided into 4 equal parts. One component (approximately 1 kg) was used for direct laboratory testing of kitchen waste analysis of physico-chemical parameters and the remaining components were used to prepare four different groups of compost. All samples were in triple state so a total of 12 kg of waste was used to prepare various samples. To prepare the compost, the experimental setup was divided into four groups (Fertilizer, Vermicompost using Eisenia fetida, Compost using Composting Culture, Fertilizer using Waste decomposer) as shown in schematic representation in the above Fig.1 . Garbage from one kilogram of kitchen waste from the above source was collected from each clay pot. Therefore 12 clay pots 20 cm wide and 30 cm high were used.

In this current research context different groups of compost enhancers are purchased from different sources.

Fig. 1: Schematic representation of work plan

Fig. 2 : Collection of Kitchen Waste

Fig. 3 : Preparation of pots

III. EXPERIMENTATION

As shown in Fig.4 For Group I Bio-Compost, Jars (triple) were prepared using the same kitchen waste and one kilogram of cow dung arranged in a layered pattern. Since the set was tripled, three jars were prepared. The water was sprinkled periodically and the mixture was dispensed every fifth day. This composting process is done in 60 days. For Group II Vermicompost The pots (three times) were prepared using the same kitchen waste and one kilogram of cow dung arranged in a well-arranged, empty pots left to fill the compost in the front. After the 10th day, 100 gm of earthworms were introduced into the composted pots. Old jute bags were used to cover the pots to protect the earth's worms from predators and to prevent moisture loss. The water was sprinkled periodically and the matter was promoted every 5 days. The vermicomposting procedure is performed for 45 days.

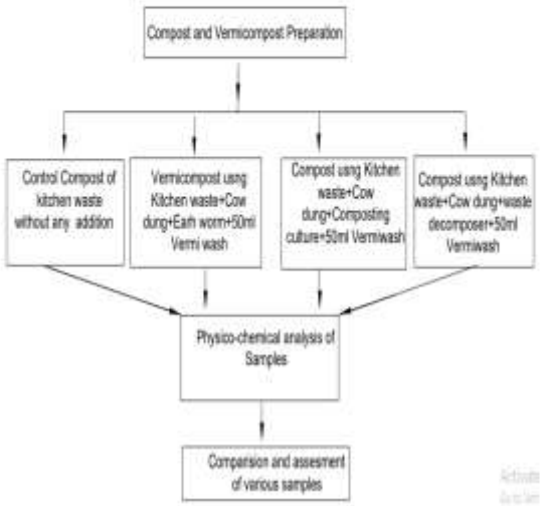

Fig.4:Schematic Representation of Preparation and Analysis of samples.

For Group-III Compost using Composting Culture Jars (triple) were prepared using one kilogram of kitchen waste over 10 gm of compost culture followed by a thin layer of cow dung. Water was sprayed periodically as needed and the matter was changed every 4 to 5 days of aeration. The composting method was carry out for 35 days. For Group IV Compost by using Waste Decomposer Jars (triple) were prepared using 1 kg of kitchen waste and 500 gm cow dung and 50 ml of waste Decomposer. Water was sprinkled frequently and the matter was changed every third to fourth day. The composting process was carried out for 28 days. After the waste is converted into compost and vermicompost samples were collected from all pots. Neem seeds are ground into a fine powder and mixed with prepared samples as neem works effectively against soil-borne pests. The samples were then sealed with various sterilized bags labelled and labelled for further analysis.

IV. OBESERVATIONS AND RESULTS

The Solid waste generation for the Real and Predicted data and population of Mumbai, Delhi, Chennai and Kolkata city from 2000 to 2020(CPCB of India). The year line plot provides the population status of the city of Mumbai, Delhi, Chennai and Kolkata as per the 2011 India census as well as the five year MSW production trends of 2000, 2005, 2010, 2015 and 2020. It can be seen from below Figures 6,8,10 and 12 that these major cities is ahead not only by means of population but it also in terms of generation of daily MSW . Fig. 5,7,9 and 11 reveals that the rapid growth in MSW production and disposal of MSW in the 2000-2020 period is a major problem today.

In this present study highlights the implications of the developing countries. Simple steps can be extended to the continuation and development of the national waste system. Trial evaluation of these future waste generating properties help the government develop a sustainable waste management policy.

Mumbai

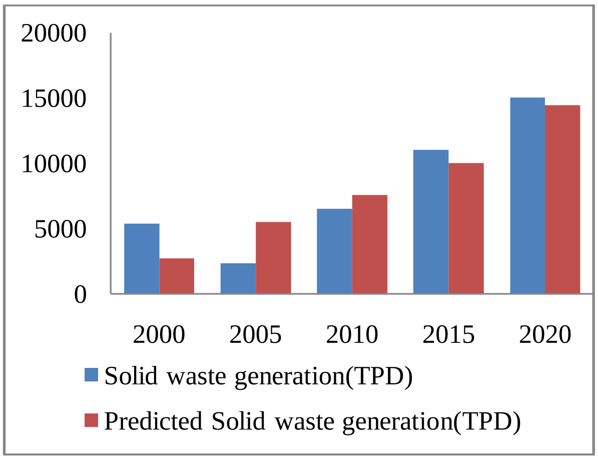

Fig. 5: Year Line Fit Plot Mumbai city.

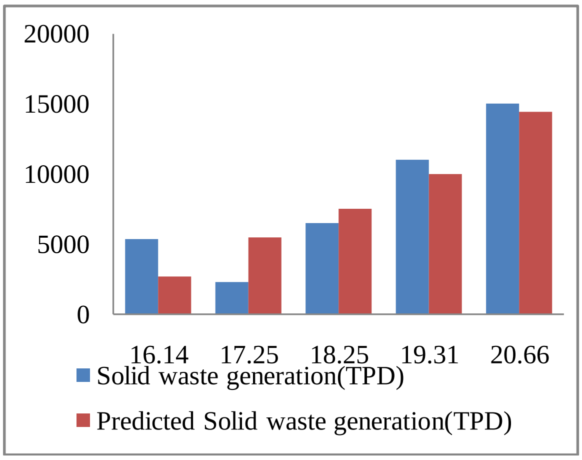

Fig. 6: Population Line Fit Plot Mumbai city.

Delhi

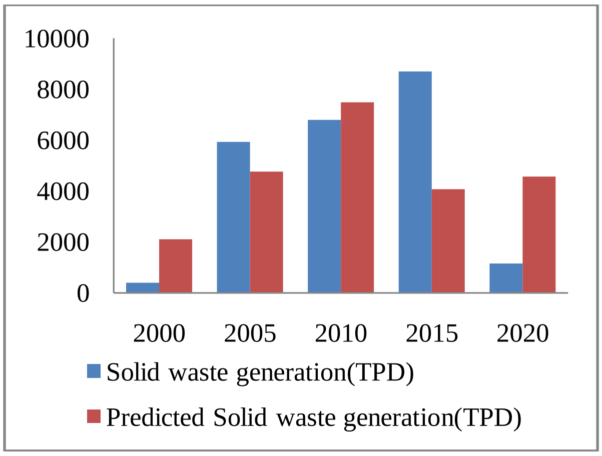

Fig. 7 : Year Line Fit Plot Delhi city

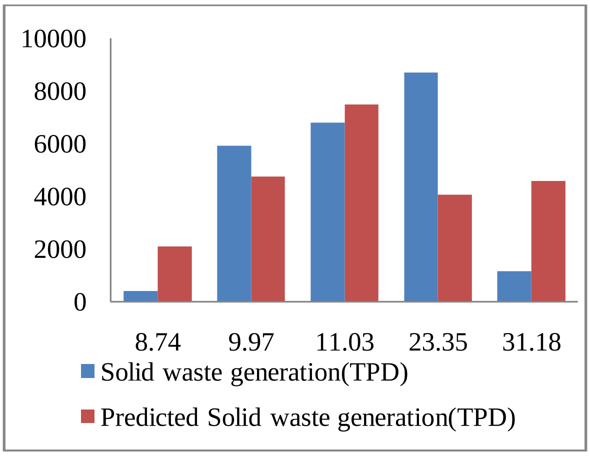

Fig. 8 : Population Line Fit Plot of Delhi city

Chennai

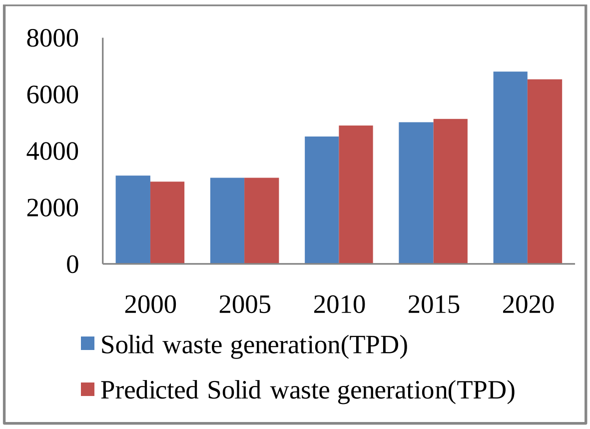

Fig. 9 : Year Line Fit Plot Chennai City.

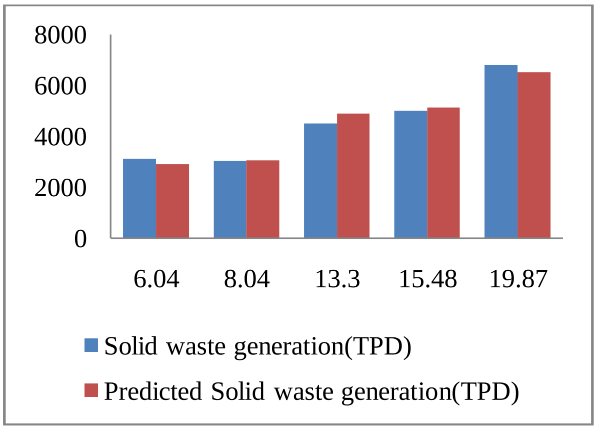

Fig. 10 : Population Line Fit Plot for Chennai City

Kolkata

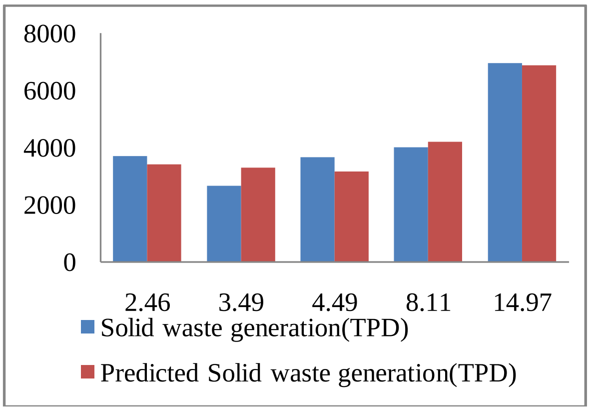

Fig. 11 : Population Line Fit Plot Kolkata city.

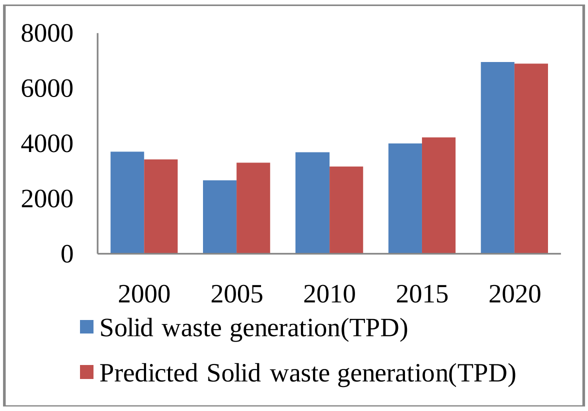

Fig. 12 : Year Line Fit Plot Kolkata city

Mean of physico-chemical parameters of kitchen waste and various compost samples

Table 1 : Mean of physico-chemical parameters of kitchen waste and various compost samples

Parameters.	Various Groups				
	Kitchen Waste	GroupI (Bio Compost)	GroupII (Vermicompost)	Group III (Composting Culture)	Group IV (Waste Decomposer)
MC(%)	86.94	22.04	20.15	17.78	15.48
pH	4.48	8.35	8.71	7.51	7.77
OC (%)	6.51	15.91	12.63	26.60	15.79
N (%)	0.00	0.12	0.16	0.21	0.13
P (%)	0.45	0.77	0.38	0.64	1.33
K (%)	0.27	0.69	0.36	0.64	0.74
Ca (%)	0.17	0.86	0.31	0.44	0.88
Mg (%)	0.14	0.23	0.22	0.43	0.45

Moisture content

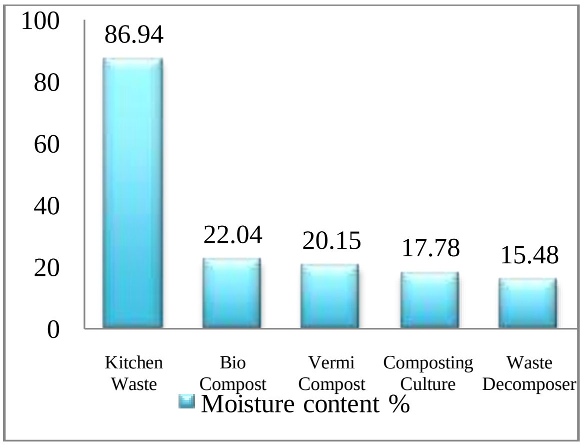

Fig. 13: Moisture Content in kitchen waste and various compost samples.

It has been analysed from Fig.13 that kitchen waste has a high humidity content of 86.94 Where as Group IV (compost using Culture) indicating a small percentage of moisture i.e. 15.48. Other groups treated with compost samples namely Group I, II, and III were found to be 22.04, 20.15, and 17.78 respectively.

pH

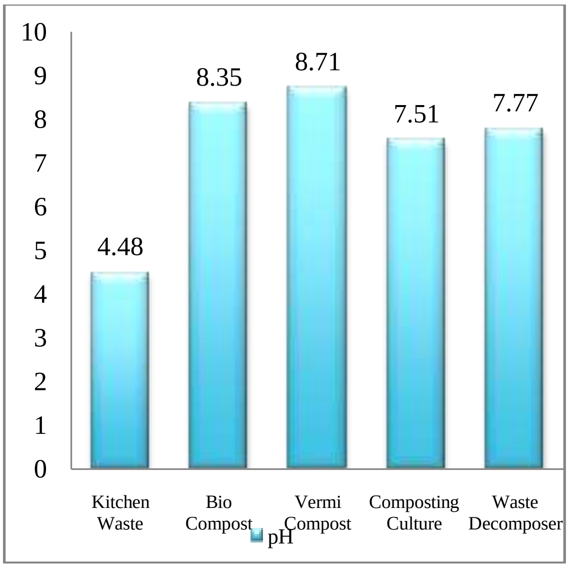

Figure 14: pH in kitchen waste and various compost samples.

pH was found to be higher in Control compost sample and vermicompost compared to other compost samples, probably due to the high mineral use of N and P in nitrates / nitrites and ortho-phosphate. In the sample the vermicompost is high, possibly due to the activity of calciferous glands in the earth's rats containing carbonic anhydrase that stimulates carbon dioxide fixation and also as calcium carbonate, thus preventing pH collapse. (Pattnaik.et.al 2009; Kale.et.al 1982).

Organic Carbon

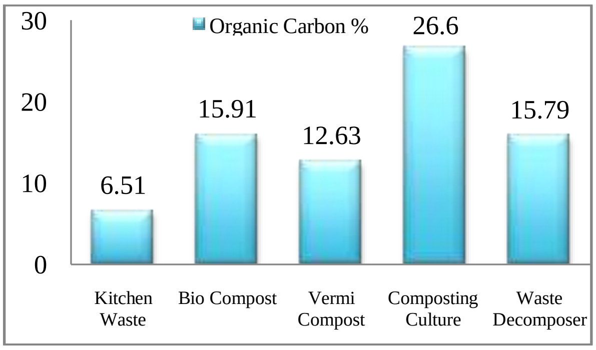

Fig. 15: Organic Carbon in kitchen waste and various compost samples

It is clear from Fig. 15 that Group III (compost using Composting culture) showed a high Organic Carbon content of 26.6 and of kitchen waste with a low amount of Organic Carbon content of 6.51. In other groups treated with compost samples namely Group I, II, and IV OC they were found to be 15.91, 12.63, and 15.79 respectively.

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Nitrogen

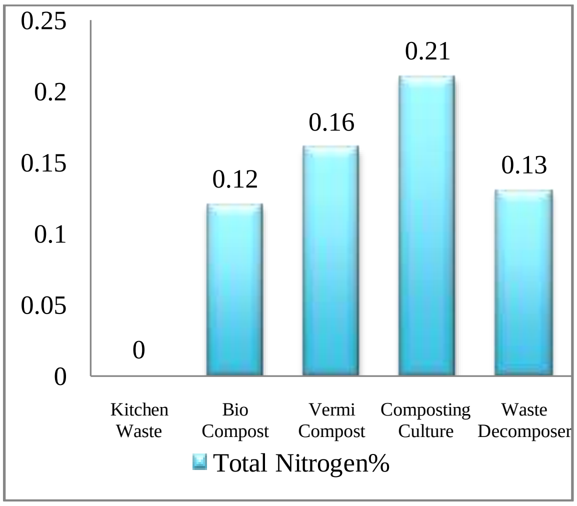

Fig. 16: Total Nitrogen in kitchen waste and various compost samples

Changes in total nitrogen compost and vermicomposting of kitchen waste selected from current studies are shown in Fig.16. The results indicate that kitchen waste did not have a way to measure the nitrogen content of nitrogen where as Groups I, II, III, and IV show significant and uniform nitrogen concentrations namely 0.12, 0.16, 0.21 and 0.13 respectively.

Phosphorous

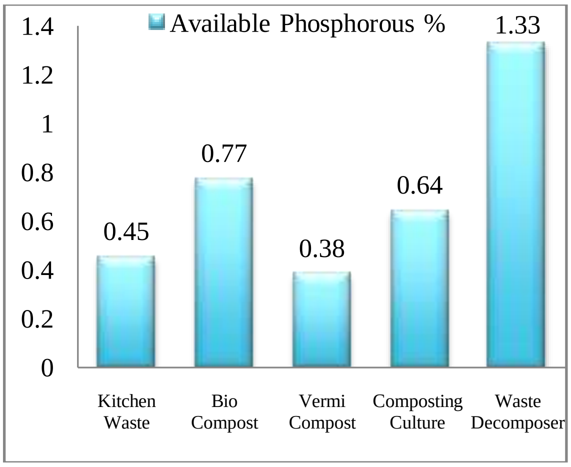

Fig.17: Available Phosphorus in kitchen waste and various compost samples

Among the compost analyses all compost samples showed an increase in their phosphorus content. Percentage of Phosphorus is analysed in Fig. 17.The results show that Group IV (compost using Waste decomposer) contains high phosphorus i.e. 1.33 and Group II (vermicompost) contains a minimum phosphorus i.e. 0.3. Whereas kitchen waste, Group I and III had significant and measurable concentrations of 0.77 and 0.64 respectively.

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Pottasium

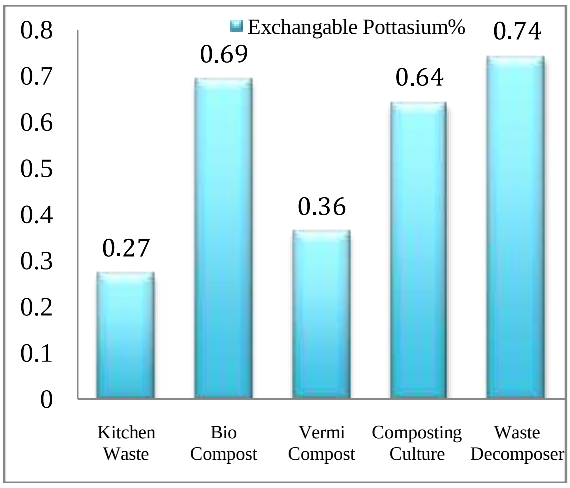

Fig. 18: Exchangeable Potassium in kitchen waste and various compost samples.

Potassium was another measurable parameter and the percentage of potassium can be analysed from Fig. 18.An increase in potassium content was observed in samples of modified various compost. .A related observation also made by Rodriguez.et.al (2001). An experiment conducted by (Pathak.et.al 2012), have shown that kitchen compost has a high nutrient content for plant growth. The results show that kitchen waste had a relatively small amount of potassium e.g. 0.27. Whereas Group I (Bio compost) and IV (compost using Waste decomposer) had a high and moderate amount of potassium high i,e 0.74 and 0.69 respectively. Potassium variability in Group II and Group III was found to be 0.36and 0.34 respectively. Values found to be insignificant in the vermicompost sample.

Calcium

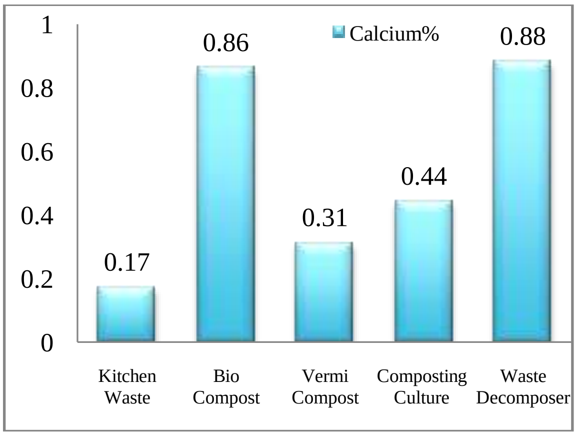

Fig. 19: Calcium in kitchen waste and various compost samples

Calcium is one of the measured parameters and the percentage of calcium produced was analysed from the above Fig. 19. The results say that kitchen waste received a minimal amount of calcium i.e. 0.17. Where as Groups I, II, III, and IV produce significant and measurable calcium concentration i.e. 0.86, 0.31, 0.44 and 0.88 respectively.

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Magnesium

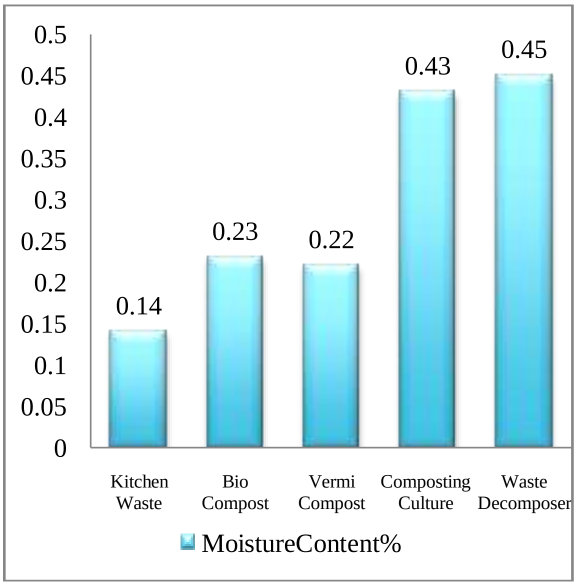

Fig. 20 : Magnesium in kitchen waste and various compost samples

From the above Fig.20 Magnesium analysis results show that kitchen waste produces a moderate amount of Mg e.g. However, Groups I, II, III and IV produced significant and measurable Mg concentartaion i.e. 0.14, 0.23, 0.22, 0.43 and 0.45 respectively. The values are greatly increased in Bio compost, vermicompost , compost prepared by Waste decomposer and compost culture.

V. CONCLUSION

In this present research study, the following suggestions here drawn for the implementation at Muncipalities in the developing countries.

1. Trial evaluation of these future waste generating properties can really help the government develop a sustainable waste management policy.
2. By Adopting and developing compost methods seems to be a viable economic and environmentally friendly way out. It is also suggested that government also plays an role to address the issues related with the, Collection of wastes and Segregation of wastes to implement a centralized Solid waste management system.

3. By adopting composting technique, the growth rate of solid waste generation and burden on landfills can be reduce.

From the laboratory analysis of various physico-chemical parameters of the different composts were prepared from kitchen waste (Group I to Group IV), It concluded that the compost prepared with the help of Composting Culture i.e. Group IV, proved to be the best suited bio-enhancer. Therefore, it was selected for further value addition studies. However, it can be concluded that, the Vermicompost , Bio-compost and Waste decomposer, can also be used with Butter Milk, Sugar cane juice and vermiwash. As buttermilk accelerate in fast composting process, sugarcane juice is helpful for micro-organisms growth and vermiwash is rich in micro and macro nutrients which are beneficial for plant growth.

REFERENCES

[1]. Alok Bharadwaj.2010. “Management of Kitchen Waste Material through Vermicomposting”.
[2]. Akbar Eslami, Monireh Majlessi , Hossein Najafi Saleh, Simin Mirshafieean and Sara Babaii. 2012. “Vermicomposting of food waste: assessing the stability and maturity”.
[3]. Bhat, S. A., Singh, J., &Vig, A. P., 2017. Instrumental characterization of organic wastes for evaluation of vermicompost maturity. Journal of Analytical Science and Technology.
[4]. Central Pollution control Board (Ministry of Environment & Forests,Govt. of India).
[5]. Dutt, A. K. 1952. “Earthworm s and soil aggregation, Journal of American Society for Agronomy” 48: 407-448.
[6]. Edwards, C. A. 1988. “Breakdown of animal, vegetable, and industrial organic wastes by earthworms”. Agriculture,

Ecosystems and Environment 24:21-31. Edwards, C. A. 2004. Earthworm ecology, CRC Press LLC, Boca Ra.

[7]. EPA. 1980. "Compendium on Solid Waste Management by Vermicomposting", U.S. Environment Protection Agency, Ohio pp 45. Ernst, G., Muller. A., Gohler, H. and Emmerling, C. 2008.

[8]. Government of Karnataka (2010). Policy on Integrated Solid Waste Management- Urban Development Department.

[9]. IS: 3025 (Part-1)- 1987, IS: 3025 (Part-14)- 1984, IS: 3025 (Part-34)1988, IS: 3025 (Part-31)- 1988,IS: 3025 (Part-40)- 1991, IS: 3025 (Part-46)- 1991:Indian Standard: Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater.

[10]. Jitendra Sarkar ,Anmol Dongre, Sachin Hichami, Ganesh Mandal. 2017. "Vermicomposting Of Vegetable Market Waste".

[11]. Management & Handling Rules, 1999 by the Ministry of Environment & Forests, Government of India, for production of compost.

[12]. M. Nayeem Shah, Bhat, J. V., 2013. "Direct Vermicomposting of Vegetable Waste Using the Concept of High-rate Vermireactor Operation"

[13]. Mohammed Yaseen , S.Suresh , Aravinda H.B.2017 "Quantification Of Solid Waste And Management Of Davanagere City"

[14]. P.Gupta,Mohamed Omer Albasha, and P.W. Ramteke. 2015. "Management of Kitchen Waste by Vermicomposting Using Earthworm, Eudrilus Eugeniae".

[15]. Phiri.A, Manyuchi. M 2013. "Vermicomposting in Solid Waste Management: A Review".

[16]. Prashantha Naik , Dukuziyaturemye Pierre , Sharath Chandra Kodandoor and 2002. "Vermicomposting of Food Waste Using Exotic Species of Earthworms".