Solid Waste

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What is Solid Waste?

- Solid waste means any garbage, trash, waste tire, sludge from a waste treatment plant, water supply treatment plant and other discarded material, including solid, liquid, semi solid or contained gaseous material.

- Arises from human and animal activities.

- In other words, solid wastes may be defined as the organic and inorganic waste produced by various activities of the society and which have lost their value to the first user.

Introduction to solid waste management:

Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area.

Types of solid wastes.

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.

Sources and types of Solid waste

- **Residential Waste:**

Food wastes, paper, cardboard, plastics, textiles, leather, yard wastes, wood, glass, metals, ashes,

special wastes (e.g., bulky items, consumer electronics, batteries, oil, tires), and household

hazardous wastes.

- **Industrial:**

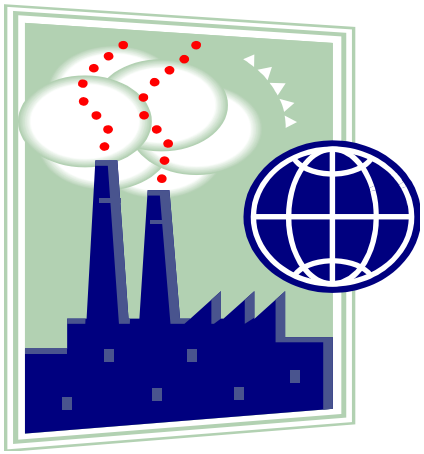
House keeping wastes, packaging, food wastes, construction and demolition materials, hazardous

wastes, ashes, special waste.

- **Commercial:** Paper, cardboard, plastics, wood, food wastes, glass, metals, special wastes, hazardous wastes.
- **Agricultural:** Spoiled food wastes, agricultural wastes, hazardous wastes (e.g., pesticides).

Sources of Wastes

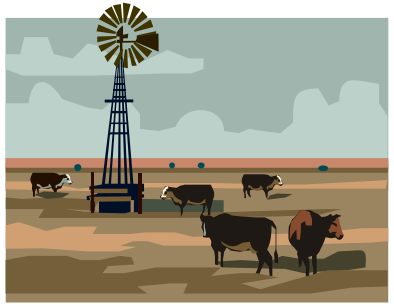
Households



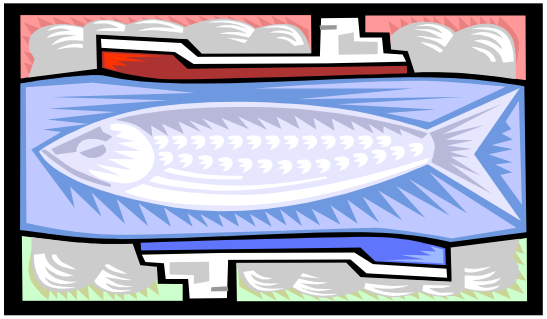
Commerce and Industry

Sources of Wastes

Agriculture



Fisheries



Types of Solid Waste

- **Municipal solid waste:** MSW consists of household waste, construction and demolition debris, sanitation residue.
- **Hazardous waste:** Industrial and hospital waste is considered as hazardous waste as they contain toxic substances.
- **Infectious waste:** Biomedical waste or hospital waste, generated during diagnosis treatment etc. Include sharps, chemical wastes, discarded medicines and human excreta etc.
- **Agricultural Waste:** is the waste produced as a result of various agricultural operations. It includes manure and other wastes from farms, poultry houses and slaughterhouses; harvest waste; fertilizer run- off from fields; pesticides that enter into water, air or soils; and salt and silt drained from fields.
- **Industrial waste:** is the waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process such as that of factories, industries, mills, and mining activities.
- **Radio Active waste:** is waste that contains radioactive material. Radioactive waste is usually a by-product of nuclear power generation and other applications of nuclear fission or nuclear technology, such as research and medicine.

Composition of Municipal Solid Waste (MSW) in India

In India the biodegradable portion dominates the bulk of Municipal Solid Waste. Generally the biodegradable portion is mainly due to food and yard waste

Source: Compendium of Environment Statistics India, 2015

Municipal Solid Waste Management

- **Municipal solid waste** (**MSW**), also called Urban Solid Waste, and is a waste type that includes predominantly household waste (domestic waste) with sometimes the addition of commercial wastes, construction and demolition debris, sanitation residue, and waste from streets collected by a municipality within a given area.
- They are in either solid or semi solid form and generally exclude industrial hazardous wastes.

  MSW can be broadly categorized into five broad categories as-
- **Biodegradable waste:** food and kitchen waste, green waste (vegetables, flowers, leaves,

  fruits), paper (can also be recycled).
- **Recyclable material**: paper, glass, bottles, cans, metals, certain plastics, etc.
- **Inert waste**: construction and demolition waste, dirt, rocks, debris.
- **Composite wastes:** waste clothing, Tetra Packs, waste plastics such as toys.
- **Domestic hazardous waste** (also called "household hazardous waste")
- **Toxic waste:** medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.

Agricultural Waste and sewage sludge:

- Waste produced by agricultural activities comprise animal slurries, silage effluents, end of spray residues and tank washing following pesticide use, and empty plastic packaging.
- Sewage sludge are produced as a result of the treatment of industrial and domestic wastes.
- Animal manures and silage effluents are the main components of agricultural wastes.
- Like sewage sludge these comprise a slurry of fine grained, organic-rich particles.
- Sewage sludge may be contaminated with heavy metals, water-soluble organic chemicals, greases oils depending on the sources of effluent and efficiency of treatment.

Industrial and Mining Waste:

•Industrial process wastes encompass a very wide range of materials and may include general factory rubbish, packaging materials, organic waste, acids, alkalis and metal ferrous sludge.

•Mining waste arise as by-products of the extraction process and may include top soil, rock

and dirt and maybe contaminated with small quantities of such materials as metals and coal.

•The most important feature of industrial and mining waste is that a significant proportion is

regarded as hazardous and such requires special treatment and disposal.

Hazardous waste

- Industrial and hospital waste is considered hazardous as they may contain toxic substances. Certain types of household waste are also hazardous.
- Hazardous wastes could be highly toxic to humans, animals, and plants; are corrosive, highly inflammable, or explosive; and react when exposed to certain things e.g. gases**.**
- India generates around 7 million tonnes of hazardous wastes every year, most of which is concentrated in four states: Andhra Pradesh, Bihar, Uttar Pradesh, and Tamil Nadu.
- Household waste that can be categorized as hazardous waste include old batteries, shoe polish, paint tins, old medicines, and medicine bottles.
- Hospital waste contaminated by chemicals used in hospitals is considered hazardous. These chemicals include formaldehyde and phenols, which are used as disinfectants, and mercury, which is used in thermometers or equipment that measure blood pressure.
- Most hospitals in India do not have proper disposal facilities for these hazardous wastes.
- In the industrial sector, the major generators of hazardous waste are the metal, chemical, paper, pesticide, dye, refining, and rubber goods industries.

Radioactive Waste

- Radioactive waste arise primarily from nuclear power generation, smaller quantities are derived from military sources and a variety of uses in medical, industrial and university establishments.

Types of radioactive wastes:

Exempt waste & very low level waste

- Exempt waste and very low level waste (VLLW) contains radioactive materials at a level which is not considered harmful to people or the surrounding environment.
- It consists mainly of demolished material (such as concrete, plaster, bricks, metal, valves, piping *etc*) produced during rehabilitation or dismantling operations on nuclear industrial sites.
- Other industries, such as food processing, chemical, steel *etc* also produce VLLW as a result of the concentration of natural radioactivity present in certain minerals used in their manufacturing processes .
- The waste is therefore disposed of with domestic refuse, although countries such as France are currently developing facilities to store VLLW in specifically designed VLLW disposal facilities

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Low-level waste

- Low-level waste (LLW) is generated from hospitals and industry, as well as the nuclear fuel cycle.
- It comprises paper, rags, tools, clothing, filters *etc*, which contain small amounts of mostly short-lived radioactivity.
- It does not require shielding during handling and transport and is suitable for shallow land burial.
- To reduce its volume, it is often compacted or incinerated before disposal.
- It comprises some 90% of the volume but only 1% of the radioactivity of all radioactive waste.

Intermediate-level waste:

- Intermediate-level waste (ILW) contains higher amounts of radioactivity and some requires shielding.
- It typically comprises resins, chemical sludge and metal fuel cladding, as well as contaminated materials from reactor decommissioning.
- Smaller items and any non-solids may be solidified in concrete or bitumen for disposal. It makes up some 7% of the volume and has 4% of the radioactivity of all waste.

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High-level waste

- High-level waste (HLW) arises from the 'burning' of uranium fuel in a nuclear reactor.
- HLW contains the fission products and trans uranic elements generated in the reactor core.
- It is highly radioactive and hot, so requires cooling and shielding. It can be considered as the 'ash' from 'burning' uranium.
- HLW accounts for over 95% of the total radioactivity produced in the process of electricity generation.

Biomedical Waste

- Hospital waste is generated during the diagnosis, treatment, or immunization of human beings or animals or in research activities in these fields or in the production or testing of biological.
- It may include wastes like sharps, soiled waste, disposables, anatomical waste, cultures, discarded medicines, chemical wastes, etc.
- These are in the form of disposable syringes, swabs, bandages, body fluids, human excreta, etc.
- This waste is highly infectious and can be a serious threat to human health if not managed in a scientific and discriminate manner.
- It has been roughly estimated that of the 4 kg of waste generated in a hospital at least 1 kg would be infected.
- Surveys carried out by various agencies show that the health care establishments in India are not giving due attention to their waste management.
- After the notification of the Bio-medical Waste (Handling and Management) Rules, 1998, these establishments are slowly streamlining the process of waste segregation, collection, treatment, and disposal.
- Many of the larger hospitals have either installed the treatment facilities or are in the process of doing so.

Characteristics of Solid waste

- To effectively implement the three fundamental functions of collection, processing and disposal, solid waste must be characterized.
- Solid waste may be characterized as to their physical and chemical characteristics.
- Physical characterization useful in solid waste management are itemization of individual components, moisture content, and density.
- On the other hand, useful chemical characterization include proximate and ultimate analyses (Chemical analysis of component atomic elements) and heating value.

MOISTURE CONTENT:

- The moisture content of solid waste is important when it is used in boilers to produce steam and electricity. It is also important when solid waste is composted or subjected to anaerobic decomposition in sanitary landfills.
- To subject an organic matter to composting and anaerobic digestion the water content must be put at the optimum.

The moisture content is expressed in terms of two bases

1. Wet -------The Wet percentage moisture of solid waste is equal to the mass of moisture divided by the total wet mass of the solid.
2. Dry-------- The dry percentage moisture of solid waste is equal to the mass of

Density of solid waste

- The most important use of the knowledge of the density of solid waste is the determination of its compacted volume.
- Densities of solid waste may be expressed on an as compacted basis.
- There are two compaction ratios, such as in landfills and the compactor machine compaction ratio.
- Compactor machines are used to reduce the volume of the solid waste before final disposal.
- Compacter machines compaction ratio can vary from 2-4
- Landfill as- compacted densities can vary from 297-891 kg/m3.
- Individual components of MSW have different bulk densities and a rage of densities exists within most components.
- Within individual categories of MSW, Bulk density increases as physical irregularit decreases.
- Compaction increases density primarily by reducing irregularity.
- Some compaction occurs in piles so density tends to increases as the height of a pile increases.

Heat Value

- Heat value includes the latent heat of vaporization of the water created during combustion.

- When this heat is deducted the result is called the lower heating value.

- The heat value is roughly proportional to the percentage of waste that is combustible fraction.

- The heat values of the plastics categories are highest because of their high carbon content.

Energy Content:

•The energy content of solid waste is the heat of combustion released when the waste is burned.

There are two types of heats of combustion:

•Higher heat: Heat of vaporization of water. It is determined by bomb calorimeter. If energy values are not available, values of the higher heat of combustion may be obtained as follows:

•The heating values of carbon and sulfur are 32,851.465Kj/Kg.and 9263.37Kj/Kg.

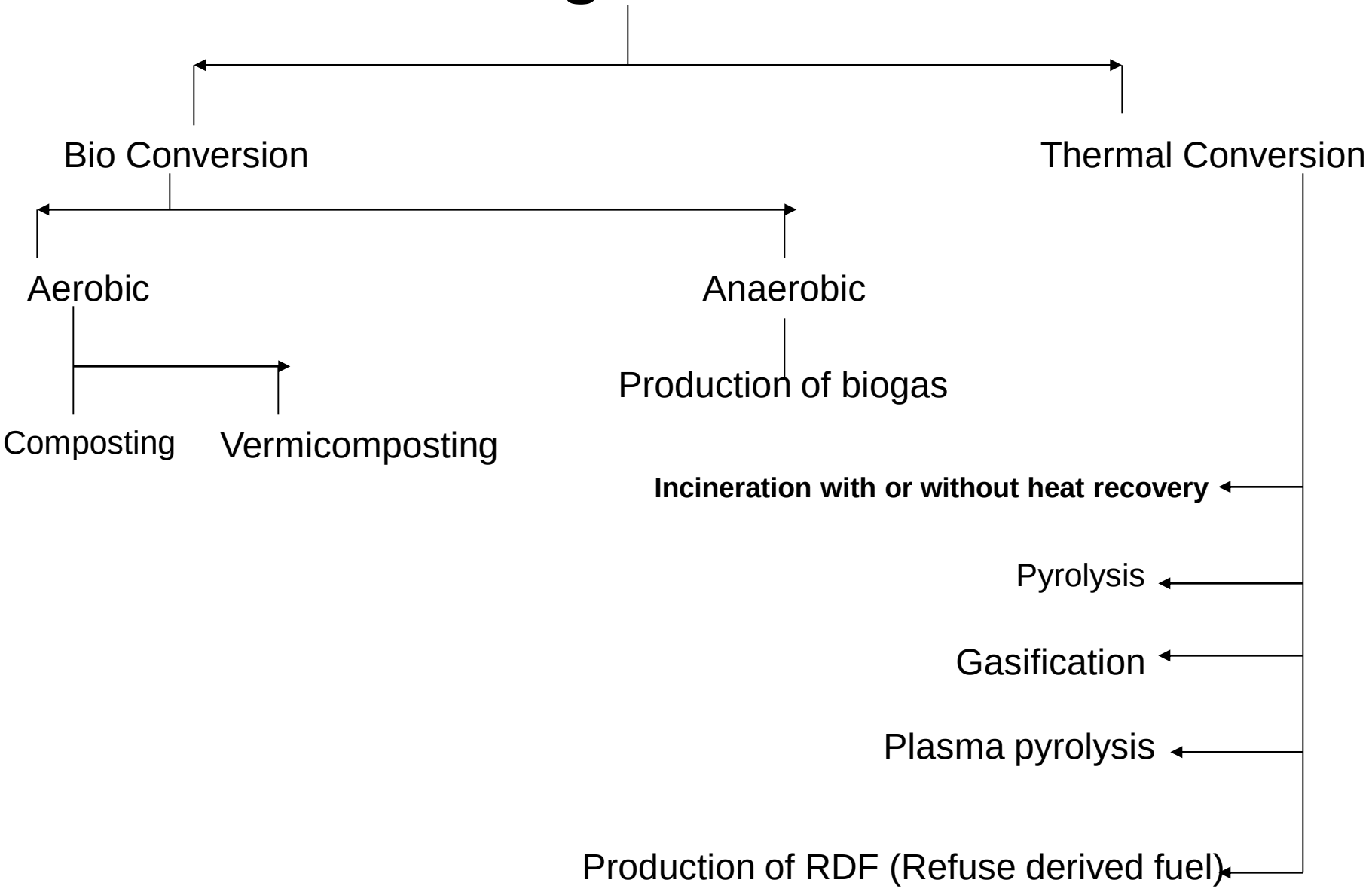
•Lower heat combustion: In practical applications the lower heat of combustion represents Net heat available in combustion reaction.

Why We Need SWM?

- With increasing urbanization and changing life styles, Indian cities now generate 8 times more solid waste than they used to in 1947.
- Generation of waste per capita increases from 1 to1.33 % per year.
- Throughout the country, more than 1/3 rd of all waste degenerated remains unclear on the streets and what is collected is dumped in in sanitary dump sites polluting ground water and degrading the environment.
- Poor waste management practices affect the health of the human.
- Solid wastes have been found to clog up drains leading to flooding.

- Impart multidimensional threats as serious health and environmental problem.
- Poorly maintained landfill sites are prone to groundwater contamination.
- Decomposition of organic materials produces different gases one of which is methane, it may cause explosions and also contributes to global warming. Some solid wastes would degrade or leach chemicals over time with long-term effects.
- Burning of waste results in air and soil pollution.
- There is an overall lack of in-country know-how to deal with the disposal of the waste.

Solid waste management-



Solid waste management also including land filling method other than these types

Thank you