Scientific Journal of Impact Factor (SJIF): 5.71

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 5, Issue 04, April -2018

CHARACTERIZATION AND GAS QUANTIFICATION ANALYSIS OF BIO DEGRADABLE WASTE

PREM KUMAR.K[1] , MANIKANDAN.P[2] , LAKSHMI NEEHARIKA AKELLA[3]

[1]*Assistant Professor, civil engineering, Periyar Maniammai University,Vallam*
[2]*Assistant Professor, civil engineering,BIET,Hyderabad*
[3] *Assistant Professor, civil engineering,BIET,Hyderabad*

ABSTRACT: *Solid waste is the most important factor in the environment pollutant. These wastes containing the materials like glasses, plastics, paper and food waste etc. The solid waste or degradable waste polluting the environment continuously by the process of open dumping .In open atmosphere these are producing the CH_4,CO_2,N_2 gases and it will affect the lands by the way of leachate and etc. So the characterization of this waste is essential while transporting and disposing. The solid wastes are taken from the hotels and house hold in around the Thanjavur district. Characterization analysis were done by six sample of solid wastes (Food waste, Kitchen wastes, night soil, vegetable waste and combined waste). In physical characterization, the density and moisture content are determined also in chemical characterization volatile combustible matter, Ash and carbon are determined. The digester model is created by the capacity of 25 lit water canes and the gas storage balloon was created by using the bike tube. Following that the presence of CH_4 for the various types of solid wastes are calculated. Finally this report shows that the types of gases produced from the various types of wastes with its quantification rates.*

Keywords: *Solid waste, Food waste, Kitchen wastes, night soil, vegetable waste, physical, chemical and biological characteristics*

1. INTRODUCTION

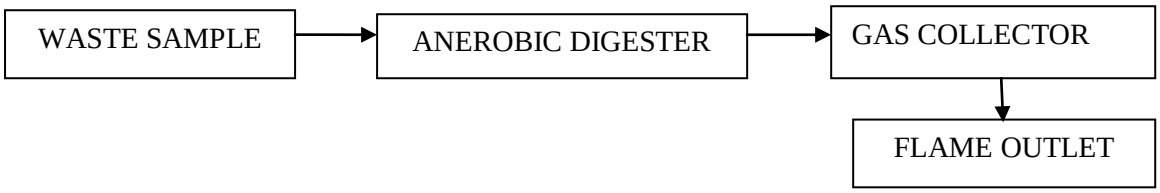
Wastes are the common factor in the world wide. The production of solid wastes increasing day by day in each and every countries. In India generated 48 million tonnes of solid waste are disposed in unsafe ways. For example burning, dumped into oceans and other water bodies and lands. While burning or open dumping of solid waste occur the environment and it will creates a toxic gases and harmful effects. So that characterization process is most important part in solid waste management. These wastes are physically characterized by segregation of waste. This paper shows the process and types of characterization of solid wastes in physically and chemically by means of moisture content, specific weight, pH, volatile matters, CO_2, CH_4 contents etc.

The composition of municipal solid waste varies greatly from municipality to municipality (country to country) and changes significantly with time. In municipalities (countries) which have a well-developed waste recycling system, the waste stream consists mainly of intractable wastes such as plastic film, and unrecyclable packaging materials. At the start of the 20th century, the majority of domestic waste (53%) in the UK consisted of coal ash from open fires. In developed municipalities (countries) without significant recycling activity it predominantly includes food wastes, market wastes, yard wastes, plastic containers and product packaging materials, and other miscellaneous solid wastes from residential, commercial, institutional, and industrial sources. Most definitions of municipal solid waste do not include industrial wastes, agricultural wastes, medical waste, radioactive waste or sewage sludge. Waste collection is performed by the municipality within a given area. The term residual waste relates to waste left from household sources containing materials that have not been separated out or sent for reprocessing.

Fig 1: Bio-Degradable Waste

2. EXPERIMENTAL STUDY

2.1 METHODOLOGY FLOW CHART



2.2 GENERAL COMPOSITION OF BIOGAS

Table 1: Composition of Biogas

Compound	Chemical Name	%
Methane	CH_4	50-75
Carbon Dioxide	CO_2	25-50
Nitrogen	N_2	0-10
Hydrogen Sulphide	H_2S	0-3
Oxygen	O_2	0-0

2.3 SPECIFICATIONS OF TUBE

- Feed ratio: 1:1 and 1:1.5
- Inner dia = 590mm
- outer dia = 660mm
- Thickness = 50mm
- Volume of Tube: 3.4 x 10^6 mm^3

Fig 2: Gas storage Tube

Fig 3: Decomposition of Food waste (Gas Formation)

Fig 4: Decomposition of Night Soil waste (Gas Formation)

Fig 5: Decomposition Process (Night soil + Food waste)

3. EXPERIMENTAL RESULTS

3.1 FOOD WASTE

Source of waste: Hotels

Table 2: Proportions of gases from food waste

Parameters	Feed Ratio 1:1	Feed Ratio 1:5
Quantity of waste	5kg	5kg
Quantity of water	5lit	7.5lit
Weight of gas	230 gms	255gms
CH_4	138 gms	153gms
CO_2	69 gms	76.5gms
N_2	18.4gms	20.4gms
H_2S	4.6gms	5.1gms

3.2 KITCHEN WASTE

Source of waste: From Households

Table 3: Proportions of gases from kitchen waste

Parameters	Feed Ratio 1:1	Feed Ratio 1:5
Quantity of waste	5kg	5kg
Quantity of water	5lit	7.5lit
Weight of gas	141gms	159 gms
CH_4	84.6 gms	95.4 gms
CO_2	42.3 gms	47.7 gms
N_2	11.28 gms	12.72 gms
H_2S	2.82 gms	3.18 gms

3.3 NIGHT SOIL WASTE

Source of waste: From PMU Hostel

Table 4: Proportions of gases from night soil waste

Parameters	Feed Ratio 1:1	Feed Ratio 1:5
Quantity of waste	5kg	5kg
Quantity of water	5lit	7.5lit
Weight of gas	153 gms	167 gms
CH_4	91.8 gms	100.2 gms
CO_2	45.9 gms	50.1 gms
N_2	12.24gms	13.36 gms
H_2S	3.06 gms	3.34 gms

3.4 COMBINED WASTE(NIGHT SOIL + FOOD WASTE)

Source of waste: From PMU Hostel and Hotels

Table 5: Proportions of gases from night soil and food waste

Parameters	Feed Ratio 1:1
Quantity of waste	5kg
Quantity of water	5lit
Weight of gas	266 gms
CH_4	159.6 gms
CO_2	79.8 gms
N_2	21.28gms
H_2S	5.32 gms

3.5 COMBINED WASTE(NIGHT SOIL + VEGETABLE WASTE)

Table 6: Proportions of gases from night soil and vegetable waste

Parameters	Feed Ratio 1:1
Quantity of waste	5kg
Quantity of water	5lit
Weight of gas	201 gms
CH_4	120.6 gms
CO_2	60.3 gms
N_2	16.08 gms
H_2S	4.02 gms

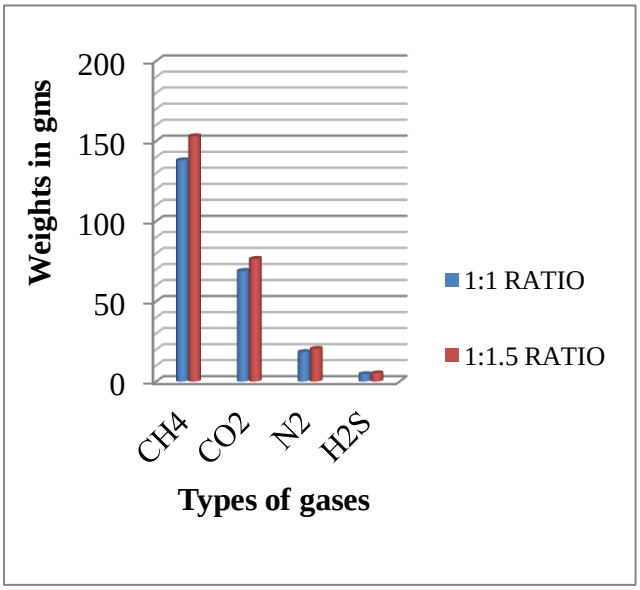
Fig 6: Gas quantification (Food Waste)

3.6 COMBINED WASTE (NIGHT SOIL + FOOD WASTE+ VEGETABLE WASTE)

Table 7: Proportions of gases from night soil, food waste and vegetable waste

Parameters	Feed Ratio 1:1
Quantity of waste	5kg
Quantity of water	5lit
Weight of gas	287 gms
CH_4	172.2 gms
CO_2	86.1 gms
N_2	22.96 gms
H_2S	5.74 gms

Fig 7: Gas quantification (Kitchen Waste)



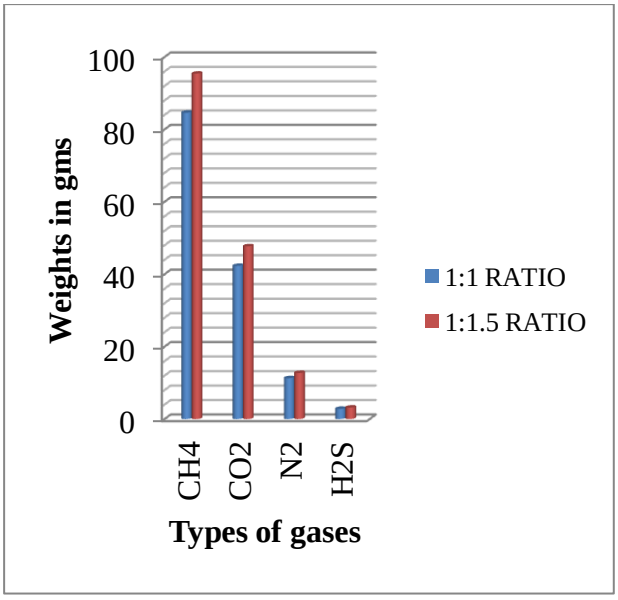
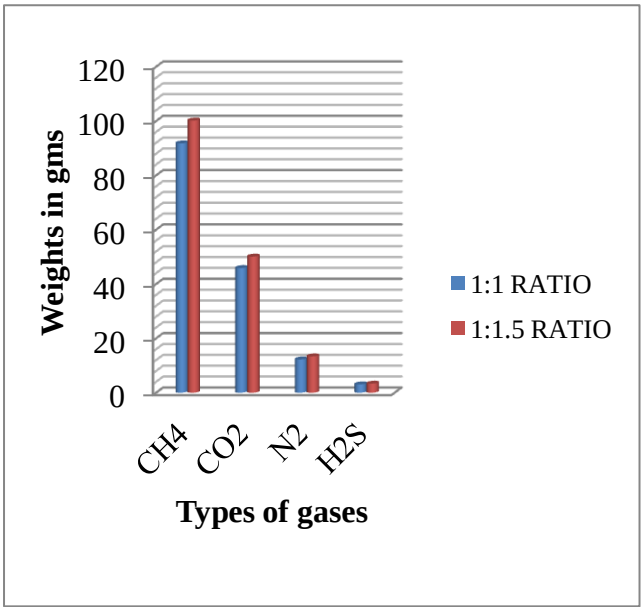


Fig 8: Gas quantification (Night soil waste)



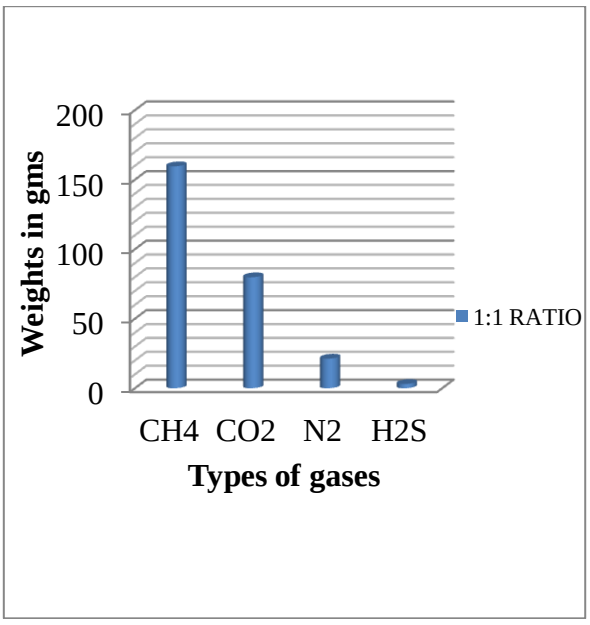


Fig 9: Gas quantification (Night soil + Food waste)

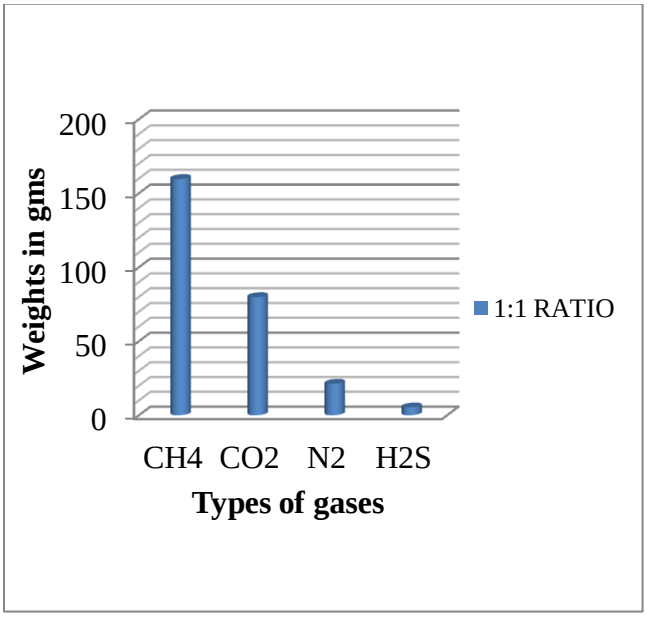


Fig 10: Gas quantification (Night soil + Vegetable waste)

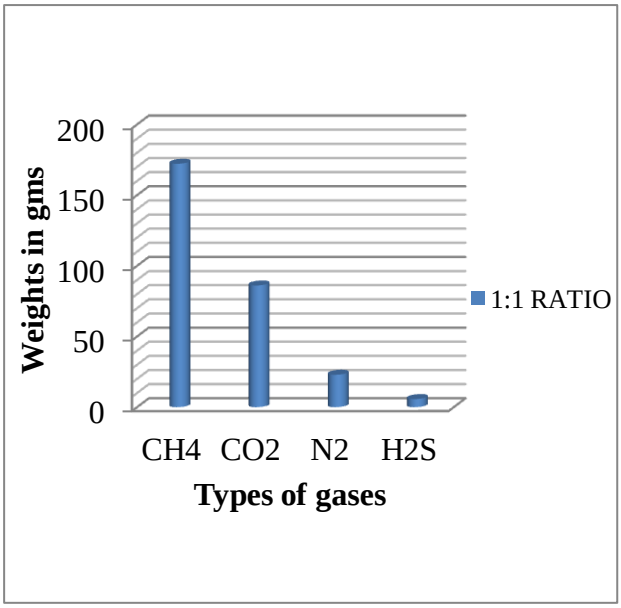


Fig 11: Gas quantification (Night soil + Food waste + Vegetable waste)

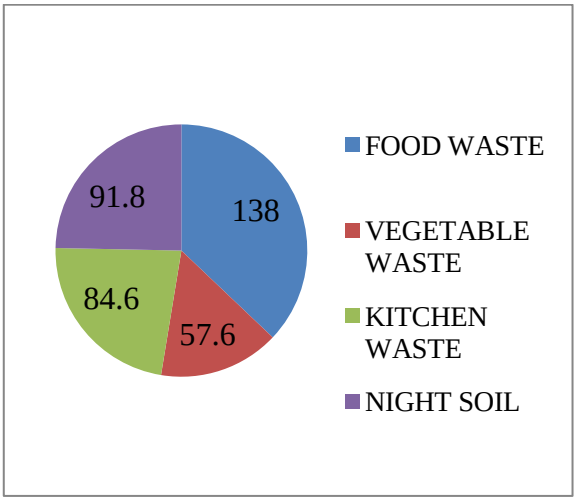


Fig 12: CH_4 Comparison (1:1 Ratio)

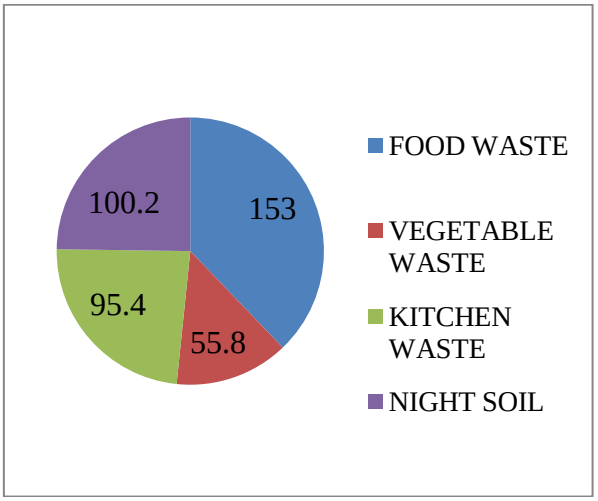


Fig 13: CH_4 Comparison (1:1.5Ratios)

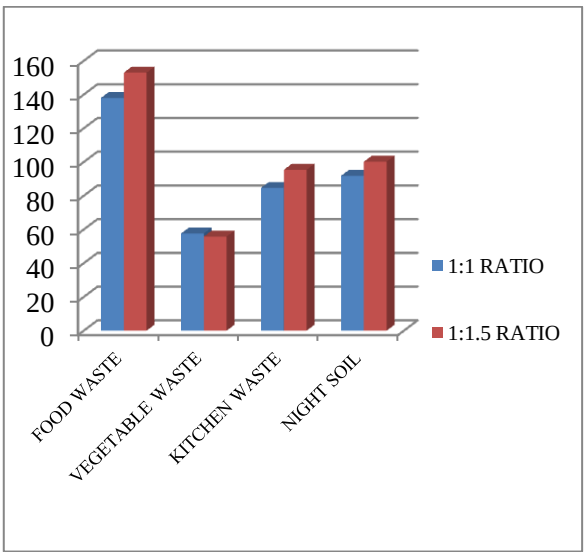


Fig 14: CH_4 Comparison (1:1 and 1:1.5 Ratio)

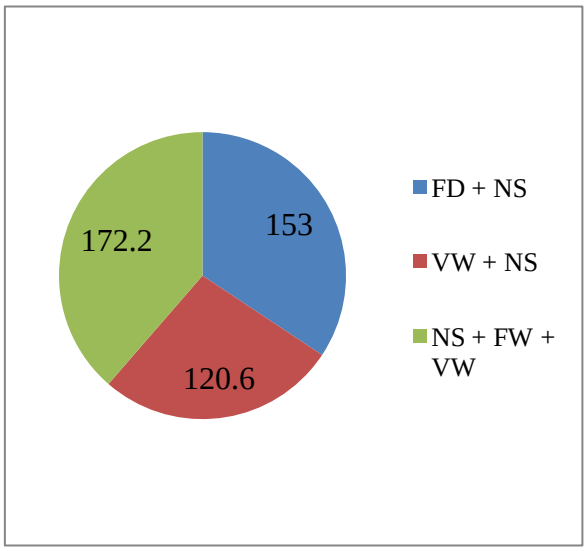


Fig 15: CH_4 Values for Combined wastes

4 DISCUSSIONS

The biodegradable waste is characterized in physically and chemically. Although the waste are produced the gases of CH_4, N_2, O_2, H_2S at the process of decomposition. In decomposition process 1:1 ratio for the food waste is produced the maximum quantity of gas was 138 gms compare to the other waste. Because the presence of microbes level is high while decomposition process. Following that the chemical characteristics of food waste will change while the decomposition period.

The maximum quantity of CO_2 was formed in food waste is 69 gms at the percentage of 30% from the CH_4 level.N_2 and H_2S gases are slightly moderate from the CH_4 and CO_2values.At the same time the night soil waste formed the CH_4 gas was 91.8gms of 10 days decomposition period.In night soil presence of microbes are less than the food waste microbes.thats why the gas quantity shall be change in decomposition process. For the total quantity of gases are formed in night soil waste is 153 gms.

The CO_2 gas formed from the night soil is 45 to 9 gms at 10 days time period. But the value is low compare to the food waste.In combined waste (food waste, nightsoil, and vegetable waste) are to be feed into the digester.

Food waste and night soil waste are developing the 159.6 gms of CH_4gas. Here the chemical characteristic of combined waste should be change withinan hour of decomposition process.The microorganisms are developed at the period of 4 to 6 hours after feeding the wastes into the digester.so that the CH_4 value is high. Compare to other separate wastes.The CO_2 level is 30% is high compare to the food waste CO_2 level .following that the quantity of gas formation is high. While adding the some more waste together.

The waste of food waste of food waste, nightsoil, vegetable waste combinely feed into the digestion and kept at 10 days decomposition process. Its create the 287 gms of gas from the overall wastes .in this case the value of CH_4 is 172.2gms.this value is high compare to any other waste separate or combined waste.

Vegetable are start to decompose at 1hr feeding period. The CH_4 value is 60 to 80% is high compare to the other wastes.it should be suitable for the other gas production process by using biodegradable waste.

In combined waste are met gas forming wastes at process of decomposition.it using a combined wastes in gas production (or) any other bioprocess means it will produce the gases 55% to 75%.Compare to the other waste also night soil. The solid waste should be suitable for the biomethanation process and food waste also. The ratios are described the quantity of wastes feed into the digester for that 1:1 ratio is more suitable for biomethanation process compare to the 1:1.5 ratio.

Because 1:1.5 ratios is generate the 0 to 5% of gas high. Compare to 1:1 ratio but the last 3 to 4 days the decomposition process will delay due to presents by water in the digester.so that for the water, the night soil (liquid) is more suitable for the decomposition process while adding a waste to the digester.

5 CONCLUSIONS

Physical and chemical characteristics of food waste, vegetable waste, kitchen waste, night soil are analyzed. The maximum quantity of CH_4 gas(230gms) produced from the food waste at the period of 0-10 day's decomposition in (1:1) ratio. The gas production of food waste is 255gms in 0-10 days for decomposition of (1:1.5) ratio. The gas production of vegetable waste is 96gms in 0-10 days for decomposition of (1:1) ratio. The gas production of vegetable waste is 93gms in 0-10 days for decomposition of (1:1.5) ratio. The maximum quantity of CH_4 gas(141gms) produced from the kitchen waste at the period of 0-10 day's decomposition in (1:1) ratio. The gas production of kitchen waste is 159gms in 0-10 days for decomposition of (1:1.5) ratio. The maximum quantity of CH_4 gas(153gms) produced from the Night soil at the period of 0-10 day's decomposition in (1:1) ratio. The gas production of Night soil is 167gms in 0-10 days for decomposition of (1:1.5) ratio. The H_2S gas was formed in the waste of food waste in a period of 10 days decomposition in 1:1 ratio was 4.6gms. The maximum quantity of Co_2 gas(28.8gms) produced from the vegetable waste at the period of 0-10 day's decomposition in (1:1) ratio. In combined waste (vegetable waste, night soil waste and food waste) the maximum CH4 gas was produced at 172.2gms.

REFERENCES

1. Benjamin TernengeAbur, Emmanuel EnomenaOguche "Characterization of Municipal Solid Waste in the Federal Capital Abuja, Nigeria" Global journals, vol 14, issue 2, year 2014.
2. M. B. Oumarou, M. Dauda, "Characterization and Generation of Municipal Solid Waste in North Central Nigeria" International journal of modern engineering research, vol 2, issue 5, sep-oct 2012.

3. Adjei, S.M., Municipal solid waste minimization through household waste segregation in Bantama, Kumasi. A thesis submitted to the Department of Environmental Science, Kwame Nkrumah University of Science and Technology, Kumasi, in partial fulfilment of the requirement for the award of Master degree in Environmental Science. 2013
4. American Society for Testing and Materials, 2008. Standard test method for determination of the composition of unprocessed municipal solid waste, In: ASTM D5231-92-2008, US.
5. Habib Fathi, AbdolhossinpariZangane, HamedFathi, hosseinmoradi "Municipal solid waste characterization and it is assessment for potential compost production: A case study in Zanjan city, Iran" American journal of agriculture and forestry, 2014, 2(2), 39-44.
6. Manohara B, BelagaliS.L."Characterization of Essential Nutrients and Heavy Metals during Municipal Solid Waste Composting" International journal of innovative research in science, engineering and technology, vol 3, issue 2, Feb 2014.
7. P. B. Vyas "Assessment of municipal solid waste compost Characterization and compliance" Jr. of Industrial Pollution Control 27(1)(2011) pp 87-91.
8. Rajesh Babu Katiyar1, S. Suresh1, A. K. Sharma "Characterisation of Municipal Solid Waste Generated by the City of Bhopal, India" International journal of chem. Tech research, vol 5, No.2, pg 623-628.

