**CHAPTER 1**

**INTRODUCTION**

* 1. **OVERVIEW OF WASTE SEGREGATION**

Waste sorting is the process by which waste is separated into different elements. Waste sorting can occur manually at the household and collected through [curbside collection](https://en.wikipedia.org/wiki/Curbside_collection) schemes, or automatically separated in [materials recovery facilities](https://en.wikipedia.org/wiki/Materials_recovery_facilities) or [mechanical biological treatment](https://en.wikipedia.org/wiki/Mechanical_biological_treatment) systems. Hand sorting was the first method used in the history of waste sorting. Waste can also be sorted in a [civic amenity site](https://en.wikipedia.org/wiki/Civic_amenity_site). "Waste segregation" means dividing waste into dry and wet. Dry waste includes wood and related products, metals and glass.

Wet waste typically refers to organic waste usually generated by eating establishments and are heavy in weight due to dampness. Waste can also be segregated on the basis of being biodegradable or non-biodegradable. Landfills are an increasingly pressing problem. Less and less land is available to deposit refuse, but the volume of waste is growing. As a result, segregating waste is not just of environmental importance, but also of economic concern.

There is rapid increase in volume and types of solid and hazardous waste in India as the result of continuous economic growth, urbanization and industrialization is becoming a biggest problem for national and local governments to ensure effective and sustainable management of waste. The segregation, handling, transport and disposal of waste are to be properly managed so as to minimize the risks to the health and safety of patients, the public as well as the environment.

The economic value of the waste is best realized when it is segregated. India is developing country with 16 per cent of the world population and having 2% of the total land area. The exponential increase in industrialization is not only consuming large areas of agricultural land but also simultaneously causing serious environmental degradation. Industrialization and urbanization have not only resulted on discharge of large wastes that are rich in organic matter but also in nutrients.

Waste is also defined that discarded material which has no value in normal use or for ordinary use. Solid wastes are those undesirable, useless and unwanted materials and substances that come from any human activity. Waste is generated in all sorts of ways such as dry, wet waste, etc. Its composition and volume largely depend on consumption patterns as well as the industrial and economic structures in place.



Figure 1.1 Waste Segregation

# 1.1.1 Methods

Waste is collected at its source in each area and separated. The way that waste is sorted must reflect local disposal systems. The following categories are common.

* [Paper](https://en.wikipedia.org/wiki/Scrap_paper)
* [Cardboard](https://en.wikipedia.org/wiki/Cardboard) (including packaging for return to suppliers)
* Glass (clear, tinted – no light bulbs or window panes, which belong with residual waste)
* [Plastics](https://en.wikipedia.org/wiki/Plastics)
* Textiles
* Wood, leather, rubber
* [Scrap metal](https://en.wikipedia.org/wiki/Scrap_metal)
* [Compost](https://en.wikipedia.org/wiki/Compost)
* Special/[hazardous waste](https://en.wikipedia.org/wiki/Hazardous_waste)
* [Residual waste](https://en.wikipedia.org/wiki/Residual_waste)
* Leftover food which has had any contact with meat can be collected separately to prevent the spread of bacteria.
* Meat and bone can be retrieved by bodies responsible for animal waste.
* If other leftovers are sent, for example, to local farmers, they can be sterilised before being fed to the animals.
* Peels and scrapings from fruit and vegetables can be composted along with other degradable matter. Other waste can be included for composting, such as [cut flowers](https://en.wikipedia.org/wiki/Cut_flowers), corks, coffee grounds, rotting fruit, tea bags, eggshells and nutshells, and paper towels.
* Chip pan oil (fryer oil), used fats, vegetable oil and the content of fat filters can be collected by companies able to re-use them. Local authority waste departments can provide relevant addresses. This can be achieved by providing [recycling bins](https://en.wikipedia.org/wiki/Recycling_bin).

**1.2 TYPES OF WASTES**

Generally, waste can be classified into solid waste and liquid waste.

**1.2.1 Solid waste**

Solid waste prominent, is any garbage, refuse or rubbish that we make in our homes and also other places. These includes the old car tires, old newspapers, broken furniture, unwanted electronics parts and even food waste.

Solid waste also can be classified into two different types depending on their source. Household waste is generally classified as municipal waste, Industrial waste as hazardous waste/ hospital waste as infectious waste.

1. **Municipal solid waste**

Municipal solid waste contains the household waste, construction as well as demolition debris, sanitation residue, and waste from streets. Mainly, this type of garbage is generated from residential as well as commercial complexes.

1. **Hazardous waste**

Industrial as well as hospital wastes are considered hazardous as they may consist of toxic substances. Hazardous wastes could be dangerous for the humans, animals, as well as plants. These are corrosive, highly inflammable, or explosive and react when exposed to certain things e.g. gases. In India, around 7 million tons of hazardous waste is generated every year.

**1.2.2 Liquid waste**

Liquid waste is the waste generated in the kitchen, bathroom and laundry and also called the Grey water. Black water is waste water generated in the toilet is called “Black water”. It contains harmful pathogen. Some solid waste can also be converted to a liquid waste form for disposal.

The different sources include point source and non-point source discharges such as storm water and wastewater e.g. liquid waste include wash water from homes, liquids used for cleaning in industries and detergent waste

**1.3 NEED OF WASTE MANAGEMENT**

The need of waste management is to gain an understanding of waste management planning concepts, frameworks, strategies, and also components that are emerging in the field. The sorting of waste is essential as the amount of waste being generated today causes immense problem.

In fact, it is believed that a larger portion can be recycled, a part of it can be converted to compost and also only a smaller portion of it is real waste that has no use and has to be discarded. A study says that 1, 60,000 metric tons is the amount of garbage India generates every day! Most of this is wet waste, which can be used to produce fertilizer and generate electricity. Studies say that waste which is segregated is very valuable which can be then used to produce fertilizers, generate biogas and electricity.

Whereas, waste dumped unsorted in open, produces harmful liquids and gases that spread diseases and also make that land barren on which it is dumped. So, effective and reliable waste management has become a need of the hour.

**1.4 E-WASTE MANAGEMENT**

Electronic waste defined as broken or unwanted electrical or electronic parts or equipment as a whole. E-waste consists of computers, refrigerators, televisions and more than 1,000 such different electronic materials which are non-biodegradable. Bangalore, a major city in India, the home of over 1,200 overseas as well as domestic technology firms, figures prominently in the danger list of cities that face e=waste hazard.

In Bangalore, e-waste in is dumped in landfills as well as is incinerated, releasing harmful toxins into air and soil.

**1.5 TYPES OF WASTE SEGREGATION**

The different types of waste segregating methods are,

**1.5.1 Incineration**

Incineration is a one of the disposal method of solid waste in which waste is subjected to combustion of organic substance which contained in the waste and also high temperature treatment system as known as “thermal treatment”.

It converts the waste into ash and gaseous products. This method also useful for disposal of residue of both solid waste management as well as solid residue from waste water management and also this process reduces the volumes of solid waste to 20 to 30 percent of the original volume. Incineration is used in both on a small scale by individuals and on a large scale by industry. This method also recognized as a practical method of disposing of certain hazardous waste materials including biological medical waste. Incineration method commonly used in countries such as Japan where land is scarcer, as these facilities generally do not require as much area as landfills.

**1.5.2 Landfill**

Landfill is most common method of waste treatment around the world. Landfill consists of burying the waste and also remains a common practice in most countries.

If landfills are properly designed and well managed, then a landfill can be a hygienic as well as relatively inexpensive method of disposing of waste. In older days, poorly managed landfills and waste dumped in open areas created a number of adverse environmental impacts like wind-blown litter, attraction of vermin, as well as generation of liquid leachate.

Landfills generate gas mostly composed of methane and carbon dioxide which kills the surface vegetation and also is a greenhouse gas. Modern landfill design techniques include methods to limit the leachate such as use of clay or plastic lining material. Basically, its deposited waste is normally compacted to increase its density as well as stability and also covered to prevent attracting vermin. Many landfills also have landfill gas extraction systems installed to extract the landfill gas.

**1.5.3 Recycling**

Recycling means the materials from which the new items are made or the materials which can be reprocessed into new products. Firstly, waste material is collected separately from general waste using dedicated bins like dry waste, wet waste and plastic and collection vehicles, a procedure also known as kerbside collection.

In different communities, different method like all recyclable materials are placed in a single bin for collection, and the sorting and this method is known as ‘single-stream recycling’. Consumer products are the most common recycled materials which include aluminium materials such as beverages cans, copper materials such as wire, steel from food and aerosol cans, old steel furnishings or equipment, rubber tyres, polyethylene bottles, glass bottles and jars, paperboard cartons, newspapers, magazines and light paper, and corrugated fibreboard boxes. In various cities and countries, different type of materials are accepted for recycling which is reflected in the resale value of the material once it is reprocessed.

**1.5.4 Re-usage of Waste**

The waste re-usage refers to using waste for generating useful things like biogas, manure etc. Some of the waste re-use methods are,

**1.5.4.1 Pyrolysis**

Pyrolysis is defined as thermochemical decomposition of organic materials by heat in the absence of oxygen which produces various hydrocarbon gases. During pyrolysis, the molecules of object are subjected at a very high temperatures leading to very high vibrations.

Hence, every molecule in the object is stretched and shaken to an extent that molecules starts breaking down and also rate of pyrolysis increases with temperature.

Temperatures are above 806°F used in industrial applications. There are two type of pyrolysis fast pyrolysis and slow pyrolysis which produces liquid fuel for feed stocks like wood. Slow pyrolysis produces gases and solid charcoal. Pyrolysis holds promise for conversion of waste biomass into useful liquid fuel. It is used for plastic waste disposal to produce liquid fuel similar to diesel.

**1.5.4.2 Biological Reprocessing**

Recyclable materials that are organic in nature, such as plant material, food scraps, and paper products, can be recovered through composting and digestion processes to decompose the organic matter. The result of organic decomposition is then recycled as compost for agricultural or landfill purposes. In addition to compost, waste gas from organic decomposition such as methane can be captured and also used for generating electricity with maximizing efficiencies.

The purpose of biological processing in waste management is to control as well as accelerate the natural process of decomposition of organic matter.