



Analysis of Municipal Solid Waste Management in 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 generation rate of municipal solid waste in Indian cities and town 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 which arising from human and animal activities that are normally solid and are discarded as useless or unwanted. The purpose of this study is to identify the various types of municipal waste and their sources. 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 more clean and 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 place to place. Study was conducted during year 2016-2017, 2018-2019 of study period at seven different zones in Aligarh. The study and suggestions takes place on the information collected to improve current MSW scenario in Aligarh. The study shows that the average solid waste produced by Aligarh 460 metric tones per day with per capita generation equals to 400 -450 grams/day.

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 city 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.

Study 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, in which Aligarh is one of the city.

The safe disposal of solid wastes of a particular society is not a big problem, if the population is less and the area available for treating the solid waste is vast. Mostly the developing countries are the one which generate larger solid waste as compare to developed nations. It required good governing laws and techniques to reduce the ill effects of solid waste in a society

In past years there was no serious concern over the solid waste management which also includes the techniques like incineration or proper disposal in land. People used to dump the wastes on the roadsides of highway and water bodies like ponds, rivers, seas, etc. And this leads to creation of many air borne and water borne diseases which are harmful to both humans and animals.

TYPES AND SOURCE OF SOLID WASTE

According to the sources and their harmful effects the solid waste are divided into certain group. The generation of solid waste are differ from where it is generated. Some content high amount of degradable material whereas some content non-bio- degradable and toxic in nature. Following are the types and source of solid waste:

MUNICIPAL SOLIDWASTE OR DOMESTIC/RESIDENTIAL WASTE

They can be defined as the wastes which are generated from residential household activities or any commercial sites. The commercial site consists of the market of any domestic uses and vegetables stores, shops, etc. Some of the components of municipal waste are as follows:

- *Food waste- Which generally includes the cooking waste, rotten vegetables, residue, garbage, etc.
- *Rubbish-It consists of papers, plastics, rubber, leather, metal can, etc.
- *Construction and demolition waste- which consists of construction waste like stone, aggregates, bricks, electrical parts and metals.
- *Special waste- They are the dead animal or useless vehicles.
- *Waste generated from treatment plant-which consist of solid and semi- solid materials taken out from waste water treatment plan.

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INDUSTRIAL WASTE

Waste usually generated from industries which may content toxic of chemical. They may be harmful to humans and plants. Typical industrial waste may include the demolition and construction waste, special wastes and hazardous waste. The waste generated from this kind of source required special attention because it may led to disturbance to nature thereby disturbing the environment creating nuisance.

BIOMEDICAL WASTES

They are basically the waste generated from hospitals and includes human waste, anatomical discard of both humans and animals, expired drugs, tissue cultures discard, fluids from the body, human excreta, disposable syringes, etc.

They required special treatment before disposal and if not treated well they are highly infectious and cause serious problem to human health. Estimated waste generated from hospital is 0.5-1kg per bed per day.

HAZARDOUS WASTES

They can be define as the waste generated from any industries which are not easily disposable before treating properly and poses instant danger which can harm human when contacted directly. The basically poses the following characteristics:

*Toxicity

*Highly reactive

*Corrosively

*Ignitability

Before the hazardous waste were grouped into radioactive substances, chemicals, biological waste, explosive, etc. The main sources of hazardous waste are from hospitals, chemical industries and research facilities.

Non-control disposal

Generally used and practice throughout the country. It is the disposal of the solid waste without proper checking or treating directly towards the landfill. Many disease causing pathogens and mosquitoes breeding ground are generated and ultimately resulting in the human health of the particular area.

Sanitary landfill of solid waste

This is the control and revised dumping of solid waste. Itt basically reduces the breeding of fly and mosquitoes because the waste before dumping was engineered and treated before the final disposal on the dumping site. It is one of the most commonly used method of the solid waste management.

Composting of the waste

When the temperature or the moisture content of a solid waste are set in a favorable condition for the breed of decomposing bacteria then, the micro-organism helps in decomposition of the waste. It can be term as biological process because the decomposition is done by living organism. The composting of solid can be done from the residential or start initiating from the household level. The final compost material have high nutrient value a can be used for agriculture needs.

Waste Incineration

The solid waste materials which are combustible in nature are burnt in this process. The temperature rises from 800-11000°C for burning and the end product are usually the ash and some non-combustible material for the final disposal.

Pyrolysis

It is the method used to recover any chemical constituent or chemical energy from the solid waste material by using the technique of destructive distillation. They are somewhat similar with the Incineration but they work in low temperature which is around 450°C.

Plasma gasification

Gasification of plasma is alternative method of management of waste. The plasma are charged electrically at initial stage or they should be highly ionized gas. Lighting is one type of plasma which produces temperatures that exceed 12,610 °F . With this method of waste disposal, a vessel uses characteristic plasma torches operating at

+10,050 °F which is creating a gasification zone till 3,000 °F for the conversion of solid or liquid wastes into a syngas. In this kind of treatment the molecular bonds of the waste are broken down due to the heat generated in the elemental components and the vessel. Because of this process dangerous waste can be destructed easily. This form of waste disposal provides renewable energy and an assortment of other fantastic benefits.

Vermicomposting of the MSW

The waste which are usually generated from the domestic as well as commercial sites or the municipal solid waste content high value of organic and vermicomposting is an alternative method for composting the waste. Here the worms are survive by eating the organic matter present in the waste and in return produces manure which are very rich in nutrient content.

Application of the Reuse and Recycle method

In order to achieve this goal segregation is very must necessary in order to identify the product which can be reuse or recycle back again. If the material can be reuse again then there will be raise in economic growth and most importantly the solid waste will be minimize accordingly. The application of the four R's that is Refuse, Reuse, Recycle and Reduce plays an important role in the waste management.

Refuse- It can be defined as using which are available from before without targeting the new one or buying new product of the same kind.

Reuse –It can be term as using the discarded material like can of soft drink for making pencil or pen stand. This will minimize the increase in solid waste generation

Recycle- One of the most commonly used method for minimizing the waste generation. Here the recyclable material are collected and recycle back for using again. Materials which can be recycle back are paper, glasses, etc.

Reduce- It can be defined as the reduction of unwanted solid waste from the source of generation

PARAMETERS USE FOR COLLECTION OF MSW

- 1) Collection of municipal solid wastes
- 2) Segregation of municipal solid wastes
- 3) Storage of municipal solid wastes
- 4) Transportation of municipal solid wastes
- 5) Processing of municipal solid wastes
- 6) Disposal of municipal solid wastes

TABLE-1 STATUS OF LAND FOR DISPOSAL OF MSW ALIGRAH CITY

Name of Municipal Committee	Class of the M. C.	Population of the Town /City	Quantity of Solid waste generated	Area of existing landfill	Age of land development of lan site
Municipal Corporation , Aligrah	A	7,60,000	450 TPD	(i) 2 Acres (low lying land near (ii) Near DAV College (closed) (iii) Vill. Waryana approx. 14 acres almost full	3 year

S.No	Month	Year (2016-2017)	Year (2017-2018)
1	April	9368.93	9268.82
2	May	9517.68	9367.23
3	June	9232.9	9329.55
4	July	9746.28	9336.25
5	August	9821.45	9308.2
6	September	9639.7	9328.31
7	October	9833.64	9312.97
8	November	9771.06	9302.09
9	December	9881.8	9371.09
10	January	9915.58	9495.77
11	February	9934.66	9399.05
12	March	9970.33	9315.6

TABLE -2 GENERATION OF SOLID WASTE IN ALIGRAH CITY

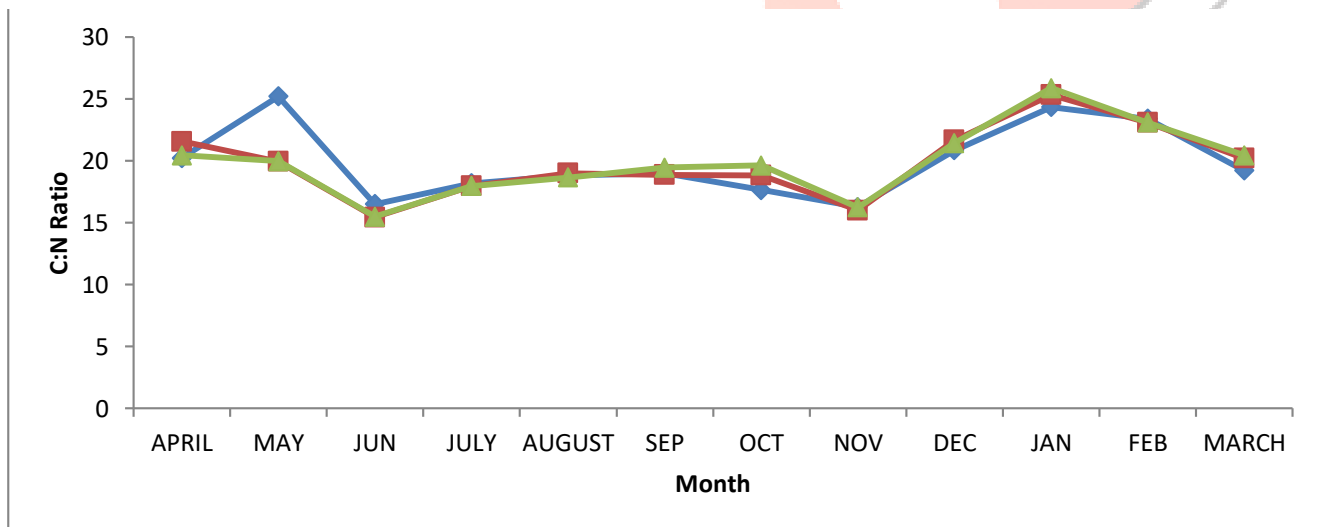
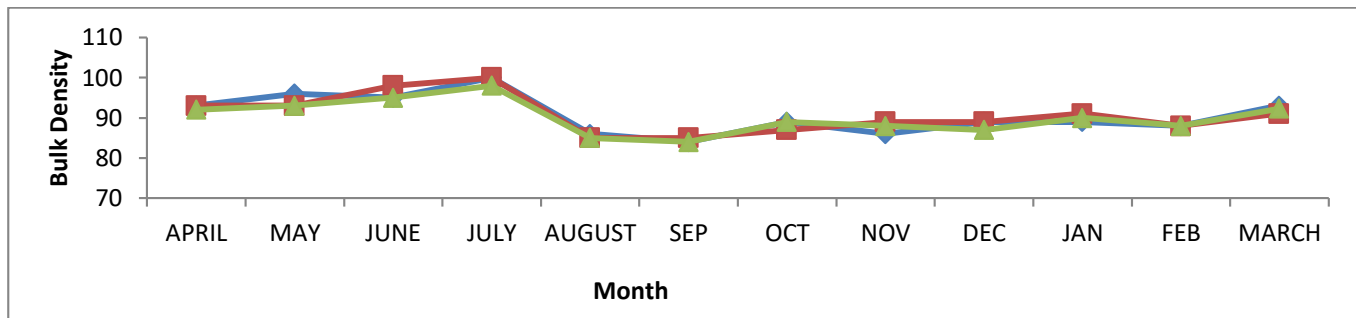
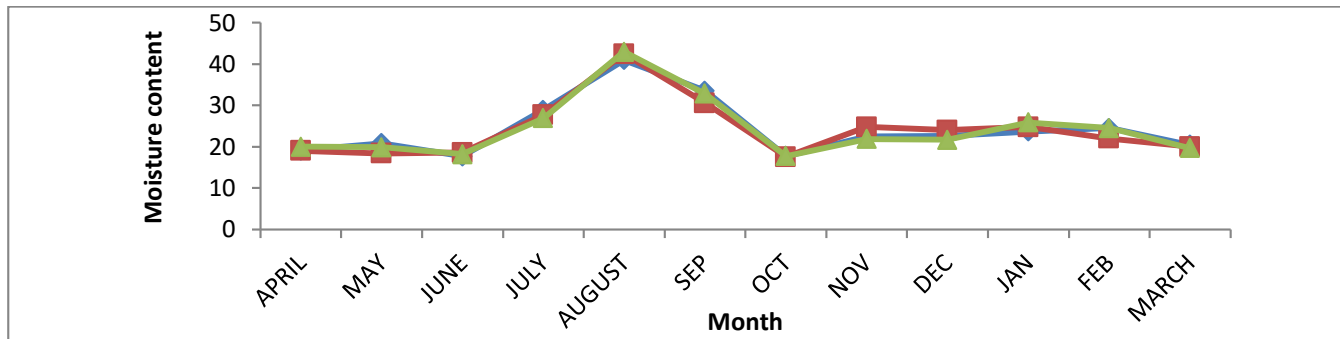
Substances	Content	Generation sources
Garbage	cooking food and domestic discard and useless vegetables	Residential, Hotel, motel, etc.
Rubbish	Markets refuse rags, cloth, rubber leather	Departmental store, shopping mall, market, etc.
Ashes	Residue form	Burning of combustible material Automobile workshops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

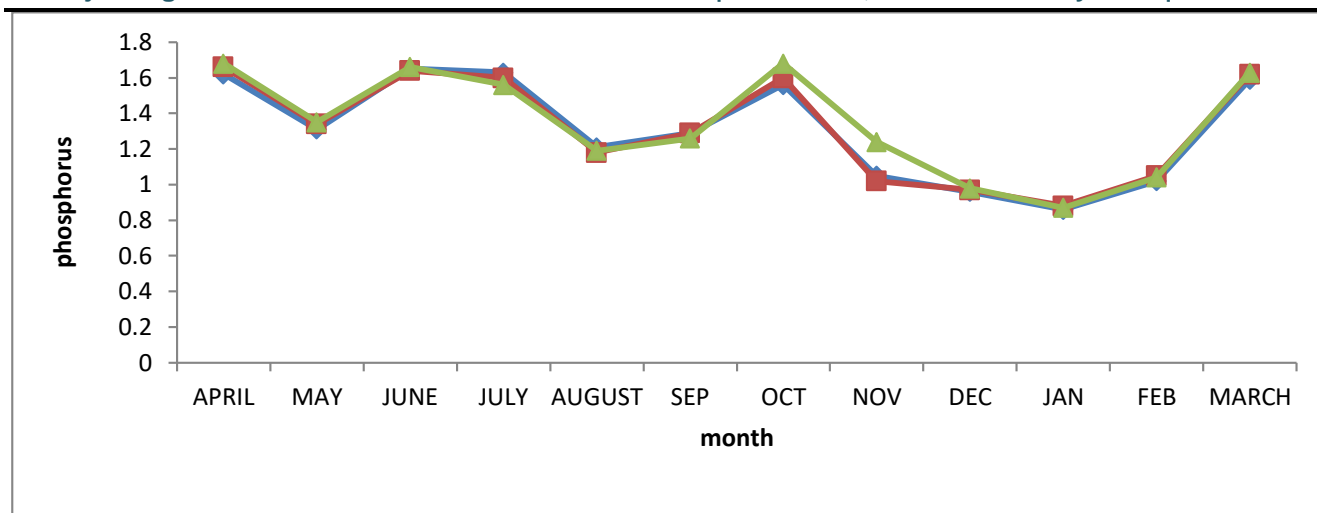
TABLE-3 WASTE GENERATION SOURCE

- i. Residential household zone-86%
- ii. Industrial area-10%
- iii. Small and big factories-1200(approx.)
- iv. Trading unit-more than 230 in nos.
- v. Commercial shops-3200
- vi. Hospital and clinic of private sector-more than 45
- vii. Health care centre in the area-11

S. No.	Study Period	Sampling seasons	Moisture Content (%)	pH	C:N Ratio	Phosphorus (P ₂ O ₅) (%)	Potassium as K ₂ O (%)
1	April-March 2016	Winter	24.5	7.9	24.36	0.86	1.06
		Summer	17.68	7.6	16.51	1.65	0.94
		Monsoon	40.96	8.2	18.2	1.21	0.87
2	April- March 2017	Winter	18.57	7.5	15.14	1.26	0.91
		Summer	42.45	8.8	17.98	1.9	0.9
		Monsoon	25.89	7.9	25.98	0.86	0.86
3	April- March 2018	Winter	25.89	7.9	25.98	0.86	0.86
		Summer	18.2	7.6	15.5	1.66	1.68
		Monsoon	42.98	8.6	18.67	1.6	0.86

TABLE 4: MUNICIPAL SOLID WASTE CHARACTERISTICS ON SEASONAL BASIS COLLECTED DURING APRIL 2016 TO MARCH 2018





FIGURES: SHOWS THE SEASONAL VARIATIONS IN PROPERTIES

RESULT AND DISUSSION

The different sources from several distant location 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 below in table [2]

MOISTURE CONTENT:

Maximum moisture content were found to be 40.96% , 42.45% ,42.98% during the monsoon season and maximum moisture content were 17.68%, 18.57%, 18.2% during summer season, study period of April to March (2013, 2014 , 2015).

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 causes the problems in handling.

BULK DENSITY:

The value of bulk density varies from 85% to 119% during April 2013 to March 2015. There is little or no uniformity in the solid waste bulk density have been reported. Frequently, no distinction has been made between un compacted or compacted specific weights.

The bulk density data need to assess the total mass and volume of waste that must be managed (transported , disposed , processed). Some typical bulk density data: (residential yard waste varies from 50 to 650lb/yd³) while Construction & demolition waste varies (1685 to 3035 lb/yd³).

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 21.68% in winter while as minimum was 15.4 % 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 bacterium are nitrogen-limited and much prefer it over carbon.

PHOSPHORUS:

Maximum values during winter season of 2013 of phosphorus content were 1.68% and minimum 0.86% in summer season (2015). A large fraction of the phosphorus in manure is considered to be plant available immediately after application.

POTASSIUM:

Maximum values during winter season of 2013 of potassium content were found to be 1.06% and minimum 0.9% in summer (2015) . 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 also contains slaughter houses waste which having average organic and inorganic content 82.94-2.68% and 18.06-2.78% dry basis, respectively and manure that are formed for agricultural purposes contained lignin, cellulose, hemicelluloses, and total lingo cellulosic materials were 22.67-14.13%, 45.57-10.76%, 19.94-10.80%, and 81.49-11.88%, respectively. We found out that for every addition of year the generation of solid waste increases and it is proportional to the population too. By seeing and observing the past trend there is 11% increase of solid waste for every 5 years which is a serious concerns and required immediate focus from all the sides which includes the general people, politician, stakeholders, NGOs and businessmen. The recommendation of introducing a Landfill also has

been done by discovering a waste land area in which it should be away from residential and educational institutions areas

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