

# Solid Waste Classification, Quantification and Management Practices in Lahore

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**Abstract**— the rates of Solid waste generation vary in various sectors of country. Waste is classified and sorted on the base of supply instead of kind. Currently, there aren't any standards or regulations for the assortment of solid waste and its disposal. In Pakistan 40-65% of solid waste is comprising bio degradable stuff. The study is about solid waste management in Lahore, the study represent work with Citizens Commission for Human Development (CCHD). CCHD is a non-governmental organization that provides social and environmental services like solid waste management, awareness and education to the people of city Lahore, Pakistan. The organization provides environmental services to over 70,000 residents in Johar Town, Township, and Model Town in Lahore. The study is about environmental protection, pollution prevention, reduction of solid waste from the environment and its proper disposal as well as awareness to the people about importance of cleaner environment and reducing the burden on environment.

**Index Terms**— Solid Waste, Management, Lahore

## 1 INTRODUCTION

**A**NTHROPOGENIC activities cause waste production, and so the waste managing ways like handling, storing, collection and disposal cause risks of atmospheric pollution and to community physical condition (Rathi, S. 2007). Effect of rapid population has on environment (Qasim, M. et al, 2014). Rapid increase in populations and industrial are major contributor to severe issues of solid waste management underdeveloped countries like Islamic Republic of Pakistan. The massive amount of waste produced requires a technical way of assortment, storage, transport of waste and waste disposal (Sharholly, M. et al 2008) Solid waste management could be a biggest challenge to every society of the country. Not solely it is futile in urban areas however equally in each a part of world (Hazra, T., & Goel, S. 2009) In urban center Pakistan, generation of Municipal solid waste, industrial waste, unsafe waste, medical specialty waste are increasing as a result of increase, modification in life vogue and economic development (Talyan, V 2008)

TABLE 1: Generation of Solid waste per day in tons from different 6 different towns of city Lahore in the year of 2013

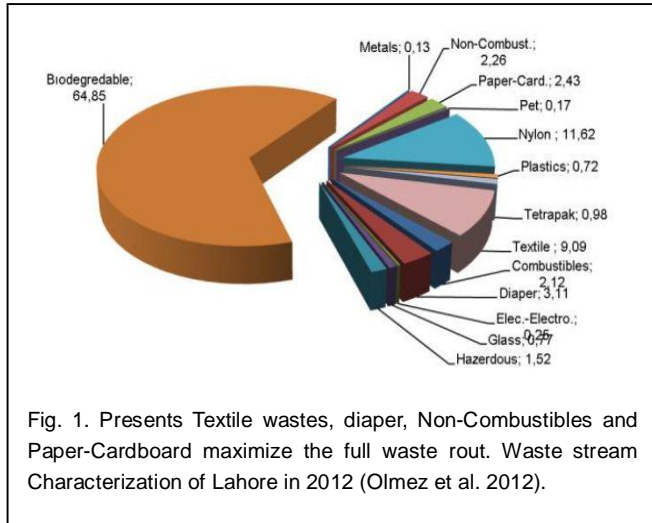
Towns	Populations (Millions)	Waste Generation (tons/day)	Area (Km <sup>2</sup> )
Allama Iqbal Town	1.00	710	513
Aziz Bhatti Town	0.69	485	68
Johar Town	1.00	702	30
Gulberg Town	0.80	563	43
Nishter Town	0.97	680	494
Ravi Town	1.04	727	31

### 1.1 Types and Composition of Waste

The rates of Solid waste generation vary in various sectors of country. Waste is classified and sorted on the base of supply instead of kind. Currently, there aren't any standards or regulations for the assortment of solid waste and its disposal. In Pakistan 40-65% of solid waste is comprising bio degradable stuff (Hafeez, M. S. 2013).

Generation of Solid waste per day in tons from different 6 different towns of city Lahore in the year of 2013 Waste embody necessary parts with over hr. of fragile, Nylon component is 12.3 %.

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Waste Production, Assortment and Treatment Methods  
Solid waste management comprises of different activities like assortment, transportation and disposal of solid waste (Baud, I. S. 2004). However, waste collected by firms and municipalities ranges from zero percent low-income solid waste is mainly collected by municipalities and waste collection efficiencies range from 0% in low-income areas and 0-90 % in high income areas (Bhutto, A. W et al 2012).

## 2 MATERIAL AND METHOD

The study was performed on the base of secondary data obtained from TMA and LDA Lahore. Dumping of waste has usually been acknowledged as the least encouraging treatment method. By combining it with incineration, it becomes the unique treatment methodology handling mixed household waste. In case of recycling, incineration is considered as the only sound treatment methodology for the waste that is not segregated. The calculated emissions of system are categorized using LCA methodology into the following types of environmental impact:

- NOx-emissions
- Acidification potential (AP)
- Eutrophication potential (EP)
- Global warming potential (GWP)
- Heavy metals

The environmental impacts and their consequences are also collected by financial prices for releases. These consequences depend on the approximations of willingness-to-pay from exclusive of eutrophication.

The solid waste management structure contains treatment of waste material and waste transportation. The yearly consumption of energy and economic means contained by the procedures square measure considered.

The revenue from energy is that the usage of many energy carriers similar to oil, coal and consequently the retrieval of heat, biogas, hydrogen and power from rubbish material. The economic revenue is defined as economical values for the procedures.

The cradle movement of materials in the structure is “waste inside the dustbin” from totally dissimilar sources, similar to domestic sectors and industries. So, the environmental and economic impacts of resources of waste excluded from the system considered. The solid waste moves square measure formerly monitored by the waste management system, astute e.g. composition changes and counting of emissions on the outcome of waste stream.

The waste collection was prepared from two assigned places. The minimum amount of waste 100kg was gathered one time in a month in one year, and the samples that were gathered were dehydrated to a persistent weight at  $103 \pm 5^\circ\text{C}$  and after that devastated to  $<0.5$  mm of size . The regular amounts or values were acknowledged to signify the mean solid waste composition in Lahore.

## 2.1 Analytical Measurements

The composition of elements (nitrogen and also the element of carbon) from the solid waste calculated by using the instrument of CE-440. The level of moisture was also calculated amongst the sample masses afore and one time heating by giving the temperature  $105^\circ\text{C}$  for 24h. The unstable solid and the contents of were measured from the division concerning the sample masses beforehand and one time heating at  $600^\circ\text{C}$  for 2h. The calorific value was calculated by using the “oxygen bomb calorimeter”. The average value of the 3 amounts was acknowledged as an outcome for greater calorific value or HCV (higher calorific value).

The LCV of moisture contents can be measured by equation

$$Q_{RCV} = \left[ Q_{HCV} \times \frac{100 - W}{100} \right] - 24.4 \times \left[ W + 9H_D \times \frac{100 - W}{100} \right]$$

Fig. 2. The LCV of moisture contents can be measured using by the succeeding equation. In the above equation W is for moisture level (%). 24 is the gasification heat constant for water (KJ/kg) and, HD is the hydrogen content of the dried sample (%).

## 3 RESULTS AND DISCUSSION

### 3.1 Study Area

The capital of Punjab Lahore covers the area of roughly estimated is 1773 square kilometer and the population of Lahore is about 8 million. It is located alongside the Ravi River and the borders of India .Moreover it is divided into nine metropolises for the management perceptions, like Samanabad town, Gulberg town, Iqbal town, Ravi, Data, Aziz Bhatti, Shalamar, Nishtar and Wahga town (Bai, X., et al 2010). Lahore is the center transport and is recognized for its businesses (Energy Sector Management Assistance Program, 2010).

The most blooming economy in Pakistan is of Lahore with (GDP of US\$43 billion), paying expressively to the nationwide GDP of US\$401 billion.

About 42% of employers are employed in sector of finance, social services and NGO’s, banking and real estate (Batool, S. A, 2008).

Waste quantity

The figures of increasing and generation of solid waste in Lahore is shown in Table 1. The inhabitants in Lahore were 13.45 million in the year of 2001 and 19.9 million in the year of

2011 with an average yearly growth of 3.38%. It has been estimated that population increased from 104.7 million in the year of 2000 to 182.9 million in the year of 2010, with an average yearly rise of 5.30 %, while GDP increased rapidly rather than the residents with an average increase 14.57% per year. By means of approximation of increase in number of residents and GDP. The total SW produced was 2.98 million tons in the year of 2000 and extended to 6.65 million tons in the year of 2008. Afterward, decrease in waste happened as an encouraging sign in the year of 2009 and 2010. The decrease in volumes of waste was obviously observed in the year of 2010, whereas a reduction of 5.09% from 6.70 million tons in the year of 2009 to 6.33 million of tons in the year of 2010 was estimated.

### 3.2 Type and Composition of Waste in Lahore

The composition of waste material differs from area to area. The residents of a specific area frequently face the same conditions as of earnings, by-laws and spending. The classification of waste is done owing to the source rather than of its composition or type of waste. According to the report of LWMC study 2012, waste material consist of significant constituents of vegetable and also of fruit dust. It also contains dirt, leaves, straw and grasses. The Organic constituents consist of 60% Biodegradable. The Nylon constituent is 11.7 %. It also constitutes Textile wastes, diaper, Global warming potential (GWM) Materials and the recycling of nutrients states less influence rather than combustion process. The complete changing are units are small, though main impact is known for use of containers for the plastic material.

In all consequences, the contribution from the Waste management system is smaller than for the compensative system. Though, in respect to combustion, only the Bio scenarios become higher because the compensative system is enclosed. In all moments, aside from land filling Combustion is the major factor that contribute the greenhouse gas arising from plastic combustion. The emissions of Paraffin from the lowland have continual effect in the condition of matter.

### 3.3 Acidification potential

All the scenarios of Bio (Bus, Car, and EI) are the main factor that effect the waste management system greatly

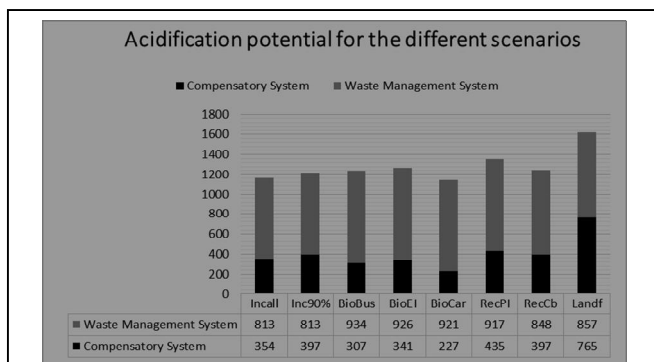


Fig. 3. This is all just because of the release of ammonia that releases from the agricultural lands and Bio EI that releases in atmosphere by internal combustion and also produces the heat and energy from biogas.

The recycling of plastic has the lower impacts than the manufacturing of primary plastics because of less emission in fuel combustion, but all the factors are contributing in the same limit.

Combustion is the major factor that contributes in the waste management system and there is no any other factor is known in the compensative system that can contribute. They are supplementary except the combustion of biomass that has very slight impacts.

### 3.3 Eutrophication

Land filling is main factor that mainly affects the system due to the release of NOx from the combustion of gas from landfill site (Fig. 4).

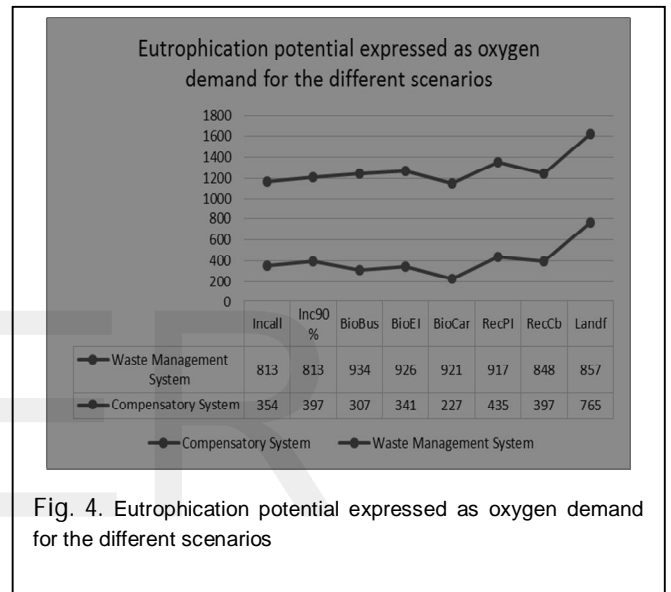


Fig. 4. Eutrophication potential expressed as oxygen demand for the different scenarios

The reprocessing of the nutrients releases from dispersion of organic manure. The recycling of materials displays almost continuous effects just like the combustion.

The relative values are not changed as once the extension of system is done. Though the effects of Bio scenario are decreased, relatively discussing

The main factor for eutrophication is dispersing the organic manure which causes the nitrate emissions and also releases the ammonia gas. All the vehicles and other machinery that run on Biogas are the main polluting factors releasing the higher amounts of oxide elements. Whereas diesel engines control the pollution image.

### 3.4 Consuming the primary energy sources

The diagram of energy carriers does not expresses the relationship of compensative and management systems but indicates that how renewable and non-renewable resources of energy are related to each other (Fig. 5).

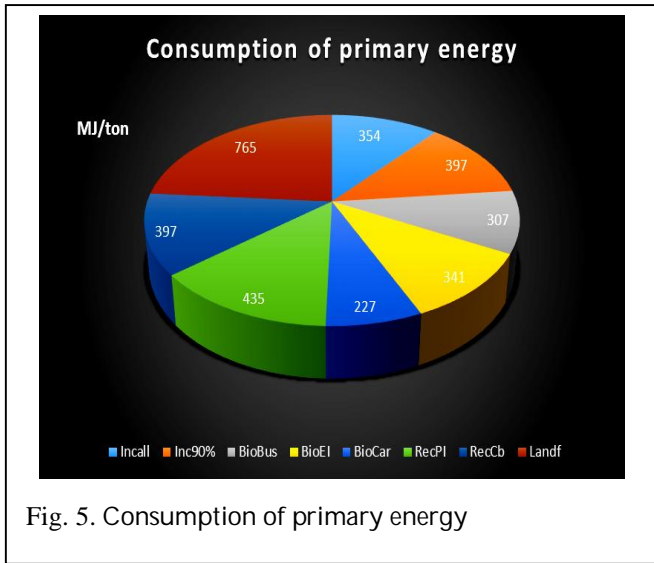


Fig. 5. Consumption of primary energy

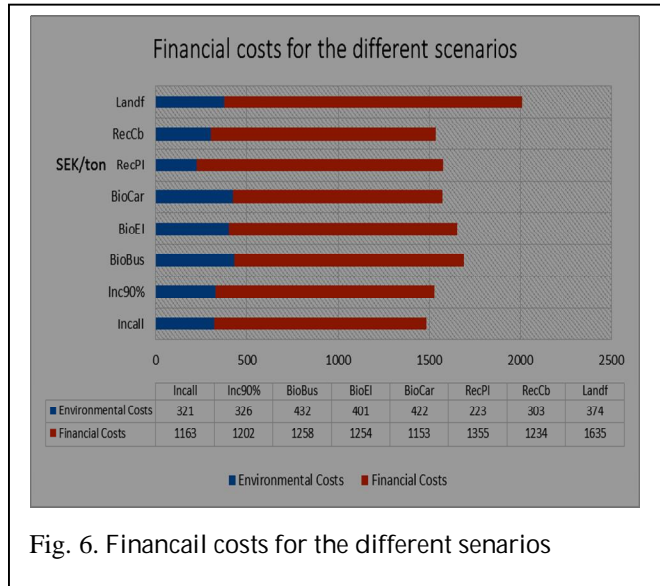


Fig. 6. Financial costs for the different scenarios

There is a little difference in Bio and the Inc. states and it is frequently compared to the recycling of cardboard. The consumption level for landfill is higher than that of combustion due to the usage of biomass to produce heat and the recycling of plastic has less as the fuel usage of gas and oil for manufacturing of plastic is fugitive. It should be considered that the area units of differences are larger, so minimum amount of waste is being exaggerated in these consequences.

All studied scenarios but the landfill are subjected to non-renewable resources of energy consisting of petroleum or gas for collection, transportation and the massive amount of coal is utilized for the production of electricity which is used to treat the plastics. It is demand of Pakistan to rise GDP craft. It need to rising renewable energy consumption (Shabbir, M.S, Shahbaz, M, and Zeshan, M. 2014).

For the manufacturing of primary plastic gas is used. The proportional quantity of renewable is minor in all of the studied scenarios avoiding landfilling as biomass will rise the usage of energy being the highest in all scenarios. Furthermore combustion, the application of biomass is done to produce the primary cardboard and a little upstream courses.

### 3.5 Economical values/ prices

Disparate of the scenarios of discussed above the waste has larger effect than the compensative system (Fig. 6).

The dumping of waste in land is very costly technique for the treatment of waste due to the selected cost for rewarding the real entities (mostly heat). The total cost for the recycling of plastic is somewhat greater associated to the cost for combustion, due to the relatively less cost of reprocessed plastics, while in the system of BioCar, it is slightly inexpensive because of the higher cost of fuel.

The system of waste management has higher cost for the collection and the incineration of waste. However Assortment doesn't differs significantly amongst scenarios but it impacts the economics greater than that of environment. The incinerated waste is costly as the most of the waste amount is burnt in all of the scenarios apart from the landfill.

By the economical point of view, combustion is more inexpensive than the choices of recycling, by avoiding the anaerobic digestion possibly of biological waste where the gas is engaged as motorized petroleum.

### 3.6 Other impact Programmes

In this research work the emissions of NOx, volatile organic compounds and metals were also considered. The consequences shows that the dumping of waste is greatest polluting scenario.

The effect of volatile organic compounds is known to be the lowermost impact for the recycling of plastics. The compensative system's major contribution due to the manufacturing of plastic and the production of vehicle fuel.

The extreme amounts of emissions from petroleum engines that cause higher rate of emission from system of managing waste all Bio scenarios and Landfill. The compensative system contributes more than that of system of waste management avoiding the BioBus.

### 3.7 Management ways

#### 3.7.1 Reduction

This is the foremost preferred methodology as a results of it will scale back system costs and resource consumption. Supply Reduction stops waste at the provision as a result of it avoids that item's entry into the waste stream. It collectively decreases the number of material employed in manufacturing, can increase a product's helpful life, and encourages further

economical client use of materials.

**3.7.2 Repair or Reuse:** the gathering of used things, like physics, electrical appliances, furniture, clothing, bedding, toys, musical instruments, vacuums, lamps, etc., to regenerate and repurpose them.

**3.7.3 Recycle or New Product Feedstock:**

This methodology is that the assortment of materials that may become waste, like glass, aluminum, and steel, plastic, paper, etc. and conjointly the sorting and process of these to manufacture as new products. Once recycled, these materials manufacture new product feedstock instead of victimization virgin resources. The new products would possibly or won't be quite just like the 1st product. This technique prevents things being place into landfills and conserves natural resources.

**3.7.4 Manufacturer Take-Back:** A program within which manufacturers take back older things, like physics and appliances for reclamation of parts and metals.

**3.7.5 Mulch or Compost:** The decomposition of organic waste, like food scraps and yard trimmings, to supply natural fertilizers and soil additives.

**3.7.6 Waste to Energy:** The creation of energy from waste materials that do not have a second life. Examples embody fats, oil, and grease changing into supplemental and biodiesel fuels, and ash from burning being converted into energy.

**3.7.7 Incineration:** the tactic of burning solid waste at a lower place controlled conditions.

**3.7.8 Landfill:** The disposal of solid waste by activity within the ground between layers of earth.

**CONCLUSION**

It is really hard to get rid of solid waste due to some factors: Dealing with solid waste was done in a totally different way regarding sorting of waste and mechanical knowledge which helps in managing of solid waste. Formerly we are not well aware and planning is quiet as smaller administrative can responsible for improper management of waste in the city. There are insufficient means and inexperienced labor force a fence for progress of assets waste management.

Additional to the present-day, the people of West Pakistan are lacking in information on solid waste. Precise info related to production of waste, its features and the land disposal environmental impacts that are major statistics obligatory for upcoming manipulative. There is need for appropriate rules and strategies that should be efficiently imposed intended to display a progressive way to solid waste management. At that time the upgraded performs for solid waste management will source contribution to environmental, societal and economic edges.

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