Waste Generation & Management

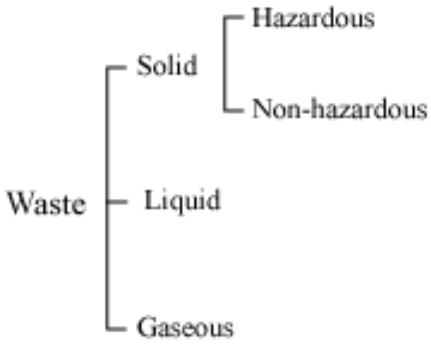
Waste Management

The existence of human beings depends upon the environment. Human interaction with the environment has resulted in many environmental changes. Let us learn about the changes and study the methods of controlling them.

Wastes generated by human beings have affected the environment. **What are wastes? How do they affect the environment?**

Waste, is any unwanted, unused, and rejected material. Waste can be categorized according to its source – municipal, agricultural, industrial etc.

In general, wastes are of three types – **liquid, gaseous, and solid.**



1. Liquid waste: It includes sewage, contaminated ground water, and industrial wastewater. These are transported through pipes or in containers. This wastewater has to be treated, before discharging it into the water sources. For example, wastewater from our sewage pipe reaches the water treatment plant.

This water is then purified using various techniques such as filtration, deionising, and water softening. This water is then released into streams, rivers, and other water bodies.

2. Gaseous waste: It includes gases produced by combustion and industrial processes. These gaseous wastes are responsible for global warming, ozone depletion etc.

Global warming may be defined as an increase in the average temperature of the Earth's surface because of greenhouse gases.

3. Solid waste: It refers to the waste that does not flow like gas or water. It includes paper, food waste, plastic, glass, metal etc. A lot of solid waste is generated from homes, offices, hospitals, schools etc. It is collected and disposed by the municipality.

Solid waste can be categorized broadly as:

- Domestic waste: Waste coming from a common household. Examples, kitchen wastes, plastics, papers, glass, etc
- Industrial waste: Waste coming out from factories and other industries. Examples, wash-offs containing harmful chemicals and other substances, fly-ash, left overs from mining operations, etc
- Agricultural wastes: Include agricultural left-overs, bagasse, pesticides, fertilizers, animals wastes, etc
- Municipal wastes: Include household discharge of excreta, kitchen washings, sewage from public toilets, hospitals, hotels, offices, etc
- *e*-Waste (Electronic wastes): Consists of discarded electrical appliances and their parts, such as TVs, radios, refrigerators, mobile phones, batteries, etc. The *e*-waste is a serious health hazard as most of the times it contains harmful substances such as lead, cadmium and mercury.

On the basis of their degradability, solid wastes can be categorised as biodegradable and non-biodegradable wastes as well.

Management of solid wastes

Waste management includes collection, transport, processing, and disposal of waste materials.

Measures for waste management

- Separate bins (blue and green) can be used for disposing non-biodegradable and biodegradable wastes respectively.
- Reduction in the use of non-biodegradable products like plastic.
- Separation of material, which can be reused or recycled.

Principles of Solid waste management

The 7 principles of waste management are:

- Reuse: The used materials should be reused for some other purposes.
- Refuse: The materials made up of non-biodegradable substances like plastic etc. should be avoided.
- Recycle: The waste materials should be converted into some useful material.

- Rethink: Rethinking about reusing a product or article.

- Reduce: The use of resources should be limited in order to reduce the waste production.

- Research: A research regarding the reuse of materials that are temporarily out of use should be carried out.

- Regulation and public awareness: The people should be made aware of the laws and rules related to waste management.

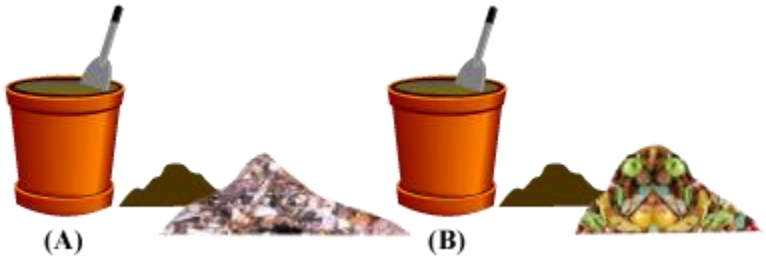
How can we reduce waste production?

Use of recyclable material reduces the generation of wastes to a large extent. Reduced usage of materials, reusing of materials, and using recycled material will reduce the generation of wastes.

Using refills, using empty jars instead of purchasing new ones, using rewashed material instead of disposable one, composting etc. are some measures which can reduce the generation of wastes. **Can you think of some more?**

Biodegradable and Non-Biodegradable Substances

Garbage collection



Collect garbage from your house before it is thrown into the dustbin. Separate the garbage into two groups.

In one group, include wastes such as polythene bags, broken glass, aluminium foil, metal pieces etc. In the second group, include only kitchen wastes like peels of fruits and vegetables, waste food, newspaper, and garden wastes like dead leaves and other plant parts.

Bury this material separately in two pots and label them as **A** and **B**. Remove the top soil after one week, and check the status of the garbage. Then, approximately after four weeks, check the condition of the garbage again.

Observation

It will be observed that the waste in pot **B** decomposes, while the waste in pot **A** does not decompose.

The waste in pot **B** does not rot completely. However, it gives a bad odour after one week. But, after four weeks the waste rots almost completely and becomes odourless. It no longer has the original material and is now dark brown in colour.

What is the reason for making this observation? What is the difference between the waste kept in pot A and waste kept in pot B?

The difference is that the waste kept in pot **A** is non-biodegradable, while the waste kept in pot **B** is biodegradable. **But what does this mean?** Let us find out.

Biodegradable substances: It includes substances mainly from plant and animal sources, which can be broken down by living organisms.

Non-biodegradable substances: It includes substances such as plastic, metal, broken glass etc., which cannot be broken down by living organisms.

Micro-organisms in soil break down (or decompose) the organic matter of pot **B** and convert it into useful compost.

This compost is very useful, as it adds nutrients to soil and increases the soil fertility. Thus, it helps in enhancing the growth of plants.

Can you tell why only the waste present in pot B got decomposed?

The waste is food for micro-organisms.

When we eat food, it is digested by various enzymes present in our body. However, these enzymes cannot digest everything. This is why we cannot eat stone, plastic, or other such material.

Micro-organisms make use of enzymes to digest the wastes (organic matter). However, these micro-organisms cannot digest certain substances, which we classify as non-biodegradable substances.

Wastes: Are They Useful or Harmful?

A short story

Rajat and Sanjay are friends.

Sanjay is a very naughty child. He always made paper-planes using paper from his note books. A lot of waste paper was always found around him. He did not care to keep his surroundings clean and often threw things around.

Rajat is very fond of creating things out of waste materials. Some of the things that he has created using waste materials are files from old charts, greeting cards using dried flowers, flowers created from pencil shavings, floor mats using old clothes, baskets and pen-stands from old poly bags etc.

You can see that Sanjay and Rajat are very different in their interests! Who would you like to be?

We know now, that managing waste is a complex issue and therefore we should try and avoid generating unnecessary wastes. Rajat used old materials to create new and useful things. This also helped to reduce the wastes. On the other hand, Sanjay's ways increased the wastes.

We need to understand that wastes are harmful, therefore, finding methods to reduce waste generation and reusing the wastes is in the interest of the environment.

Let us explore and learn

How do we reduce waste generation?

Actions	Waste generated	Methods to minimize wastes generated
Shopping	Packaged cartons, Plastic bags	Carrying our own bags for shopping would reduce the usage of plastics.
Cleaning	Tissue paper	Using handkerchiefs would reduce the use of paper
Using plastic-coated paper to cover books	Plastic wastes	Using normal paper to reduce the generation of plastic wastes

Can you think of more activities that generate wastes?

You will observe that plastic and paper are common wastes generated everyday.

Let us understand the methods that can be adopted to reduce paper and plastic wastes

Each day we see that a lot of paper is used. Did you know that you too can recycle paper and reduce paper wastes?

Recycling is the reprocessing of used or wasted materials, to make new and usable things out of those waste materials.

Tear old newspapers into small pieces and soak in water for a day. Mix well to make a thick paste. Spread the paste over a framed wire mesh in a uniform layer. Wait for the water to drain out. Extra newspaper or cloth can also be used to soak the water. Carefully remove the layer from the mesh and spread to dry in the Sun. Paperweights can be placed to avoid curling up while drying.

Dried flowers can be used to decorate. Turmeric or other vegetable colours may also be used.

Greeting cards, photo frames, papier-mâchè objects, cardboards, etc are a few materials that are prepared by recycling paper.

Papier-mâchè is a material prepared by soaking old paper. It can be molded into different objects. Can you think of making some things from this material?

Did you know that using both sides of the paper rather than a single side will reduce the utilization of paper by half?

Reducing plastic wastes

Plastic is a very useful substance which we commonly use. Various types of substances are made of plastic. Some of the items made of plastic are toys, shoes, bags, pens, combs, tooth brushes, buckets, bottles, water pipes etc. Parts of radio and television sets, refrigerators, and automobiles such as buses, cars, and scooters are made of plastics.

What happens when plastic materials become old? You may have thrown away the wrappers of chocolates and toys. What do you think happens to them?

Did you know that?

- Plastics can choke up the sewage system, resulting in the overflowing of drains.
- Street animals may consume this plastic while trying to eat the eatable things that are wrapped in plastic bags. Doing so may even result in their deaths.
- Plastics do not decompose easily and remain in the environment, thereby causing pollution.
- Plastic bags used by the shop keepers release poisonous substances; when food is wrapped in such bags, it may cause many health problems.
- On being burnt, plastics release polluting gases that cause respiratory problems.
- Knowing that plastics cause a lot of environmental and health related problems, the Government of India has laid down certain rules governing the use of plastic bags and the recycling of plastic products.

Methods to reduce the wastes generated from plastic:

- Reusing shopping bags.

- Proper disposal of plastic wastes rather than burning them.
- Using paper bags instead of plastic bags for shopping, storage etc.

Thus, we understand that wastes are harmful. We therefore, need to follow the various methods in order to reduce the generation of wastes, and propagate the recycling of paper and plastic. This would benefit the environment and make it a more beautiful place for all to live.

Methods of Safe Disposal of Waste

We all know that solid waste management is very important to make our environment pollution free and maintain a good social health. Improper management of waste can cause serious problems of pollution and may pose several health hazards to all living beings.

Some methods for the management of solid wastes are:

1. Separation of waste: All the solid waste is collected and disposed by the municipality. Solid waste can be categorized into two types - **biodegradable and non-biodegradable.**

Biodegradable substances include substances mainly from plant and animal sources, which can be broken down by living organisms.

Non-biodegradable substances include substances such as plastic, metal, broken glass, etc., which cannot be broken down by living organisms. They accumulate in the environment and are harmful to the environment. Therefore, the generation of such wastes should be reduced.

Biodegradable solid waste can be separated from non-biodegradable ones so that they can be treated appropriately.

Different coloured dustbins represent the types of materials that they cater to. Green-coloured dustbins are meant for garbage materials that are generated from kitchens, plants and animals, i.e. biodegradable. These materials decompose and, therefore, can be easily mixed with soils, thereby increasing the fertility of the soil. Blue-coloured dustbins contain materials that remain in the environment and, therefore, need to be recycled, i.e. non-biodegradable.

Biodegradable waste

Non-biodegradable waste

2. Composting: Solid waste that is obtained from plants and animals,like vegetable peels, egg shells, dry leaves, etc., when mixed with soil in a pit gets converted into a useful substance called **manure or compost.** This process is known as **composting**. Compost is very useful, as it adds nutrients to the soil and increases its fertility. Thus, it helps in enhancing the growth of plants.

3. Vermicomposting: It is a method of preparing compost in which earthworms are mixed with soil in a pit, along with the waste materials that are obtained from plants and animals. Earthworms cannot survive in very cold or very hot temperatures. Therefore, the compost is not prepared in direct sunlight and too much water is not used.

After the earthworms are introduced into the pit, the composting material is covered to provide protection from sunlight, heavy rainfall and animals. Gunny bags, newspapers, cloth or a layer of grass can be used for this purpose. After three or four weeks, the soil turns dark, moist and loose, and is ready to be used. This material is termed compost.

Nowadays, vermin processing toilet facilities have been provided by the government. **Vermin processing toilet** is a type of toilet in which human excreta is treated through earthworms. Earthworms convert human excreta into **vermin cake**, which is a good variety of natural manure.

4. Landfills: A landfill is a specially designed facility for the burial of municipal solid waste. Garbage vans carry the wastes to areas on the outskirts of the city and dump them. Such regions are called **landfills**. Landfills are established on abandoned or unused lands where wastes are disposed and buried under the soil.

A garbage dump is used as landfill. Leaching of waste can be prevented by placing either clay or plastic liner in the landfill before dumping the waste into it. After a landfill is filled with garbage, it is covered with soil and converted into a playground, golf course or park. For about 20 years, no construction activity is carried out on it.

5. Pyrolysis: It is another suitable municipal method for the solid waste management.It is the chemical decomposition of solid waste by **heat**. The end products of pyrolysis are used to produce **steam** and **electricity**. This process is usually carried out under high pressure.

6. Incineration: It is a process of solid waste disposal by burning at very high temperatures. When burnt, the weight and volume of wastes are reduced and the toxic substances present in it are rendered into less toxic or non-toxic wastes.

The left over product contains ash that can be then deposited into landfills. The heat released during burning can also be used for generating electricity. However, some precautions must be taken with incineration process, such as

- Incinerators should be installed away from residential areas.
- They must be equipped with pollution control devices.
- Incineration should be carried out at very high temperatures.

Drainage

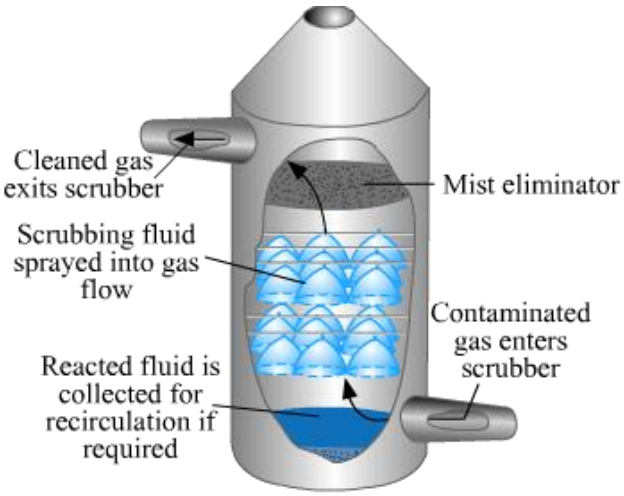
All kinds of fluid wastes other than sewage are usually disposed off into water bodies. They need proper drain system for this purpose. The industrial and municipal waste waters are first treated in effluent treatment plants before disposal.

It is required to remove all the harmful substances from these waters so that no harm is caused to the life forms present in the water bodies in which these waste waters are being disposed. This treatment is done in three parts:

- **Primary treatment:** Large debris are separated by sedimentation in tanks.
- **Secondary treatment:** The waste water is then treated with the help of microbes. The waste water is pumped into large ponds where different microorganisms (bacteria, algae, etc) oxidise the organic matter present in these water. In the process CO_2 is released and a solid precipitated material, **sludge**, is produced that can be used as manure.
- **Tertiary treatment:** It involves removal of dissolved chemicals, pathogens, etc. Afterwards the waste water is either discharged into the water bodies or is used for irrigation.

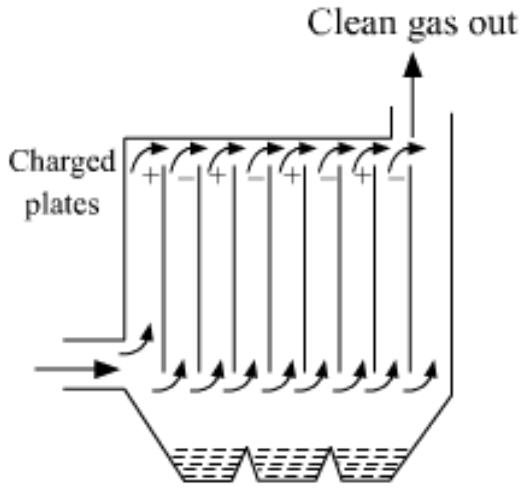
Removal of Air Pollutants

- **Through Scrubbers:** These are special devices used to remove gaseous and particulate air pollutants. The polluted air is made to pass through a wet packing material. While passing through it, the gaseous pollutants get dissolved in the wet packing and particulate matters get trapped in the same. The air then coming out of the device is hence dust-free and clean.



Scrubber

- **Through Electrostatic Precipitators:** This device is used to remove the particulate matters present in the air and consists of electrically charged plates. When polluted air is passed through the charged plates of the precipitators, the particulate matter present in it get collected on the plate carrying opposite charge. This method can remove up to 90% of the particulate matter and gives out clean air.



A plate type electrostatic precipitators