

M.sc. Semester II CC-V

E-waste management

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Solid waste management

- **Solid wastes can be easily categorized into five categories:**
 - 1. Municipal**
 - 2. Electronic**
 - 3. Biomedical**
 - 4. Industrial**
 - 5. Nuclear/Radioactive**

What are e-wastes?

- **Wastes of electronic or electrical goods that have completed their span of life or are of no utility to its consumer.**
- **China and India are one of the biggest importer of e-waste in the world.**
- **They are highly dangerous and toxic and should not disposed off with other solid wastes.**
- **The rate of production of e-waste per year is around 10%.**

Most of us lack the basic awareness of the toxic metals or chemical substances that are present in the devices we use in daily life. Gadgets such as computers, mobile phone or other electric devices which are making our life easier are in parallel creating a big mess when it comes to their disposal after use. It has been assumed that a single computer that is being used in daily life consists of around 1000 chemicals included brominated and chlorinated hydrocarbons.

What are the probable constituents of electronic devices?

- **Chlorinated and brominated hydrocarbons**
- **Toxic Metals such as cadmium, mercury etc.**
- **Biologically active materials**
- **Acids and bases**
- **plastics and their additives**

Most of the workers in industries based on manufacture of electronic devices are reported to develop skin and lung cancer with the passage of time which shows that how much their impact is on the body

Sources of e-wastes

- Every used electronic items can be considered as e-waste such as
- discarded cellphones, cameras,
- CD players, TVs, radios, drillers, fax machines,
- photocopiers, printers, toners, ink cartridges,
- batteries, re-chargeable batteries, digital calculators
- and clocks, CRT monitors, electric solders, computer
- mother boards, key board, industrial and house hold
- electronic machinery such as oven, fridge, sewing & washing machines, fan, air-conditioner, grinder, iron,
- heater, military and laboratory electronic equipment's, etc.

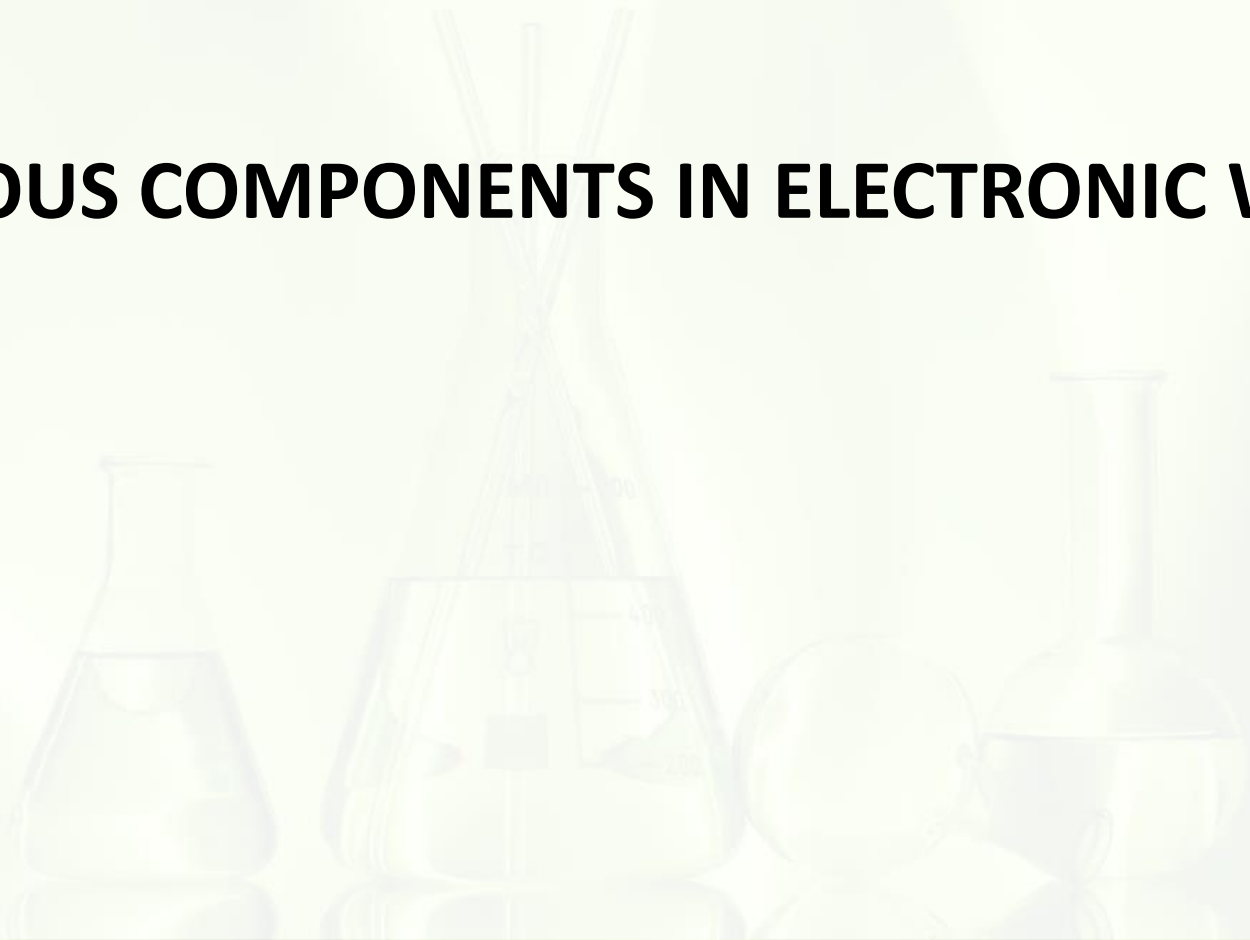
The proposed Threat

- **According to a report from USEPA, 1998 the average lifespan of the computers is decreasing. While it was around 4 to 6 years previously, it has now been certainly reduced to 2 to 3 years in recent times.**
- **Certainly with the growth of consumerism its been observed that companies are upgrading themselves and hence are creating an anxiety among the customers to stay updated and purchase more and more electronic devices.**

Issues and challenges of e-waste

- **Leaching of heavy metals from landfills and incinerators.**
- **Exposure to workers and communities.**
- **Absence of proper legal framework.**
- **Improper Collection system**
- **Unawareness about the constituents of e-wastes.**
- **Less chances of reuse.**

HAZARDOUS COMPONENTS IN ELECTRONIC WASTE



Metals

- **Lead:** damages Central and peripheral nervous systems, blood system, endocrines and rectal system in human beings. It derogates the children's brain development. Also its been states that lead tends to accumulate in the environment and shows toxic effects on plants, animals, and microorganisms. They also leach and contaminate drinking water supplies.
- **Cadmium:** They are highly toxic compounds and their toxic effects are irreversible on human health. Produces damaging effect on kidneys and enters through respiratory systems or digestive tract. They have long half life and stays in the system for a long time and creating negative health impact

- **Mercury:** Mercury in any form i.e. organic or inorganic or elementals is toxic for the human system as well as environment. Inorganic mercury is converted to methylated mercury in water bodies. It then easily accumulates in living organisms and concentrates through the food chain (**bio-magnification**), via sea food or water animals such as fish. It has been established for affecting the brain. Some of the devices that use mercury are thermostats, sensors, relays and switches.
- **Hexavalent Chromium (Chromium VI):** It can easily penetrates cell membranes and absorbed creating toxic effects of cells. It causes allergic reactions such as asthmatic bronchitis, DNA damage,

Plastics

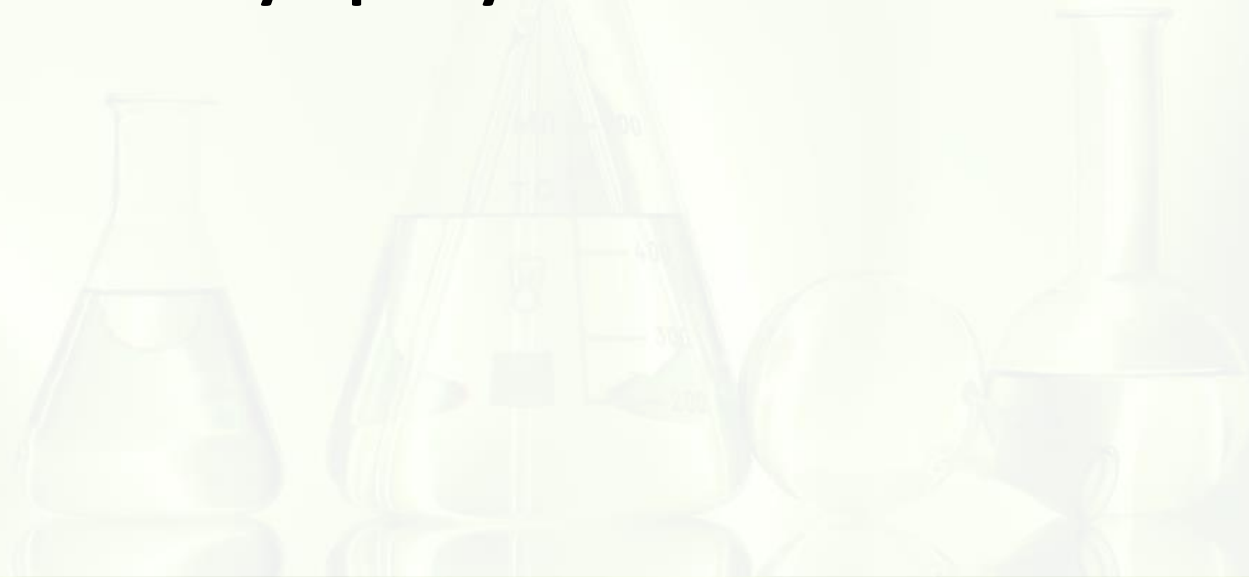
According to a study the largest volume of plastic based materials in electronics used in electronics manufacturing used polyvinyl chloride (PVC) which is the most hazardous among all the plastics that are being used. Their use in computers is mainly in cabling and computer housing. Even when most of the moldings in computers are made up of ABS plastics the use of PVC is preferred for fire retardant property. But on burning or fuming even PVC can prove to be fatal because of chlorinated gases that are being generated. This leads to the need of an alternative for safety purposes.

- Low-density polyethylene and thermoplastic olefins are now emerging as an alternatives for such reasons. PVCs are tough plastics and also effects other types of plastics during the recycling of the wastes. They generate dioxins and furans on pyrolysis in open burning and garbage incinerators.
- Disposable gloves and IV bags in hospitals are now being switched for more eco-friendly chemicals other than PVCs.

Brominated Flame-Retardants

- Brominated flame-retardants such as polybrominated biphenyls (PBBs) and polybrominated diphenylethers (PBDEs)] are used in electronic products to reduce flammability (SVTC, 2000).
- The four major applications of these retardants in computers can be stated as in printed circuit boards, as components of connectors, plastic covers and cables.
- PBDEs have been identified to be endocrine disrupters and their level in human breast milk is doubling every five years. They also reduces hormone thyroxin in exposed animals and also affect the fetal growth and development.

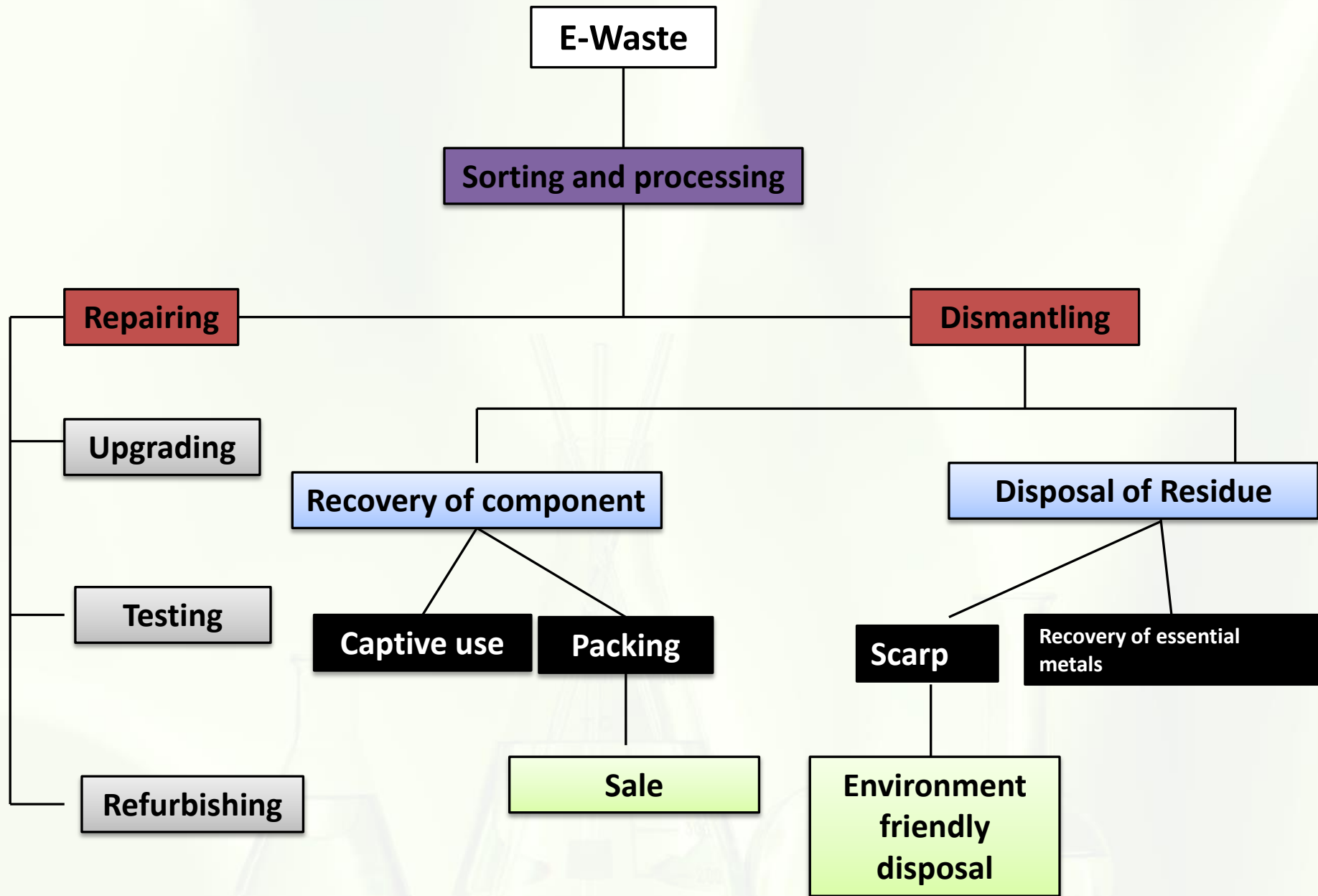
- **Researchers in the United States showed and confirmed that exposure to polybrominated biphenyls causes an increased risk of cancer of the digestive and lymph systems.**



Modes of disposal of e-waste

- ✓ **Landfills: the wastes are dumped into land fills and disposed.**
 - ✓ **Incinerating the wastes.**
 - ✓ **Recycling of the wastes.**

All these will be discussed in the next e-notes. As for now the next slide has some informative content for additional reading and awareness among us.



Is there any clean alternative for these ?

With the increasing environmental concerns many big companies are opting to design cleaner products but most of them are still far beyond application and it is necessary to ensure that the products are non toxic and upgradable.

- **Hewlett-Packard has developed a safe cleaning method for electronic chips in devices using carbon dioxide for cleaning as a substitute for hazardous solvents.**
- **Base materials that are self-extinguishing can be used in Printed circuit boards and therefore the need for flame-retardants can be tackled.**
- **Matsushita is promoting the elimination of toxic substances and develop highly environment-friendly materials such as lead-free solder, non-halogenated lead wires and plastics).**

Dear Students (PG Sem II)

Due to the lockdown situation and online classes I have decided that on Friday i.e. 22.05.2020 there will be a class on WebEx. The details have been shared with Kr. Raghvendra of your batch and I wish that most of you join this class.

In case of any confusion please mail on ankitajha26@gmail.com

Topic will be waste management. I have already shared content for nuclear and waste which will be constantly upgraded. So it will be good if you go through college portal and download PDFs for guided study.

Good Luck