UNIT 4 WASTE MANAGEMENT

Structure

4.0 OBJECTIVES

After reading this unit, you should be able to:

- identify various types of waste along with their source of origin;
- assign the correct disposal treatment method for different categories of waste; and
- discuss the life cycle of waste from its origin to its final disposal.

4.1 INTRODUCTION

All activities whether domestic, commercial and industrial generate wastes of different kinds and in different proportions. Piles of garbage scattered all around the city is a common site in developing countries. In this unit we will focus mainly on solid waste generated by domestic and commercial sectors. It is realized that mostly it is not the waste that causes the problem but the unscientific management of waste that leads to serious environmental problems. Open dumping of garbage serves as breeding ground for disease vector such as flies, mosquitoes, cockroaches, rats, etc., thereby leading to the spread of diseases like typhoid, cholera, dysentery, jaundice, plague, etc. The outbreak of plague in 'Surat' some years back is a classic example of an outbreak of disease due to insanitary conditions of the city.

The modern lifestyle has greatly affected the quality and quantity of the waste generation. Use of packaging material and plastic bags, has become an essential part of everyday life. The indiscriminate use of polyethylene bags not only creates unsightly surroundings but often leads to choking of sewers and other water bodies. Cases have been reported where polyethylene bags were found inside the cow's stomach of stray cattle.

Thus, the present scenario shows how important it is to adopt proper waste management practices.

There are three major steps involved in the management of municipal solid waste, viz., collection, transportation and disposal. However, segregation of waste at source level is a useful step prior to collection. All these steps are discussed in detail in this unit. Besides ensuring proper disposal and maintaining sanitary/hygienic conditions, waste management also involves the use of latest technology for making the best use of the waste products. Thus, the energy recovery technologies that can be made use of are:

- **Biomethanation:** Biological decomposition of organic waste to yield energy rich bio-gas which can be used for cooking purpose.
- **Sanitary landfill gas:** Bio-gas generation through sanitary landfilling process.
- **Pelletisation:** Compacting organic waste into small cubes/pellets to be used as a substitute for coal/wood.
- **Composting:** Converting organic wastes into humus by microbial action for use as a nutrient rich source in farming.
- **Vermiculture:** Utilizing earthworms for converting organic waste into bio-fertilizer to improve the soil fertility.

4.2 WASTE AROUND US

A little reflection will reveal that all human activities generate waste. In this unit we will examine waste in detail with reference to its source, characteristics so that we can evolve the most suitable method for its disposal. You will soon realize how complex is the problem of waste disposal.

In the next block you will learn about different types of health care waste and its management.

4.2.1 Definition and Identification

When we talk of wastes we generally refer to solid wastes. However, liquid waste/ wastewater and waste gases are also important categories. Let us first identify solid wastes around us. Whether one lives in a city, town or village, one can easily identify different types of waste scattered around in one's locality. These wastes arising from residential and commercial sectors can be placed into following categories of material: papers, dirt and dust (from sweepings), metals (ferrous, aluminum, etc.), glass, plastics, rubber, textile, leather, wood, food material, garden waste, animal excreta and some other inorganic wastes.

Though the categories of wastes remain the same in urban and rural settings but their quality and quantity is different. In urban dwelling one encounters more of paper, plastic, glass and metal wastes whereas in rural setting we find more of biodegradable waste. Agriculture and food processing industry is considered to be the largest single contributor to the total annual production of solid wastes. Unfortunately, huge volumes of these wastes are set afire in order to dispose them off quickly and easily. Instead these wastes can become a good resource and generate employment when properly utilized. "What is waste to one industry may be raw material for another." Agriculture and food processing industry wastes have tremendous potential for setting up small scale industries, viz., paper and cardboard manufacture, packing material, boxes manufacture etc. Even if these wastes are not utilized they do not pose pollution problem as they are biodegradable. Biodegradable materials are those, which break up into simpler elements naturally by the action of bacteria present in soil thereby enriching the soil with nutrients.

Thus, we see that it is not the biodegradable waste, which is of much concern, but rather the wastes such as glass, metals, plastics and polyethylene bags. Though we can manage these wastes through recycling and reusing but cost can be a constraint. Best would be minimizing the use of such products, which generate these wastes, and to strictly ban the use of polyethylene bags, which are the greatest menace. Burning of plastic particularly

PVC (poly vinyl chloride) forms highly corrosive hydrochloric acid, which is an extreme nuisance in the operation of refuse incinerators. A highly poisonous gas phosgene ($POCl_3$) may also be produced where PVC is burned at inadequately high temperatures.

Fig. 4.1: Wastes around us

4.2.2 Classification of Wastes

Wastes can be put under the following categories:

1) **Garbage:** It is the decomposable fraction of waste e.g. waste food, vegetable peelings and other organic matter. Its quality varies throughout the year. It needs careful handling because it breeds flies and insects, attracts birds and rodents for food. Garbage decomposes rapidly resulting in unpleasant odour. Valuable products like biogas, manure and animal food can be recovered.

2) **Rubbish:** Rubbish includes all non-putrescible waste except ashes. The combustibles and non-combustibles can be subjected to recycling. It includes paper, plastic, metals, glass, etc.

3) **Ashes:** Ash is the residue from solid fuel combustion incinerators as well as from refuse and biomass burning. One of the largest contributors of fly ash is the thermal power plants. Ash can create nuisance during collection and disposal.

4) **Large Wastes:** This includes demolition and construction rubble (pipes, lumber, bricks, masonry), automobiles, furniture, refrigerators and other home appliances. These wastes find their way to junk markets from where they are recycled into other useful goods. However, the demolition rubble needs to be disposed off via landfilling and thus requires some investment in terms of transportation and landfill site.

5) **Dead Animals:** Such as household pets, birds, rodents, zoo animals, cattle, etc., need to be disposed off properly so as to maintain a healthy environment.

6) **Sewage:** Sewage is the wastewater disposed from the kitchens and bathrooms. It can form the breeding ground for mosquitoes.

7) **Human Excreta:** These are a source of infection. It is an important cause of environmental pollution. The health hazards of improper excreta disposal are: soil and water pollution, contamination of foods and propagation of flies and other insects.

The sources of the above-mentioned solid wastes have been identified as:

i) **Municipal:** Street sweepings, sewage treatment plant wastes, wastes from schools and other institutions.

ii) **Domestic:** Garbage, rubbish, occasional large wastes and dead animals and ashes from some houses.

iii) **Commercial:** From stores and offices and market place.

iv) **Industrial:** Chemicals, paints, sand, explosives, sludge cakes from treatment plants, rags from textile industries and a large number of other types of wastes from various industries.

v) **Mining:** "Tailings", slagheaps etc. from coal mining and mining of other minerals.

vi) **Agricultural:** Crop residues, farm animal excreta.

vii) **Hospital:** Anatomical and pathological wastes from hospitals.

4.2.3 Characterization of Wastes and its Importance

Characteristics of wastes are very important for the development of proper waste management systems, viz., to explore the potential for the recovery of specific waste components, reuse of certain wastes, to select appropriate method for waste disposal, by product development, suitability of a waste as a resource for manufacturing new products and to extract maximum energy and fertilizer value from them. For example, "Garbage" which comprises of biodegradable waste can be a useful source of manure as it can be subjected to composting and can also serve as a raw material for biogas generation.

Characterization of solid wastes is done on the basis of:

- Proximate analysis;
- Ultimate analysis; and
- Calorific value.

Proximate analysis involves determination of parameters like moisture content (free and inherent), volatile matter, ash content, fixed carbon and total carbon. Ultimate analysis involves elemental analysis for carbon, hydrogen, nitrogen, sulphur and oxygen. Calorific

value can be determined through bomb calorimeter. Characterization of waste is an important step, which helps in determining the nature of its utilization.

The waste characteristics like bulk density, viscosity, compaction behaviour, acidity, calorific value, moisture, volatile matter, ash and fixed carbon, are explained briefly in Table 4.1.

Table 4.1: Characteristics of Waste

Bulk Density	:	Bulk density is the weight of a unit volume of a material. It is expressed in grams per cubic centimeter. The bulk density of most solid wastes is considerably lower than the ultimate density of their components. The low initial density and poor compaction characteristics of solid wastes contribute to the high cost of collection and transportation.
Compaction Characteristics	:	Compaction is required to reduce transportation costs and the disposal space. Densification of biomass is important for combustion and gasification process. Moisture affects compaction characteristics.
Viscosity	:	Viscosity is a measure of the fluid resistance to shear when the fluid is in motion. The viscosity decreases with temperature.
Acidity	:	It is important to know the pH of the liquid or semi-solid wastes as strongly acidic or basic waste require special attention in handling, storage and incineration. Strongly acidic wastes with pH less than 3.0 may be reactive and corrosive.
Calorific Value	:	Calorific value of a material is defined as the amount of heat released from combustion of a unit weight of a substance.
Moisture	:	Moisture content of solid wastes can be estimated by drying them at 104-110°C for 24 hours and then measuring the difference in weight. It is important to know the moisture content of the wastes before subjecting it to any treatment and disposal facility. Moisture affects the burning quality, composting and fermentation property of the wastes.
Volatile Matter	:	Volatile matter is estimated by heating the material in a furnace at 600°C for about 10 minutes. The material is heated in the absence of air to prevent oxidation and the volatile material such as oils and other chemical compounds volatize to gas or vapour form.
Ash	:	Complete combustion of the material results in the production of ash. It is important to know the elemental composition of the ash for its suitable applications and disposal.
Fixed Carbon	:	Fixed carbon is that portion of the solid waste that is left after driving off the moisture and volatile matter excluding ash. The fixed carbon content is calculated as follows: Fixed carbon (%) = 100 – (moisture % + volatile matter %) Total carbon = Volatile matter + Fixed carbon

Check Your Progress 1

1) List the various sources of solid waste generation along with examples.

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2) What is the importance of characterizing wastes?

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4.3 PRINCIPLES OF WASTE MANAGEMENT

Waste management involves effective and efficient management of the different types of wastes, from its generation, collection, transportation, storage and treatment to its final disposal; in such a way that it causes no threat to the environment in terms of health and safety and also ensures appropriate recovery, reuse and recycle of the materials wherever possible. Waste management is, therefore, an integrated process. The process differs for different categories of wastes. Waste management is often confused with waste disposal but, it is much more intricate, involving careful planning and handling at each of the above-mentioned stages. It involves the use of latest technology for extracting the best, whatever possible, from the waste.

Let us now discuss in detail the various steps involved in waste management.

4.3.1 Collection and Segregation

Collection

Door-to-door collection of waste is a common practice in countries of South East Asia and is done through privately hired scavenging staff. This system is quiet efficient since the housekeeper ensures that the waste is prepared for collection everyday. This collected waste is then dumped at a municipal dust bin, made to cater to the need of individual localities. These dust bins are often flooded with stray animals (viz., dogs, pigs, cows, etc.) and are often mis-managed leading to overflowing of waste into streets and adjoining areas. The air in this area often stinks making it difficult for the nearby residents as well as passers-by. It often creates unsightly and unhygienic conditions. The waste from these dust bins is collected by municipal trucks and disposed off to a landfill site.

Segregation

Apart from domestic waste, commercial waste from shops and market complexes is also managed in a similar fashion. Besides, there is also an informal sector which consists of individuals and groups of waste pickers, dealers and wholesalers selling solid wastes as raw materials to material recovery units.

Unlike solid waste, liquid wastes also have their origin from domestic, commercial and industrial sectors. While liquid wastes from domestic and commercial sectors are disposed off through closed or open channels into municipal drains, industrial liquid waste needs to be properly treated in specially built treatment plants before they are discharged into any river or natural streams. The objective of treating the industrial waste before discharge is to make it chemically inert, pathogen free and safe for nature to recycle and recharge it.

Mixing of industrial wastewater with municipal sewage drains, although strictly prohibited, has sadly become common practice. Segregation is the process of separating the various components in the waste. It has been explained that the characteristics of waste to a very large extent depend upon the source from where waste is produced and to a considerable extent is influenced by the process. In simple terms, industrial waste consists of chemicals and metallic parts, largely non-biodegradable. The domestic waste contains a mixture of biodegradable and non-biodegradable wastes. Biodegradable wastes are those waste which originate from life forms. Examples of biodegradable wastes include food wastes, wastes produced in the vegetable market yard, paper, clothes, rags, dead animals, etc. The non-biodegradable wastes include metal cans, plastic wares, glass wares, ceramics, etc.

It stands to reason that the time taken for degradation will depend on the characteristics of the waste, some very short and some very long. Generally speaking, more complex wastes (that is admixture of several types of wastes), compact, dense or solid wastes, large volume of wastes all take longer time to undergo degradation. The objective of segregation is to separate the various kinds of wastes so that appropriate treatment can be given to each type separately and thus hasten the degradation process. The other objectives are to separate the reusable and non-usable, recyclable from non-recyclable. Segregation is best carried out at the time of collection, but can be carried out at subsequent stages also. A chart showing segregation of waste helps in recycling waste into material is provided in Fig. 4.2.

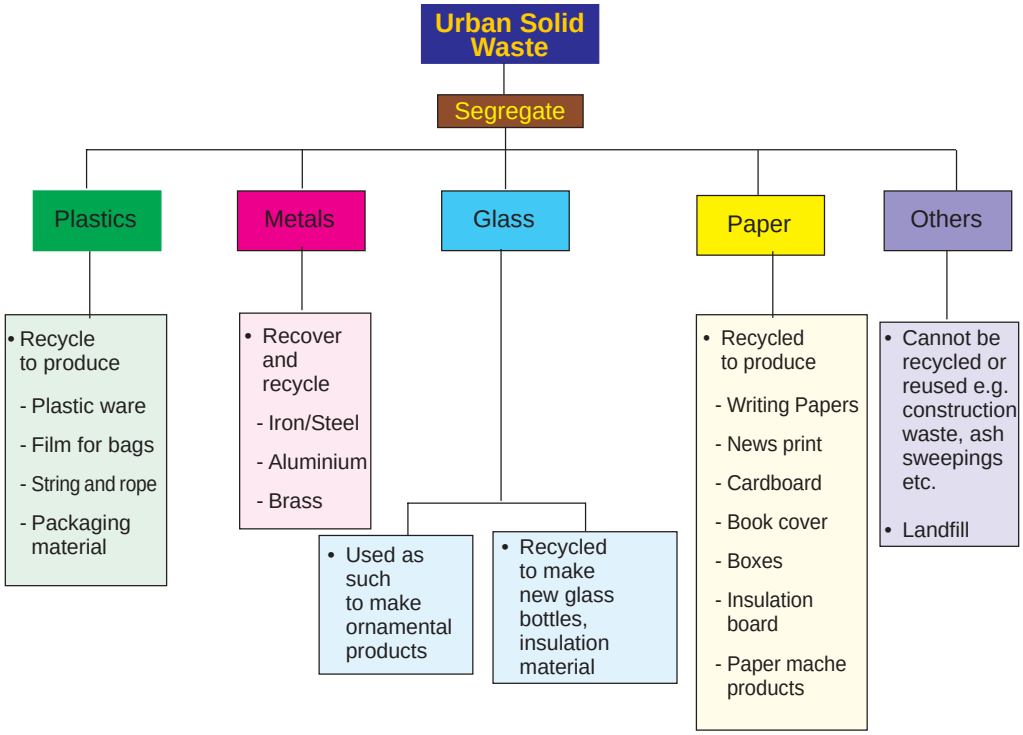

Fig. 4.2: Chart showing how segregation of wastes helps in recycling wastes into useful material

4.3.2 Recycle, Recovery and Reuse

Recycle: Recycling is another important waste disposal method. Here some of the waste products are used as raw materials to produce either similar materials or other materials of daily use. Broken glass pieces are used by the glass factory to produce new glass products. Similarly waste paper is recycled to produce paper, plastic wastes are recycled to produce plastic wares and so on. Sometimes in the recycling process many waste materials are combined, e.g., rags are also used in the manufacture of paper. Recycling should be encouraged as it is an efficient economical method of waste disposal for the finished product is marketable while the raw material used is almost free. You can see some examples of recycling in Fig. 4.3.

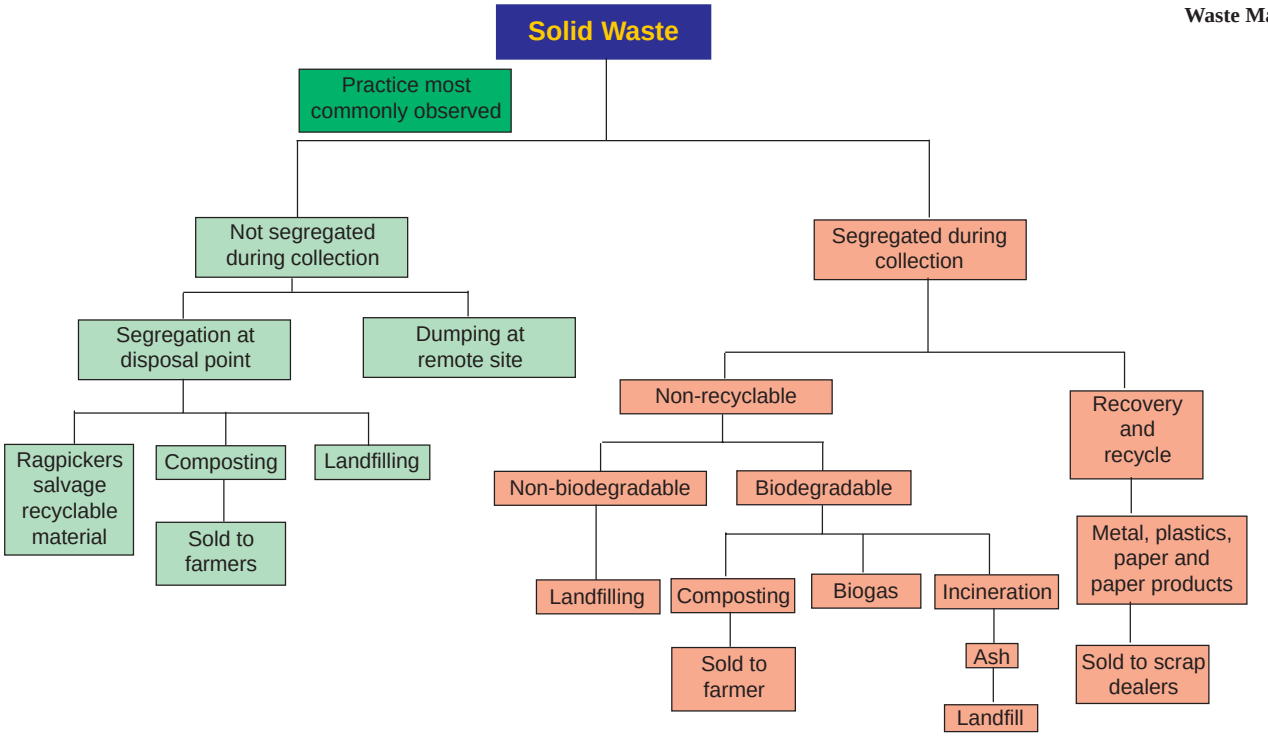

Fig. 4.3: Management of solid wastes

Composting

In 1985, Maharashtra Agricultural Bioteks was formed and established a small plant to manufacture vermicompost from agricultural waste. The organization currently produces 5,000 tons of vermicompost annually. Its real achievement, however, has been in raising awareness among farmers, researchers and policy makers in India about regenerative food production methods. The group is directly responsible for 2,000 farmers and horticulturists adopting vermicomposting. These converts have begun secondary dissemination of the principles they were taught. Nearly 1,000 farmers have reduced their use of chemical fertilizers by 90 per cent by using vermicompost as a soil amendment for growing grapes, pomegranates and bananas. Similar work is underway on mangoes, cashews, coconuts, oranges, limes, strawberries and various vegetable crops.

The organization has devised methods to convert biodegradable industrial waste like pulp waste from paper mills and filter cake and liquid effluent from sugar factories into vermicompost. These wastes are commonly regarded as pollutants, but three facilities are already producing 30 tons of vermicompost each month from this waste.

Through the simple act of eating, earthworms promote bacterial growth, enhance soil structure and hasten the decomposition of organic matter. However, due to different feeding habits, not all earthworms are suitable for vermiculture. Earthworms are divided into two groups — humus formers and humus feeders. The first group dwell on the surface and feed on nearly 90 per cent fresh organic materials and 10 per cent soil. They are generally red in colour, have a flat tail and are also called epegic or detritivorous worms. It is these worms that are harnessed for vermicomposting. The second group, the humus feeders, is deep burrowing worms that are useful in making the soil porous and mixing and distributing humus through the soil.

There is confusion between the terms reuse and recycle, they are used with the same meaning. Reuse as explained is using the material for the same purpose for which it was originally manufactured, a syringe used for drawing blood or for giving injection, bottles and tins used as containers are used again for the same purpose. On the other

hand, recycling involves using the material to remanufacture either similar product or some other product. For example broken glass syringes can be used for manufacturing new syringes or glass containers. Plastic wastes can be used for the manufacture of cheap plastic household items and so on. Thus recycling is different from reuse.

Recovery: Recovery is similar to recycling but usually restricted for recovering metals and expensive materials which goes in the waste. One good example of recovery is the recovery of silver from the wash fluids from the photo studio. Goldsmiths always recover gold from the shop sweepings. Magnetic recovery systems are used to recover ferrous materials in the domestic and city wastes. The recovered materials generally are used as raw materials.

Reuse: Wastes can be classified in yet another way, namely, reusable and not reusable. Glass bottles and metal containers are good examples of reusable waste product. We are familiar with hair oil bottles, medicine bottles and such other products which are marketed in glass bottles, when empty, are washed and used to store some other materials. Similarly milk powder tins, edible oil tins are also used. Appropriate reuse of reusable waste is desirable as it can effectively reduce the volume of waste for disposal. Those articles which are labeled disposable and are intended for single use (e.g. disposable syringes, infusion sets, etc.) should never be reused.

4.3.3 Transportation and Disposal

Solid waste is transported in corporation trucks which goes around in different parts of the town and collect refuse or garbage from community bins. This activity usually takes place in the day time and creates nuisance for the commuters and pedestrians as these trucks emit offensive stench all along the route from which they pass. While in big cities these trucks cover the waste to prevent unsightly view, in many towns the trucks or carts do not cover the waste thus creating a double nuisance of obnoxious odours as well as unsightly view. Many ill managed trucks often go dropping the waste all along the route from which they pass.

This waste transportation problem can be prevented by some simple steps:

i) The collection and transportation of waste by corporation trucks should be done at night time preferably after mid-night.

ii) Trucks should be designed in such a manner that they are air tight so that neither offensive smell is emitted nor is there any dropping of waste while transportation. Collection and transportation of waste in the night time will prevent unhygienic and unsightly experiences by the commuters and local people. It would also ensure speedy transportation of waste to disposal site due to absence of traffic jams. Prior to disposal, waste material needs to be treated according to its characteristics in order to hasten the degradation process.

It was stated early in this unit that an important step in the waste management is the waste treatment. The aim of treatment is to “transform” the waste so that it loses its waste characteristics, and either becomes a useful product for some other purpose or it loses its infectious or toxic character and becomes safe for life forms and environment. That is, at the end of treatment, the waste is no longer capable of creating any problem. Obviously this generalized statement is a simple explanation of complex combination of physical and chemical action.

Nearly 75-80 per cent of all collected residential and commercial solid wastes are sent to open dumps. Less than 10 per cent is buried in sanitary landfills. A small but locally significant quantity is even dumped in nearby waste bodies. The reminder is incinerated to get rid of waste easily and immediately. Some of the common disposal methods include:

i) **Open Dumping:** This is the most common method of solid waste disposal. The collected refuse is dumped in open areas be it roadside, residential areas, parks, etc. Open dumps produce health and air pollution problems and are not an acceptable method of disposal. They cause public health problems by encouraging the growth of flies, rats, cockroaches, mosquitoes and attract birds and other animals. This in turn leads to typhoid, cholera, plague, dengue and other diseases.

ii) **Sanitary Landfills:** A method of disposing of refuse on land without creating nuisance or hazard to public health and safety, by utilizing principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume and to cover it with a layer of earth at the end of each day. When properly run, a sanitary landfill is odourless, smokeless and ratless. The sanitary landfill may be spread over the land area or a trench. In a well run sanitary landfill operation the soil covering has been deep enough to keep out rodents and flies and it prevents the escape of noxious odours. A carefully sited landfill should not be near a community groundwater reservoir as rain water may leach pollutants into the water supply.

iii) **Incineration:** Incineration involves the burning of solid wastes. Air pollution can be a major problem, because of emissions of highly toxic pollutants into the atmosphere during the burning process. The important factors to be observed during incineration are: (i) Never burn plastics, nor wastes contaminated with heavy metals (like mercury or lead), (ii) Maintenance of a temperature greater than 850°C to burn up not only the waste but also the smoke produced, and (iii) Ensure the presence of grit extractors to filter the finely divided dust particles, impeding them from discharging into the atmosphere.

iv) **Pyrolysis:** Pyrolysis unlike incineration involves heating the wastes at very high temperatures but in the absence of oxygen in order to produce useful chemicals and combustible gases. Thus it is an energy recovery technique as the obtained products are petroleum like mixture of gases and liquid which can be burned as fuel.

Check Your Progress 2

1) What is the importance of segregation?

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2) What precautions one must observe while reusing articles salvaged from waste?

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3) What is recycling of waste? How it is different from reuse?

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4) Which is the most unhygienic method of waste disposal?

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5) Which waste disposal method gives useful energy rich products?

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4.4 WASTE DISPOSAL VERSUS WASTE MANAGEMENT

These two terms are used commonly with the same meaning. However, they are different. Waste disposal simply means to "get rid off" the waste. It does not matter what happens to the waste, or what problem it creates at the new place. On the other hand, waste management is a comprehensive procedure where every step from waste generation to the final disposal is planned action. One crude way of describing waste management is that the waste is so handled that it does not complicate the existing problem. Waste management also ensures that the operating cost is minimized and every effort is made to generate new resources from waste.

In developing countries the most common practice of waste processing is uncontrolled open dumping/burning. This method involves little capital investment and has low operational costs.

However, these uncontrolled dumps have a negative effect on the landscape and surrounding environment. If combustion occurs regularly toxic gases are emitted. Also waste and soil pollution occur.

Let us consider a very common example; the uncooked waste food that comes from the kitchen is thrown along with other household wastes. These are then dumped by the city sanitation department or by the household itself at some distance away from

Fig. 4.4: Life cycle of waste

the city or the house and allowed to degrade by itself. The process gives an unsightly mound of rotting garbage, emitting offensive stench. It also becomes the abode for vermin who are in search of food, and a breeding place for flies.

Consider an alternate way of treating the same waste. Since these are food waste, they can be fed to the animals. Alternatively it may be buried in the ground in shallow trenches where after a short period of a few months, it would become biomass, which is something like manure. Yet another alternative is to put it in the biogas generator along with other materials for the generation of bio-gas. Only some common examples are stated here, there are several other methods that are beyond the scope of present discussion. The point that is being made is that in all the three methods, the waste is effectively used as a resource, viz., as an animal feed, soil nutrient and bio-gas generation. In each one, the final outcome is clean, efficient sanitary final disposal of the waste. What is the end result of the waste management? Firstly, the waste is disposed off in a sanitary manner so that neither the process nor the end products are offensive and unsightly. It is also important that the process or the procedure is cost effective. Secondly, one should be able to recover the resources to the maximum be it recyclable material, biogas for energy or manure for use as organic fertilizer. In fact a good waste management system, in addition to paying for itself is also capable of giving profits. Lastly, at the end of the process, nothing offensive is left or no new environmental or health problems are created. That is, the waste disposal technique should not cause pollution of air, water, or soil and should not become a health hazard for the life forms.

Check Your Progress 3

1) What is waste management?

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2) How does it differ from waste disposal?

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3) Why is incineration a hazardous practice?

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4.5 LET US SUM UP

Wastes are generated because of the normal life process and also because of development related human activities. The waste is generated because of the human activities is complex and large in volume. It is the natural decomposition process, which finally disposes the waste and allows it to enter the nature's recycling process. We can augment the process of the waste disposal by segregating the waste into biodegradable and non-biodegradable and thus reduce the quantity of waste, which will be subjected to natural decomposition process, at the same time putting the non-biodegradable waste to profit oriented uses such as recycling. Useful products such as biogas and organic fertilizer can be obtained by appropriate management of biodegradable waste. The integrated process of sanitary disposal of waste along with generation of resources from the waste is the objective of waste management.

4.6 KEY WORDS

Biodegradation : Decomposition due to the action by micro-organisms

Environmental Sanitation : The control of all those factors in the man's environment which exercise or may exercise a deleterious effect on his physical development, health and survival

Enzymes : An organic catalyst produced by the living cells but capable of acting independently of the cells producing them. All enzymes are proteins by nature

Night Soil : Human excreta

Pathogens : Microbes which cause disease

Sanitary	**:**	Promoting or pertaining to conditions improving health
Sewage	**:**	Human excreta, liquid waste together with street washing, industrial waste and storm water
Soil Bacteria	**:**	Bacteria which are normally found in soil
Street Washing	**:**	Waste materials from street surface, sidewalks, etc.

4.7 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) Sources of solid waste generation are:

   i) **Municipal:** Street sweepings, sewage treatment plant waste

   ii) **Domestic:** Garbage, rubbish

   iii) **Commercial:** Paper, plastic, cardboard boxes, packaging material

   iv) **Industrial:** Chemicals, rags, oil

   v) **Mining:** Tailings, ashes

   vi) **Agriculture:** Crop residues, farm animal excreta

   vii) **Hospital:** Cotton swabs, anatomical and pathological waste, sharps

2) Characterization of wastes is important for not only knowing the type of waste but also for developing proper waste management system. It is important to know about the wastes potential for recovery, whether it is suitable for reuse or whether it can be recycled. After knowing the characteristics of wastes we can subject them to the most appropriate disposal method, which would help in not only hygienic and safe disposal but also in recovering energy and fertilizer value.

Check Your Progress 2

1) Segregation helps to sort out different components of waste so that appropriate treatment can be given to each type and thus hasten the degradation process. It also reduces the volume of the waste by separating out the reusable and recyclable parts.

2) Reuse of articles of waste should not be done for the same purpose for which the article was initially made. Articles, which are labeled disposable and are intended for single use should never be used.

3) Recycling of waste is the use of waste as raw material for the production of similar or some new product e.g. glass.

   In reuse, the material is used as such e.g. a container is used as container.

4) Open dumping

5) Pyrolysis

Check Your Progress 3

1) Waste management is the comprehensive procedure of planned action for all steps involved from waste generation to its final disposal. The aim of waste management is that apart from being the “most economically viable” solution, it will ensure that no new problems are created while solving the existing problem.

2) Waste disposal is one step in waste management, usually the end step. When the term is used alone (not as a part of waste management), it does not cover the other possible environmental pollution that may result.

3) Burning plastics, and notably PVC containing plastics will allow highly toxic molecules to form dioxins and furans. These chemicals are amongst the most dangerous. Incinerators can also discourage segregation and turn, with time, into dump sites where all is finally burnt. Burning mercury containing wastes (from broken thermometers, for example) is a health risk, as mercury will evaporate and fall back, polluting water, the soil/plants.

4.8 FURTHER READINGS

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