3.2 Municipal Solid Waste Management

The rapid population growth in India has resulted in the increased promotion of Municipal Solid Wastes in India in the last few decades. The daily per capita generation of municipal solid waste in India ranges from about 100g in small towns to 500g in large towns .About 11% to 20% of the wastes are recyclable.

Solid Wastes

The wastes generated and discarded from human and animal activities that are normally solid arc called as solid wastes.

Types of Solid Wastes

The three general types of solid wastes are

1. Municipal Wastes
2. Industrial Wastes
3. Hazardous Wastes

Components of Municipal Solid Wastes

The main components of municipal solid wastes are:

a. Garbage (or) Food wastes
b. Rubbish
c. Ashes and Residues
d. Construction and Demolition Wastes
e. Treatment Plant Wastes
f. Special Wastes

Table 3.1 Types and Characteristics of Solid Wastes

Types and Characteristics of Wastes	Examples
(1) Food Wastes These are resulting from the handling, Preparation, cooking and eating of foods. Decompose rapidly in warm weather condition.	Meat, bones, fruit residues, vegetable residues, spoiled food items, etc.
2.Rubbish These are the solid wastes of house-holds, institutions, commercial activities etc. These wastes don't decompose rapidly. There are two types of rubbish. They are: (a) Combustible Rubbish (b) Non-combustible Rubbish	Paper, Cardboard, Wood, Rubber, Leather, Textiles, furniture, garden trimmings, etc. Glass, Crockery, Tin cans, Aluminium cans, metals, dirt, etc.
(3) Treatment Plant Wastes Wastes generated from treatment plants.	Solid and Semi-solid wastes from water, wastewater and industrial waste treatment.
(4) Construction and Demolition Wastes Generated from construction, demolition, repair and remodeling of residential, commercial and industrial buildings.	Bricks, Stones, Dust, Concrete, Plaster, electrical, plumbing and sanitary parts.

(5) Ashes and Residues These are the materials remaining from the burning of wood, coal, coke and other combustible materials.	Fine powdery materials, clinkers, cinders, partially burned materials, etc.
(6)Special Wastes Wastes those are not included in any of the above categories.	Street sweepings, roadside litter, catch pit debris, dead animals etc.

3.2.1 Stages of Solid Waste Management

If the solid wastes are not disposed properly, it will cause more adverse environmental effects.

The flow chart for the Solid Waste Management is given below:

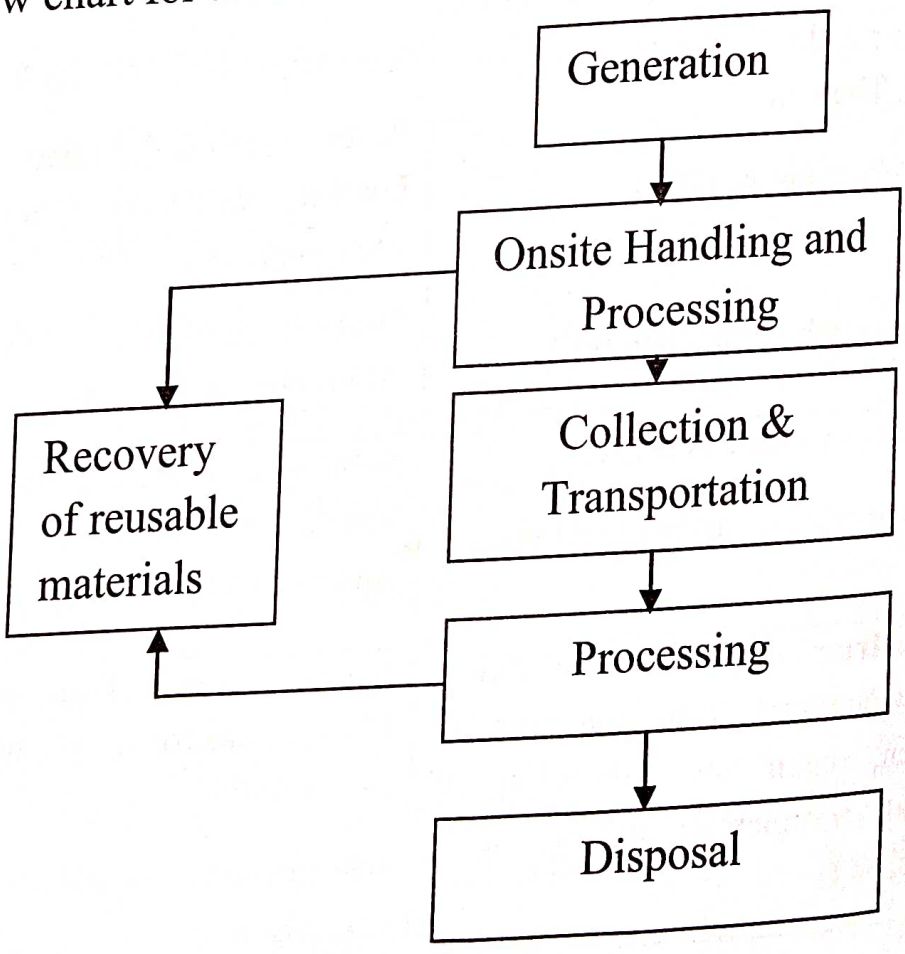

Fig. 3.2 Stages of Solid Waste Management

Collection and Transportation of Solid Wastes

Collection of solid wastes includes all the activities related to the gathering of wastes from the point of generation. The wastes are collected and transported in the covered vehicle. Two types of collection systems are used depending upon the mode of transportation.

1. Hauled container system
2. Stationary container system

1. Hauled Container System (HCS)

In the Hauled Container Systems, the containers used for the storage of wastes are taken to the processing or disposal site, emptied and returned to the generation or collection point. In this system, the container may be returned to its original location or some other location. This type of system is highly suitable for the removal of wastes from sources where there is more generation of wastes.

2. Stationary Container System (SCS)

In Stationary Collection system, the waste storage containers are kept in the point of generation of wastes which will be rarely moved for collection. Presence of labour is highly essential in this system of collection. Wastes of all types will be collected by this system.

Disposal of Solid Wastes

The following methods are used for the disposal of solid wastes:

1. Manual component separation
2. Compaction or Mechanical volume reduction
3. Incineration or Thermal volume reduction
4. Open dumping
5. Land filling
6. Land farming
7. Compositing or Bio-degradation

1. Manual Component Separation

The manual separation of the components present in the wastes is done before the disposal of wastes. This is done to recover some materials that could be recycled to get some useful products. The materials such as cardboard, newspaper, glass. aluminium cardboard, metals, wood and bulky items of value are recovered by manual separation.

2. Compaction or Mechanical Volume Reduction

After separating the reusable materials, mechanical volume reduction is done to reduce the volume of the wastes. Compactors are used for the purpose. Stationary and movable type compactors are available. Recently high pressure compactors are developed and used to reduce landfill requirements .Collection vehicles with compaction mechanism are used to collect the wastes from the sites.

3. Incineration or Thermal Reduction

Incineration is the hygienic way of disposal of solid wastes. This method is employed to reduce the volume of wastes chemically. In this method, wastes like cartons, wood scrap, floor sweepings cardboard etc are burnt in a furnace called Incinerator.

The incineration process has the ability to reduce the original volume of combustible wastes by about 80 to 90%. The left out ashes and clinkers from the incinerators is accounted for about 10 to 20%, which can then be disposed by sanitary landfill or by other means.

The heat produced in the incubator during the burning of the wastes is used in the form of steam power for the generation of electricity through turbines.

The municipal solid waste is generally wet but has high calorific value. So it has to be dried before burning to produce power.

Advantages

1. It is the safest method of disposal from the hygienic point of view.
2. It requires less space.
3. The operation cost is not very high as the incinerators are located within the city limits.
4. The residue obtained is only about 20 to 25 % of the original weight, the clinker can be used after the treatment.
5. An incinerator plant of 300 tons per day capacity can generate 3 MV of power.

Disadvantages

1. The capital and the operation cost are very high.
2. Skilled persons are required for operating the incinerators.
3. Causes air pollution due to the smoke, dust and ashes, which are to be disposed further.

4. Open Dumping

Open dumping is the method of dumping the wastes in the low lying areas and outskirts of the cities.

Advantages

1. It is a cheaper method when compared to other methods.
2. This method is extensively used in India.

Disadvantages

1. Open dumping cause public health hazards due to the breeding of flies, mosquitoes, rats and other pests.
2. Air pollution is caused due to the release of gaseous and particulate matter by burning the combustible solid wastes.
3. A large area is required for open dumping, which may cause shortage of land space for human habitation.

5. Land filling

Land filling is the most common and cheapest method of disposal

of solid waste. This is the extensively used method in India. The landfill structure is built either into the ground or on the ground into which the wastes are dumped. The solid wastes are placed in the sanitary landfill in alternate layers of 80cm thick refuse covered with selected earth fill of 20 cm thickness. When the area is left as such for two to three years, the waste volume shrinks by 25-30% and the land can be used for parks, roads and small buildings.

If the landfill is not properly provided, rain water leaches into the ground and pollute ground and surface waters. Poorly managed landfill sites produce foul smell due to the digestion of organic components in the wastes. Methane, one of the dangerous gas in polluting the environment is predominantly found in the mixture.

Advantages

a) Land filling is a simple and economical method.
b) Segregation is not required.
c) Landfills can be recovered and used for other purposes.
d) Converts low-lying, marshy wasteland into useful areas.
e) Natural resources are returned to the soil.

Disadvantages

1. A large area is required.
2. Transportation cost is high as the landfill site is away from the cities.
3. Bad odours may be produced if the landfills are not properly carried out.

4. Land fill areas are the sources of mosquitoes. Hence it is necessary to apply pesticides and insecticides at regular intervals of time.
5. There may be possibility of fire hazards due to the release of methane gas in wet weather.

6. Land Farming

In this method of disposal, the biodegradable industrial wastes are treated by the biological, physical and chemical processes. The organic wastes are either applied on the top of the land or below the soil surface where they undergo bacterial decomposition.

Advantages

The land farming site can be reused without any adverse effects provided the site is properly managed.

7. Compositing or Biodegradation

Compositing is the process of constructing a composite by making alternate layers of organic matter and soil (Source of microorganisms).Some fertilizer and water is periodically added to the composite pile to stimulate microbial action and to maintain moisture content (55%).

The refuse is turned over periodically to allow the penetration of oxygen to all parts of the organic refuse to facilitate aerobic bacterial decomposition. It takes nearly a month for compositing to be complete.