

# ANALYZING THE MUNICIPAL SOLID WASTE MANAGEMENT SYSTEM FOR ALIGARH

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**Abstract** - Due to rapid increase in the population over the last few decades, urbanization, industrial growth and rising in the living standards. The rate of generation of municipal solid waste in Indian cities and towns have also accelerated. In India, the urban local bodies popularly known as the municipal councils are responsible for management of activities related to public health. The bodies are doing their best but are not able to achieve the desired target. We find variety of waste leading the city to more unhygienic and haphazard growth of urban area particularly in the last 20 years. Municipal solid waste is a part of solid waste, and the waste that arises from human and animal activities are solid so it is discarded as useless/unwanted. The purpose of this study is to identify the various types of municipal waste and their sources. The sole purpose of this study is:

- To examine the physical and chemical composition of the municipal waste.
- To consider in general terms, the elements involved in the management of waste.
- Engineering aspects in the management of municipal solid waste.
- Reuse and recovery of the material from the municipal solid waste.

There should be sustainable waste management strategies which are lagging behind. Present working model is PPP (public private partnership) to sustain the waste management so that the city appears cleaner and more hygienic. The paper aims to study the quantity and properties of municipal solid waste generated in municipality of Aligarh, Uttar Pradesh, India.

The MSW generated is heterogeneous; composition of waste varies from place to place. Study was conducted during year 2018-2019, 2019-2020 of study period at seven different zones in Aligarh. The study and suggestions take place on the information collected to improve current MSW scenario in Aligarh. The study shows that the average solid waste produced by Aligarh is 460 metric tons per day with per capita generation equals to 400 - 450 grams/day.

## 1. INTRODUCTION

Aligarh is located in the northern Indian. It lies 126 miles (203km) northwest of Kanpur and is approximately 90 miles (140km) southwest of state Uttar Pradesh. Aligarh is one of the most populous cities of Uttar Pradesh and is 55th largest city in India. The city is an agricultural trade center. The Aligarh is the famous business center of Uttar Pradesh and is most famous for its lock industries.

The study has been conducted in two parts in first part it includes the calculation of amount of solid waste generated from seven zones of Aligarh. In the second part it includes the study of properties of waste generated.

The quantity of waste increasing & causing a critical situation in Aligarh as well as all over the country due to rapid population growth and urbanization. The growth rate was seen in the last decade tends to 17.6% (Census of India 2011) while population growth rate of Aligarh city (22.78%). The issue is aggravating in urban due to increase in population and the economic growth that encourages the people for the consumption of goods, and it results in the waste generation. This causes the worst situation for coming generation.

To keep the country clean and maintain healthy quality of life of the citizens is an obligatory duty of the municipal authority of India, almost in all the cities/towns due to lack of consideration solid waste that results into heaps & waste littered on the road side. The amount of organic matter in solid waste in developing countries like India is very high than that of developed countries. Within India, Uttar Pradesh is the most populous state. The state is having five cities above one million populations, among which Aligarh is the one.

If the available area for treatment of solid waste is vast enough and the population is less, then safe disposal of solid waste for the town/city shall not be a big problem. Majorly in developing countries the generation of solid waste is larger as compared to the developed nations. To reduce and minimize the ill effects of solid waste on society/town/city precise governing laws & techniques need to be in place.

## 2. SOURCES & DIFFERENT TYPES OF WASTE

According to the sources and their harmful outcomes the strong waste are divided into certain group. The technology of stable waste fluctuates from where it's far generated. Some incorporate high quantity of degradable material while some incorporate non-bio- degradable and poisonous in nature. Following are the kinds and supply of stable waste:

### 2.1 Municipal Waste or Domestic Waste

They may be defined as the wastes that are generated from residential household activities or any industrial sites. The

commercial site consists of the market of any domestic use and vegetables shops, general shops, and so forth. Some of the types of municipal solid waste are as follows:

- Food waste - These wastes generally includes cooking waste, rotten vegies, residue, garbage waste and so on.
- Rubbish - It includes papers, rubber, plastics, metal can, leather and many more.
- Construction & demolition waste – These type of waste is having in it construction waste items like aggregates, stone, bricks, metals and electrical parts.
- Special waste – These waste are the useless vehicles parts and dead animal.
- Waste generated through treatment plant - This type of waste contains solid and semi- solid materials which are taken out from the treatment plants.

In past years there has been no serious subject over the stable waste management which also consists of the strategies like incineration or right disposal in land. Human beings used to sell off the wastes on the roadsides of motorway and water bodies like ponds, rivers, seas, and many others. And this ends in creation of many air borne and water borne sicknesses which can be dangerous to each human beings and animals.

## 2.2 Industrial/Commercial Waste

The waste commonly generated from industries which can also incorporate toxic of chemical. They will be dangerous to humans and flora, regular industrial waste can also encompass the demolition and production waste, hazardous waste and special waste. The waste generated from this type of supply required special attention because it may cause disturbance to nature thereby creating the nuisance in the surroundings.

## 2.3 Biomedical/Hospital Wastes

They're essentially the waste generated from hospitals and consists of human waste, anatomical discard of both people and animals, expired capsules, tissue cultures discard, fluids from the body, human excreta, disposable syringes and many others.

These waste require special treatment before the disposal and if not dealt with it they're pretty infectious and cause severe problem to human health. The hospitals generate an estimated waste of 0.5 - 1kg per bed per day.

## 2.4 Hazardous/Dangerous Wastes

These are described as the waste generated from industries that are not easily disposable before treating it well and poses instant hazard that may harm human beings when contacted directly without any primary treatment. These basically poses following characteristics:

- Toxicity
- Highly reactive
- Corrosively
- Ignitability

The risky hazardous waste is grouped into radioactive materials, chemical substances, organic waste, explosives, and many others. The primary sources of these dangerous waste are from hospitals, chemical industries and research facilities.

## 2.5 Non-Manageable disposal

Normally used and practiced all throughout the country. It is disposal of the solid waste without necessary checking and treating it directly at the landfill sites. Many disease causing pathogens and mosquitoes breed on landfill site are generated and in the end ensuing in the human health of the surrounding area.

## 2.6 Sanitary solid waste

This is the controlled and revised dumping of solid waste. It essentially decreases the breeding of fly and mosquitoes due to the fact that the waste before dumping has been engineered and treated before the very last disposal at the dumping site. It's so far one of the majorly used approach of the solid waste management.

## 2.7 Composting of the waste

When the moisture content or the temperature of a solid waste are in favorable condition for the breeding of decomposing micro-organism then, the micro-organism promotes the decomposition of waste. It may be termed as biological process since the decomposition is through living organism. The composting of waste shall be done from the residential level or begin initiation from the household level. The very last compost product has excessive nutrient value and can be used for agriculture needs.

## 2.8 Incineration of Waste

In this procedure the combustible solid waste materials are burnt at the temperature ranging from 800-10000°C for burning and the end products are generally ash and very less non-combustible product remaining for the very last disposal.

**2.9 Pyrolysis**

It is the technique used to extract any chemical constituent or chemical energy from the solid waste by utilizing the method of detrimental distillation. This can be said similar to Incineration, but the working temperature of that is very low around 450°C.

**2.10 Plasma-Gasification**

This technique of gasification of plasma is another method of management of waste. The plasma is charged electrically initially and it should have to be highly ionized gas. Lighting is one form of plasma that produces temperature which exceeds 12,610 °F. In this method of waste disposal, there is a vessel which uses characteristic of plasma torches operating at a temperature of +10,050 °F that is producing a gasification zone up to 3,000 °F for converting the solid or liquid wastes into a gaseous form. In this type of treatment, the molecular bonds of waste material are broken down because of the heat that is generated within the elemental components and vessel. Hence, due to this procedure the hazardous waste is destructed effortlessly. This form of waste disposal results in providing renewable energy and a variety of different incredible benefits.

**2.11 Vermicomposting of Solid Waste**

In this the waste that are normally generated from the domestic and industrial sites or the municipal waste which contain very high value of organic and vermicomposting is another technique of managing the solid waste. The worms present in the waste survive through ingesting the organic material present inside the waste and in then produces manure that is rich in nutrient content.

**3. APPLICATION OF THE REUSE AND RECYCLE METHOD**

The segregation of solid waste is very necessary in order to achieve the reuse & recycling of solid waste. It can be identified through segregation that; which product can be reused or recycled back again. If the solid waste materials are reused again the solid waste dump will be minimized accordingly and also there will be a gradual rise in the economic growth of the city/town. The four R's stand for Refuse, Reuse, Recycle and Reduce plays an important role and are described as follows:

**3.1 Refuse**

It is defined by using solid waste which were earlier available without targeting the new one or may be buying the new product of same kind.

**3.2 Reuse**

This can be defined as using the discarded material; like soft drink can which is generally used for making pencil or pen stand. By this the increasing solid waste generation shall be minimized.

**3.3 Recycle**

The recycling of solid waste is one of the most used method for minimizing the waste generation. Some materials that can be recycled back are used papers & glasses etc.

**3.4 Reduce**

The application which has the reduction of unwanted solid waste from the source of generation is taken into consideration.

**3.5 Parameters Used for Collecting MSW**

- Collecting municipal solid wastes
- Segregating municipal solid wastes
- Storing municipal solid wastes
- Transporting municipal solid wastes
- Refinement of municipal solid wastes
- Disposing the municipal solid wastes

**Table-3.1 Status of Land for Disposal of MSW Aligarh City**

Municipal Committee	Class of M.C.	Population of City	Solid waste generated	Area of existing landfill	Age of land development of land site
M.C, Aligarh	A	7,60,000	450 TPD	3 Acres (low lying land near DAV College (closed))	4 year

**Table-3.2 Generation of Solid Waste in Aligarh City**

Substances	Content	Generation sources
Garbage	Cooking food and domestic discard and useless vegetables	Residential, Hotel, motel, etc.
Rubbish	Markets refuse rags, cloth, rubber leather.	Departmental store, shopping mall, market, etc.
Ashes	Residue form	Burning of combustible material
Heavy waste	Auto parts, tyre, etc.	Automobile workshops
Road-side refuses	Dust and dirt	Destructive road and sweeping
Hazard	Hazardous harmful chemical	Chemical industries and hospital waste

**3.6 Waste Generation Source based on Land Category**

- Residential zone (Households): 85%
- Industrial zone: 11%
- Small factories & big factories: 1350 (approx.)
- Trading units: >230 nos.
- Commercial shop: 3310
- Hospitals & clinics (private sector): > 45
- Health care centers: 12

**Table-3.3 Municipal Solid Waste Characteristics on Seasonal Basis Collected During April 2018 To March 2020**

S. No.	Study Period	Sampling seasons	Moisture Content (%)	pH	C: N Ratio	Phosphorus (P <sub>2</sub> O <sub>5</sub> ) (%)	Potassium as K <sub>2</sub> O (%)
1	April-March 2018	Winter	24.5	7.9	24.36	1.86	1.16
		Summer	17.18	7.6	16.51	0.65	0.94
		Monsoon	40.36	8.2	18.2	1.21	0.87
2	April- March 2019	Winter	25.89	7.5	25.64	1.91	0.91
		Summer	18.07	8.8	15.14	0.86	0.78
		Monsoon	42.75	7.9	17.98	1.56	0.86
3	April- March 2020	Winter	25.89	7.9	25.98	1.68	1.26
		Summer	18.70	7.6	15.5	0.66	0.97
		Monsoon	42.58	8.6	18.67	1.56	0.86

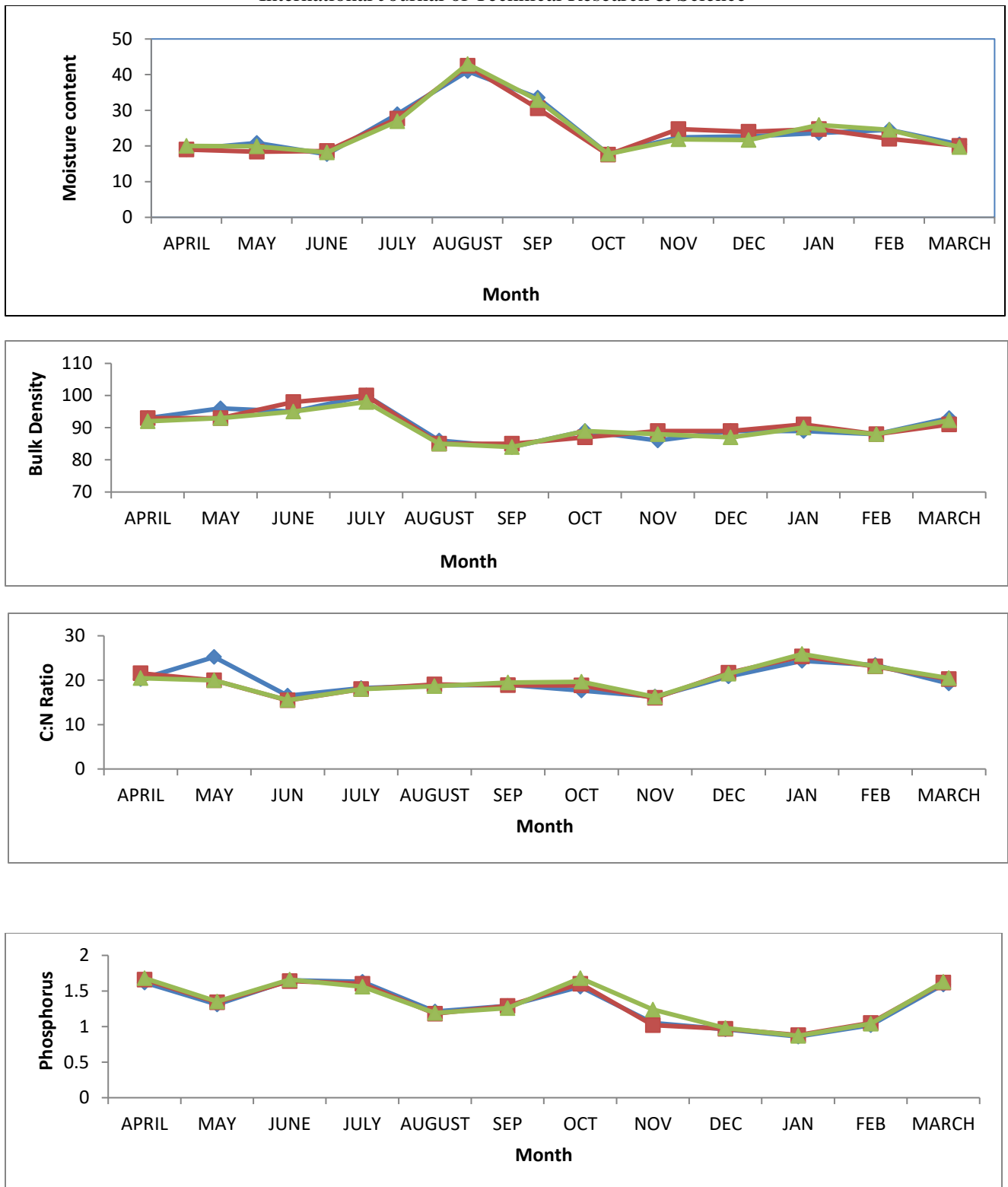


Fig. 3.1 the Seasonal Variations in Properties

#### 4. RESULT AND DISUSSION

The different sources from several distant locations generate different type of municipal solid waste. No. of systematic & continuous analysis of municipal solid waste by Aligarh municipal corporation has done so far. The average generation rate of two years is shown in TABLE [1]. As per the study the amount of waste generation by Aligarh city is 460MT per day out of which approximately only 240MT per day waste is collected each day.

The different experiments have been carried out to analyze properties of municipal solid waste seasonally and results are shown in table [3]

#### 4.1 Moisture Content

Maximum moisture content was found to be 40.36%, 42.75% ,42.98% during the monsoon season and maximum moisture content were 17.18%, 18.07%, 18.70% during summer season.

The amount of moisture content in the city waste is higher which determines that waste is higher viable for composting or anaerobic digestion rather than that of combustion, sometimes high moisture content may cause the problems in handling.

#### 4.2 C:N Ratio

**Carbon-to-Nitrogen ratio** is ratio of the mass of carbon to the mass of nitrogen in a substance. The maximum value of C:N were found 25.98% in winter while as minimum was 15.14 % in the month of summer. There should be C/N ratio of 30-35:1 for microbial activity while higher ratio will result in slower composting rates. The microbial communities utilizing the sinking organic carbon as an energy source are partial to nitrogen-rich compounds because much of these bacteria are nitrogen-limited and much prefer it over carbon.

#### 4.3 Phosphorus

Maximum values of phosphorus content during winter season were 1.91% and minimum 0.65% in summer season. A large fraction of the phosphorus in manure is considered to be plant available immediately after application.

#### 4.4 Potassium

Maximum values of potassium content during winter season were found to be 1.26% and minimum 0.78% in summer. The action of potassium in plants is not like that of N; rather than it plays a backstage role in nearly every phase of crop production.

### CONCLUSION

The study of solid waste generated from the seven zones is collected from the disposal site conclude that the parameters of waste like pH, moisture content, C:N ratio, P and K are found in the optimum range. It also had concluded that the solid waste (municipal) generated from the city Aligarh (7 zones) are favorable for the application of composting technique and can be reuse again. Study also reflects that solid waste can also be reuse in organic farming which is also the present need of the era C:N ratio, Phosphorus present in effective range. The Aligarh city waste contains slaughter houses waste which is having an average organic and inorganic content 81.79 – 2.56% and 18.23 - 2.63% dry basis, respectively and manure that are formed for agricultural purposes contained lignin, cellulose, hemicelluloses, and total lingo cellulosic materials were 22.37 - 14.43%, 45.77 - 10.96%, 19.64 - 10.50%, and 81.29 - 11.68%, respectively.

It was founded that with every addition of year the solid waste generation is also increasing and that is proportional to the population also. Observing the previous trend there has been an increase of solid waste generation by 11% for each five years which is an extreme problem and require immediate attention from all of the facets which includes the general public, stakeholders, NGOs, politicians and businessmen. Also, the recommendation of proposing a new landfill site has been achieved by coming across a waste land location wherein it shall be far from residential and academic establishments.

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