

E-waste (Module:2)

E-waste:

- Basically, includes electronic or electrical goods which can no longer be used. They may contain hazardous or toxic material which cannot be disposed with other solid waste.
- It includes mobile phones, batteries, telephones, switch, socket, cable wires, computer hardware and other electronic products which are not of use.

Types of e-waste:

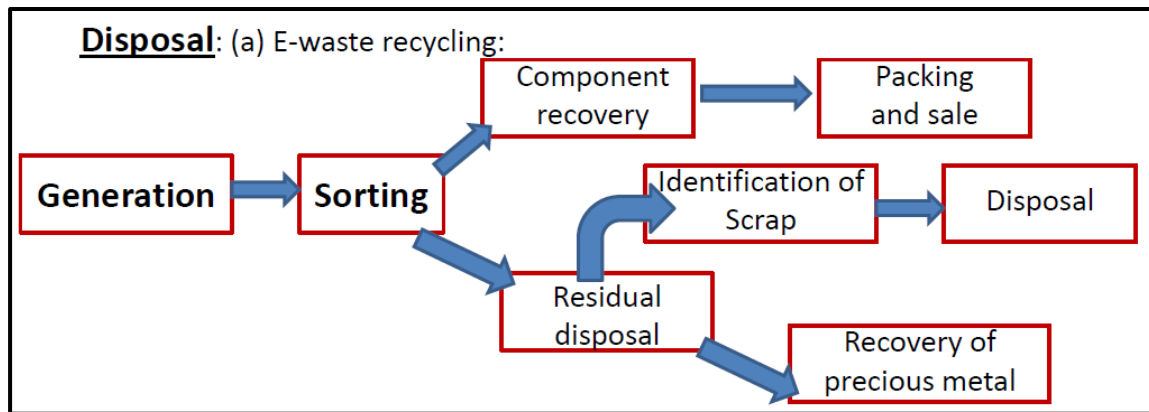
- Fridges, freezers and other cooling equipment.
- Computers and telecommunications equipment.
- Consumer electronic devices and solar panels.
- TVs, monitors and screens.
- LED bulbs.
- Vending machines.

Effects of e-waste on environment and human health:

- E-waste can be toxic, contains various types of toxic metals (lead, mercury, nickel, cadmium, lithium etc.), which can get accumulated in the environment, in the soil, air, water. This can cause a long term damage in the environment and also to the human health.
- It also contains biodegradable materials. Their disposal techniques also harmful for the environment and living beings. For example, open-air burning and acid baths being used to recover valuable materials from electronic components release toxic materials leaching into the environment.
- The improper disposal of lead acid batteries and alkaline batteries also causes contamination of toxic chemicals with the soil and water.

Disposal:

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- **Landfilling:** A landfill site, also known as a tip, dump, rubbish dump, garbage dump, or dumping ground, is a site for the disposal of waste materials. By this the technique, the e-waste are to be disposed scientifically, so that the soil and water resources doesn't get effected in the nearby area.
- Incineration (decomposing the waste material by burning) and pyrolysis (heating at high temperature and decomposing the product) are one of the coming techniques to dispose the e-waste.
- The electronic waste are required to be recycled and reused in a scientific way.
- **Plastic Waste:** Products made from plastics such as keyboards, casing, front or rear panel. Miscellaneous parts encased in plastics – disposed by shredding and melting method.
- **Printed Circuit Board Waste:** Used in electronic parts such as motherboard, TV internal circuits, etc. need to be disposed by desoldering and open burning to remove metals.
- Lead acid batteries and alkaline batteries should be disposed properly, so that the toxic metals, harmful chemicals like acid and base should not get contaminated with air and water sources.

Extraction of gold from E-waste:

When electronic products, such as computers, cell phones, televisions, VCRs, stereos, copiers, fax machines, internal chips and other relating parts, reach the end of their lifetime, they become electronic waste, otherwise known as “e-waste.” E-waste can often comprise of several hazardous components which can include heavy metals like mercury and lead. Despite this reality, gold, as well as

other precious metals, also make up a significant amount of e-waste, and its extraction could have advantageous properties for the gold industry. The extraction of gold is done from e-waste using Hydrometallurgy method.

Prior treatment:

Prior to the Hydrometallurgy method, physical treatments such as sorting, dismantling and size reduction are performed to produce granular form of the waste material.

Hydrometallurgy method:

- There are certain metals such as copper (Cu), silver (Ag) and gold (Au) are extracted by dissolving the concentrated e-waste in some suitable reagent and then recovering the metal from the solution by treatment with some more electropositive metal.
- The use of cyanide in gold leaching has been a useful, but dangerous technique of metal extraction. This extraction process involves the chemical reaction between the pulverized e-waste and sodium cyanide, which produces a soluble gold cyanide solution that allows for easier extraction of the precious metal.



- Then the solution containing Gold cyanide complex is treated with zinc powder. As zinc is more electropositive than Au, it results in the precipitation of pure Au.
- In another method, the concentrated e-waste is treated with aqua regia (which is 1:3 mixture of conc. HNO_3 and HCl). As HNO_3 is a strong oxidising agent, which oxidizes Au to $\text{H}[\text{AuCl}_4]$ and bring it into the solution.



- This hydroauric chloride is treated with Sodium meta bisulphite [$\text{Na}_2\text{S}_2\text{O}_5$], which is a reducing agent and results in the formation of pure gold (Au).

Extraction of copper from E-waste:

When electronic products, such as computers, cell phones, televisions, VCRs, stereos, copiers, fax machines, internal chips and other relating parts, reach the end of their lifetime, they become electronic waste, otherwise known as “e-waste.” E-waste can often comprise of several hazardous components which can include heavy metals like mercury and lead. Despite this reality, copper, as well as other precious metals, also make up a significant amount of e-waste, and its extraction could have advantageous properties for the copper industry.

Prior treatment:

Prior to the Hydrometallurgy method, physical treatments such as sorting, dismantling and size reduction are performed to produce granular form of the waste material.

Hydrometallurgy method:

- There are certain metals such as copper (Cu), silver (Ag) and gold (Au) are extracted by dissolving the concentrated e-waste in some suitable reagent and then recovering the metal from the solution by treatment with some more electropositive metal.
- The crushed printed circuit boards are allowed to react with the acidic solutions like HNO_3 , HCl , and H_2SO_4 . The concentrations of the acidic solutions are kept at proper proportion. It

was found that the metal present in the sample get dissolved into solution with appropriate amount at different concentration of acids.

- The Cu metal metal exist in the solution as CuSO_4 salt, which then treated with with zinc powder. As zinc is more electropositive than Au, it results in the precipitation of pure Cu.

