

## A STEP TOWARDS THE SMART CITY- SOLID WASTE MANAGEMENT

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### ABSTRACT

Solid waste could be a downside that has got to be properly managed so as to safeguard the human health and surroundings and preserve the natural resources. Several don't understand that solid wastes additionally create an exact impact on the climatical modification. The makers, users, distributors of the merchandise likewise because the disposal of the ensuing wastes all leads to emission of the part gases- "inexperienced House gases" that has affected the earth's surroundings to an oversized extent. Once the organic wastes decomposes on the landfills and uncontrolled it produces the alkane series gases one in every of the foremost inexperienced house gases tributary to a forceful modification within the encompassing climate and also the surroundings.

Topics coated include: the evolution of solid waste management; legislative trends and impacts; sources, types, composition and properties of municipal solid wastes; sources, sorts and properties of venturous wastes found in municipal solid waste; engineering principles of solid waste generation, collection, separation, storage, transport, process and transformation each at the supply and off-site; disposal of solid wastes and residual matter (landfills, lowland leachates and lowland gases); separation, transformation and employment of waste materials, as well as biological conversion technologies; closure, restoration and rehabilitation of landfills; and solid waste management and designing problems.

**KEYWORDS:** Solid Waste Management, Methods of Waste Management, Reuse, Recycle

### INTRODUCTION

There has been a significant increase in waste generation in India in the last few decades, largely due to rapid population growth and economic development. This is an attempt to explore business potential for private investors, especially Small & Medium Enterprises (SMEs), in Waste Management business.

In modern society, several of the things used daily area unit designed to be used and discarded. Single-use packaging and also the disposable things defines several of our consumer's patterns. With exaggerated convenience of the disposals it's value-added to the matter of a way to get eliminate of these wastes.

### REASONS FOR GROWING WASTE

There area unit numerous reasons for growing municipal waste generation. Following area unit a number of the reasons:

- Changing Lifestyles
- Food Habits
- Change in Living Standards

- Fast Economic Development
- Urbanization
- Growing Business Enterprise Trade

Solid waste is that the unwanted or useless solid materials generated from combined residential, industrial and business activities in an exceedingly given space. it's going to be classified per its origin (domestic, industrial, commercial, construction or institutional); per its contents (organic material, glass, metal, plastic paper etc); or per hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc). Management of solid waste reduces or eliminates adverse impacts on the surroundings and human health and supports economic development and improved quality of life. Variety of processes square measure concerned in effectively managing waste for a municipality. These embrace observance, collection, transport, processing, use and disposal.

## TYPES OF WASTES

There are degradable and non-degradable wastes. Degradable wastes are mainly organic substances. There are hazardous and non-hazardous wastes. As far Municipal waste is concerned, a major chunk of it emanates from households, hotels, schools, institutions, marriage parties, slaughter houses etc. Further, there are E- wastes as well.



**Figure 1**

Following tables present a picture of sources and types of solid wastes generated in Municipal localities in a developing:

**Table 1**

Source	Typical Waste Generators	Types of Solid Wastes
Residential	Single and multifamily dwellings	Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes, special wastes (e.g. bulky items, consumer electronics, white goods, batteries, oil, tires), and household hazardous wastes
Industrial	Light and heavy manufacturing, fabrication, construction sites, power and chemical plants	Housekeeping wastes, packaging, food wastes, construction and demolition materials, hazardous wastes, ashes, special wastes
Commercial	Stores, hotels, restaurants, markets, office buildings, etc.	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Institutional	Schools, hospitals, prisons, government centers	Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes
Construction and demolition	New construction sites, road repair, renovation sites, demolition of buildings	Wood, steel, concrete, dirt, etc

Municipal services	Street cleaning, landscaping, parks, beaches, other recreational areas, water and wastewater treatment plants	Street sweepings, landscape and tree trimmings, general wastes from parks, beaches, and other recreational area, sludge
Process	Heavy and light manufacturing, refineries, chemical plants, power plants, mineral extraction and processing	Industrial process wastes, scrap materials, off specification products, slag, tailings
Agriculture	Crops, orchards, vineyards, dairies, feedlots, farms	Spoiled food wastes, agricultural wastes, hazardous wastes (e.g. pesticides)

## IMPACT OF SOLID WASTE ON CLIMATE CHANGE

Even before a cloth or the merchandise becomes solid waste, it goes through a protracted cycle that involves removing and process the raw materials, producing the merchandise, transporting the materials and merchandise to the market and exploitation energy to control the merchandise. every of those activities has the potential to get gas emissions through one or a lot of of the subsequent means:

- Energy consumption: Extracting and process raw materials, producing products, and transporting materials and merchandise to plug all inexperienced house gas emission by consumption of energy.
- Alkane Emissions: once organic wastes decompose in landfills it generates methane that is major element of inexperienced house gases.
- Carbon storage: Trees absorb carbon dioxide from air and store it in wood through carbon sequestration. Waste hindrance and use of wood and paper merchandise permit a lot of trees to stay standing within the forest wherever they'll still take away carbon dioxide from air that helps in minimizing the climatical changes. currently use reduces the alkane emission by preventing the consumption of energy for extracting and process the raw materials. Communities that square measure longing for ways in which to assist stop climatical changes ought to get it on by implementing and integrated solid waste management program.

## REDUCE, REUSE, RECYCLE

Methods of waste reduction, waste apply and use square measure the well-liked choices once managing waste. There square measure several environmental edges which will be derived from the utilization of those ways. They cut back or stop inexperienced house gas emissions, cut back the discharge of pollutants, conserve resources, save energy and cut back the demand for waste treatment technology and lowland house. thus it's recommended that these ways be adopted and incorporated as a part of the waste management set up.

## WASTE REDUCTION

Waste reduction and apply of merchandise square measure each ways of waste hindrance. They eliminate the assembly of waste at the supply of usual generation and cut back the strain for giant scale treatment and disposal facilities. Ways of waste reduction embrace producing merchandise with less packaging, encouraging customers to bring their own reusable luggage for packaging, encouraging the general public to decide on reusable merchandise like artifact napkins and reusable plastic and glass containers, curtilage composting and sharing and donating any unwanted things instead of discarding them. All of the ways of waste hindrance mentioned need public participation.

## **SOLID WASTE MANAGEMENT**

Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. It may be categorized according to its origin (domestic, industrial, commercial, construction or institutional); according to its contents (organic material, glass, metal, plastic paper etc); or according to hazard potential (toxic, non-toxin, flammable, radioactive, infectious etc). Management of solid waste reduces or eliminates adverse impacts on the environment and human health and supports economic development and improved quality of life. A number of processes are involved in effectively managing waste for a municipality. These include monitoring, collection, transport, processing, recycling and disposal.

### **Easy and Effective Ways for Individuals to Handle Waste**

#### **Waste Management at Home**

- Keep separate containers for dry and wet waste in the kitchen.
- Keep two bags for dry waste collection- paper and plastic, for the rest of the household waste.
- Keep plastic from the kitchen clean and dry and drop into the dry waste bin. Keep glass /plastic containers rinsed of food matter.
- Keep a paper bag for throwing sanitary waste.

#### **First Few Steps to Initiate a Waste Management Programme in Your Apartment Complex**

- Form a group with like-minded people.
- Explain waste segregation to your family / neighbours in your apartment building.
- Get the staff in the apartment building to also understand its importance.
- Get separate storage drums for storing dry and wet waste.
- Have the dry waste picked up by the dry waste collection centre or your local scrap dealer.

#### **We Would Like to Suggest the Following Procedure for Domestic Waste Collection**

- All residents will collect the kitchen waste only in the compostable bags provided by the society management. This can be collected separately by the house keeping agency every morning and placed by them in the GREEN BIN, to be handed over to the municipal collection van. The society can look at the option of a suitable composting system for domestic kitchen waste and the compost can be used for the gardening purpose.
- All plastic bags and pouches will be collected in a separate recyclable plastic bag and the same will be collected by the house keeping agency once in a week from each flat and placed in the BLUE BIN.
- All Plastic bottles and containers shall be collected separately in a separate recyclable plastic bag and the same will be collected by the house keeping agency once in a week from each flat and placed in the RED BIN
- All paper bags, news prints, loose paper packaging etc shall be collected separately and handed over to the house keeping agency once in a week.

- Glass bottles and articles of all kinds shall be collected separately by the housekeeping agency once in a week from each flat and placed separately.
- All disposable nappies, medical waste and disposable hygiene products shall be collected in a bio hazard waste collection bag and disposed suitably by the house keeping agency on daily basis.

The recyclable material collected in the process shall be sold to the scrap dealer for recycling and the funds generated from this shall be used for compensation towards the cost of solid waste management system and additional funds, as required for the same shall be provided by the society members.

Stay green!!! Say no to plastic bags in municipal waste. REDUCE, REUSE, RECYCLE

## **METHODS OF SOLID WASTES DISPOSAL**

### **Waste Processing: Technology and Potential**

#### **Waste to Energy**

According to Planning Commission, there is a potential of 2,700 MW of power generation from urban and industrial waste in the country. The eleventh five year plan in fact targets 4000 MW of power generation from wastes.

#### **Scrap Recycling Business**

Scrap recycling and processing is yet another element of waste management. After segregating the garbage, after organic and inert waste has been removed, what remains is recyclable material, mostly PET bottles, cold drink cans, metal scrap, paper cartons and certain types of plastic products. These could be sold to companies who recycle such products.

#### **Sanitary Land Filling**

A sanitary landfill is a low-lying area that is filled with waste rejects. It has a liner at the bottom to prevent the groundwater from contaminating with the mix of the liquid that oozes from the waste that is buried called the leachate. Waste is buried in-between layers of soil and is compacted nicely to make it a hard surface. When the landfill is completed, it is capped with a layer of clay or a synthetic liner in order to prevent water from entering. A final topsoil cover is placed, compacted and graded, and various forms of vegetation may be planted in order to reclaim the otherwise useless land.

In a sanitary landfill, garbage is spread out in thin layers, compacted and covered with clay or plastic foam. In the modern landfills the bottom is covered with an impermeable liner, usually several layers of clay, thick plastic and sand. The liner protects the ground water from being contaminated due to percolation of leachate.

Leachate from bottom is pumped and sent for treatment. When landfill is full it is covered with clay, sand, gravel and top soil to prevent seepage of water. Several wells are drilled near the landfill site to monitor if any leakage is contaminating ground water. Methane produced by anaerobic decomposition is collected and burnt to produce electricity or heat. Sanitary Landfills Site Selection:

- Should be above the water table, to minimize interaction with groundwater.
- Preferably located in clay or silt.
- Do not want to place in a rock quarry, as water can leech through the cracks inherent in rocks into a water fracture

system.

- Do not want to locate in sand or gravel pits, as these have high leeching. Unfortunately, most of Long Island is sand or gravel, and many landfills are located in gravel pits, after they were no longer being used.

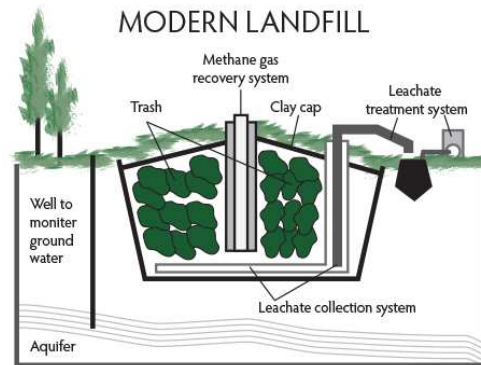


Figure 2

### Incineration

The term incinerates means to burn something until nothing is left but ashes. An incinerator is a unit or facility used to burn trash and other types of waste until it is reduced to ash. An incinerator is constructed of heavy, well-insulated materials, so that it does not give off extreme amounts of external heat.

The high levels of heat are kept inside the furnace or unit so that the waste is burned quickly and efficiently. If the heat were allowed to escape, the waste would not burn as completely or as rapidly. Incineration is a disposal method in which solid organic wastes are subjected to combustion so as to convert them into residue and gaseous products. This method is useful for disposal of residue of both solid waste management and solid residue from waste water management. This process reduces the volumes of solid waste to 20 to 30 per cent of the original volume.

Incineration and other high temperature waste treatment systems are sometimes described as “thermal treatment”. Incinerators convert waste materials into heat, gas, steam and ash. Incineration is carried out both on a small scale by individuals and on a large scale by industry. It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials. Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants.

### Composting

Due to shortage of space for landfill in bigger cities, the biodegradable yard waste (kept separate from the municipal waste) is allowed to degrade or decompose in a medium. A good quality nutrient rich and environmental friendly manure is formed which improves the soil conditions and fertility.

Organic matter constitutes 35%-40% of the municipal solid waste generated in India. This waste can be recycled by the method of composting, one of the oldest forms of disposal. It is the natural process of decomposition of organic waste that yields manure or compost, which is very rich in nutrients.

Composting is a biological process in which micro-organisms, mainly fungi and bacteria, convert degradable

organic waste into humus like substance. This finished product, which looks like soil, is high in carbon and nitrogen and is an excellent medium for growing plants.

The process of composting ensures the waste that is produced in the kitchens is not carelessly thrown and left to rot. It recycles the nutrients and returns them to the soil as nutrients. Apart from being clean, cheap, and safe, composting can significantly reduce the amount of disposable garbage.

The organic fertilizer can be used instead of chemical fertilizers and is better specially when used for vegetables. It increases the soil's ability to hold water and makes the soil easier to cultivate. It helped the soil retain more of the plant nutrients. Aerobic composting is the creation of fertilizing compost using bacteria that thrive in an oxygen-rich environment. Aerobic composting is considered the fastest method of composting, but involves more work in terms of rotating the organic material periodically. Anaerobic composting is the creation of fertilising compost using bacteria that cannot thrive in the presence of oxygen. Anaerobic composting is known to work slowly, but also requires lesser work.

Vermi-composting has become very popular in the last few years. In this method, worms are added to the compost. These help to break the waste and the added excreta of the worms makes the compost very rich in nutrients. In the activity section of this web site you can learn how to make a compost pit or a vermi-compost pit in your school or in the garden at home.

To make a compost pit, you have to select a cool, shaded corner of the garden or the school compound and dig a pit, which ideally should be 3 feet deep. This depth is convenient for aerobic composting as the compost has to be turned at regular intervals in this process.

Preferably the pit should be lined with granite or brick to prevent nitrite pollution of the subsoil water, which is known to be highly toxic. Each time organic matter is added to the pit it should be covered with a layer of dried leaves or a thin layer of soil which allows air to enter the pit thereby preventing bad odour. At the end of 45 days, the rich pure organic matter is ready to be used. Composting: some benefits

- Compost allows the soil to retain more plant nutrients over a longer period.
- It supplies part of the 16 essential elements needed by the plants.
- It helps reduce the adverse effects of excessive alkalinity, acidity, or the excessive use of chemical fertilizer.
- It makes soil easier to cultivate.
- It helps keep the soil cool in summer and warm in winter.
- It aids in preventing soil erosion by keeping the soil covered.
- It helps in controlling the growth of weeds in the garden.

### **Pyrolysis**

Pyrolysis is a form of incineration that chemically decomposes organic materials by heat in the absence of oxygen. Pyrolysis typically occurs under pressure and at operating temperatures above 430 °C (800 °F). In practice, it is not possible to achieve a completely oxygen-free atmosphere. Because some oxygen is present in any pyrolysis system, a small



amount of oxidation occurs. If volatile or semi-volatile materials are present in the waste, thermal desorption will also occur.

Organic materials are transformed into gases, small quantities of liquid, and a solid residue containing carbon and ash. The off-gases may also be treated in a secondary thermal oxidation unit. Particulate removal equipment is also required. Several types of pyrolysis units are available, including the rotary kiln, rotary hearth furnace, and fluidized bed furnace. These units are similar to incinerators except that they operate at lower temperatures and with less air supply.

## LIMITATIONS AND CONCERNS

- The technology requires drying of soil prior to treatment.
- Limited performance data are available for systems treating hazardous wastes containing polychlorinated biphenyls (PCBs), dioxins, and other organics. There is concern that systems that destroy chlorinated organic molecules by heat have the potential to create products of incomplete combustion, including dioxins and furans. These compounds are extremely toxic in the parts per trillion ranges. The MSO process reportedly does not produce dioxins and furans.
- The molten salt is usually recycled in the reactor chamber. However, depending on the waste treated (especially inorganics) and the amount of ash, spent molten salt may be hazardous and require special care in disposal.
- pyrolysis is not effective in either destroying or physically separating inorganics from the contaminated medium. Volatile metals may be removed as a result of the higher temperatures associated with the process, but they are not destroyed. By-products containing heavy metals may require stabilization before final disposal.
- When the off-gases are cooled, liquids condense, producing an oil/tar residue and contaminated water. These oils and tars may be hazardous wastes, requiring proper treatment, storage, and disposal.

## CONCLUSIONS

Waste Management is an essential service to be provided by the municipal and local government authorities. Failure to provide it efficiently could be disastrous. Examples of Surat plague menace in the early 1990s and recent outbreaks of Chickunguniya and other unknown diseases in Kerala are all suggesting the need to address the issue of waste management in a war-footing. But what is required is putting in place a professional management system, adoption of latest available technologies and best practices so that there is no failure in this essential service delivery to our citizens.

Urban solid waste management is an essential social service for protection of environment and health of the citizens. Therefore, a least cost most appropriate technological option for safe management should receive the needful funding. Industries, institutions, non-government agencies and individual citizen should all co-operate with the municipal authorities in ensuring safe management. As society moves waste to the forefront of public policy, it is more apparent that what we discard annually contains a multitude of valuable and recoverable materials. An intergraded waste management system entails a careful analysis of what is in the waste stream and offers ideas on practices to recover the various materials at the point of highest value. The best strategy for a community is to match its unique position with the mix of activities that will best serve it now and far into the future.



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