

An awareness creating study on a hazardous contaminant - E-Waste and Green Computing

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Abstract The advancement within the technology has cause a most dangerous drawback “E-Waste”. E-Waste creates significant issue to the atmosphere and affects the human health, if it's not handled properly. the main objective of this paper is to debate concerning the causes of unsafe part e-waste and the ways it affects the atmosphere and well being of the humans, and economic loss because of e-waste and therefore the measures that would be used for mitigating the matter of environmental degradation. This study paper can explore the dreadful waste, green computing and can produce a powerful awareness among the people within the society.

IndexTerms - E-waste, Degradation, hazardous.

I. INTRODUCTION

Environment is that the encompassing shaped by organic phenomenon and a biotic parts. Surrounding is important for survival and well-being. A country's economy indistinguishably tied to the productivity of the natural resources and therefore the quality of the surroundings. In India most of the population depends directly for their livelihood on the activities based on natural resources such as agriculture, fishery etc.

Water sources are also highly polluted. Due to this water pollution drinking of water and water irrigation are getting scarce. Fishery yielding is declining and the air quality is worsening. The increasing levels of air, water and land pollution results a serious threat to human health and longevity. So good management of natural resources is essential to attain and sustain economic growth and development.

Natural resources are the basis for the life in earth. Natural resources (water, soil, land, soil, rocks, forests, animals, fossil fuels and mineral) are polluted by “dumping” of wastes which results environment degradation. The quality and quantity of agricultural yielding is affected by the factors such as soil erosion, water logging, salinity and loss of fertility.

Due to increase in urbanization rate, pollution of natural resources conjointly will increase. Governments, through numerous Clean Water Acts and water resource policies have sought-after to control the discharges of pollutants within the water to reduce pollution and contamination. From 1990 to 2006, an extra 1.6 billion people had access to safe drinking water. However most factories still realize the way to dump their venomous wastes within the ocean, unseen[1].

The main objective of this paper is to explore e-waste, environmental impacts of the e-waste and its ways to reduce e-waste, and degradation procedures in vital approach. [1].

1. WASTE

Wastes are unwanted or unusable materials, discarded after primary use, or it is worthless, defective and of no use. Some of the examples of wastes are municipal solid waste (household trash/refuse), hazardous waste, wastewater (such as sewage, which contains bodily wastes (faeces and urine) and surface runoff), radioactive waste, and others.

1.1 Classification of Waste

Wastage is classified by its source and properties and is classified as in Fig.1.1. The generation and types of wastes must be clearly understood, to work towards a solution.

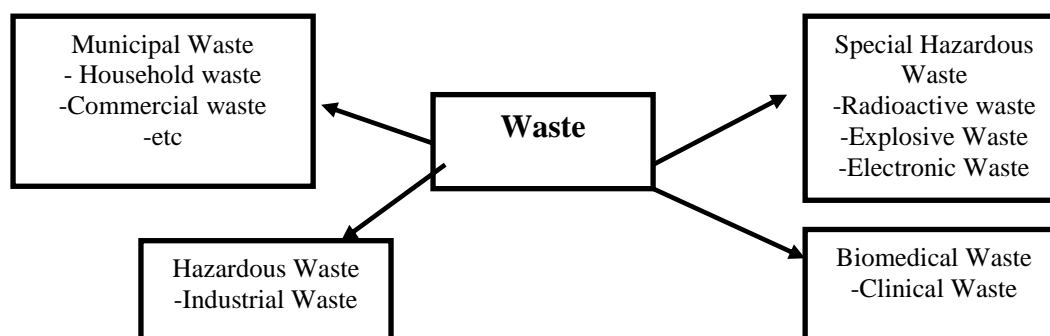


Fig. 1 Classification of Waste

2. OVERVIEW OF ELECTRONIC WASTE

“E-Waste” means “Electronic waste”. Due to rapid expansion of technology a very large amount of e-waste is created every passing minute. It includes the **discarded computers**, entertainment devices such as **television sets, mobile phones, radios, and home appliances such as, refrigerators, washing machine and other office electronic equipment**. Informal processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution. Fig. 1.2 shows some of the electronic materials as become e-waste.



Fig.1.2 Electronic materials - E-Waste

The main characteristics of e-waste/dead-waste includes toxic components and no longer operational or thrown away and hard to recycle. Due to the pervading reach of information technology in trade and commerce, computer waste is the most significant of all e-waste, along with televisions and cellular phones [2].

Most of the household products such as televisions, computers and phones contain toxic chemicals that can pollute the air and contaminate soil and water [3]. A toxic waste is only the waste that when ingested or absorbed, is harmful or fatal to the living organism.

Most of the computer components have toxic contents, that the computer users are unaware of that. A Cathode Ray Tube (CRT), is also called a “picture tube” is found in computer monitors, televisions, camcorders, and other electronic devices. A standard computer monitor contains approximately **8 pounds of lead**. This toxic metal is utilized to line the glass in the cathode ray tube in order to shield the user against radiation exposure.

Table 2.1 [4] lists out the waste components, its toxic constituents and potential hazards to environment.

Minute amounts of mercury, a highly regulated toxic metal can be found in some of the computer’s printed wiring boards, switches, relays, and batteries. Cadmium compounds, metals suspected as persistent carcinogens in the state of California, are utilized in the computer’s batteries, wiring boards, and plastic stabilizers.

Toxic metals are also found in the circuit boards of other Consumer Electronic Devices (CED) such as microwave ovens, VCRs, DVD/CD players, stereo equipment, cell phones, printers, cordless phones, and electronic lab equipment. If these devices are disposed of in a municipal landfill, they can potentially contaminate the soil which can lead to a costly contamination of our water supplies [6].

Table 2.1. E-Waste Components and its adverse effects in environment and human

| Computer/e-waste component | Adverse effect to environment | Adverse effect to human being |
|---|---|---|
| Cathode ray tubes | Lead, barium and other heavy metals leaching into ground water and release of toxic phosphor. | Lead : Synthesis of hemoglobin, teratogenic, Dysfunctions in the kidneys a notably serious. |
| printed circuit boards | Air emission of the same substances | Respiratory problems |
| Dismantled printed circuit board processing | Tin and lead contamination of immediate environment, including surface and ground waters, brominated dioxins, beryllium, cadmium and mercury inhalation | It causes damage to the reproductive, blood and nervous systems. It deficits in cognition, learning, behavior and neuromotor skills in children. |
| Plastics from the computer and peripherals | Emission of brominated dioxins and heavy metals and hydrocarbons | It is disruption in the thyroid hormone balance, brain damage and cancer. |
| Chips and other gold-plated compounds | Hydrocarbons, heavy metals, brominate substances etc. discharged directly into river and banks. Acidifies the river destroying fish and flora | Health effects include impaired development of the nervous system, thyroid & liver problems. |

3. IMPACTS OF E-WASTE IN ENVIRONMENT

The toxic waste results from chemical industries, industrial, and biological processes substances, improper disposal of electronic equipment, thrown away electronic devices cause adverse effect to public health or the environment and its environment impact is listed in the table 1.

3.1 Toxic element and Air

Toxic elements also known as **air toxics**, are the pollutants that at sufficient concentrations and exposure are known or suspected to cause cancer, other serious health problems, or damage to the environment.

Short-term exposure can lead to eye irritation, nausea, or difficulty in breathing. Long-term exposures may result in damage to the respiratory, nervous, or reproductive systems, birth and developmental defects, and other serious health problems.

While everyone is at risk from exposure to air toxics, many factors determine how seriously any pollutant will affect a person or at-risk population. These include the level, duration, and frequency of exposure, the toxicity of the pollutant, and the overall health of people who are exposed.

Some air toxic, such as mercury, can deposit onto soils or surface waters, where they are taken up by plants, ingested by animals and fish, and work their way up the food chain. Like people, animals may experience health problems if exposed to sufficient quantities of air toxics over time.

EPA conducts a periodic National Air Toxics Assessment (NATA) focused on air toxics that are of greatest concern to public health [5].

3.2 Toxic element and Water

Water pollution is contamination of water by foreign matters that deteriorates the quality of the water. Water pollution covers pollutions in liquid forms like ocean pollution and river pollution.

Some of the pollutants like lead (Pb), arsenic (As), mercury (Hg), chromium (Cr) especially hexavalent chromium, nickel (Ni), barium (Ba), cadmium (Cd), cobalt (Co), selenium (Se), vanadium (V), oils and grease, pesticides, etc are very harmful, toxic and poisonous even in ppb (parts per billion) range. There are some minerals which are useful for human and animal health in small doses beyond which these are toxic. Zinc (Zn), copper (Cu), iron (Fe), etc fall into this category. For agriculture, some elements like zinc, copper, manganese (Mn), sulphur (S), iron, boron (B), together with phosphates, nitrates, urea, potassium, etc are useful in prescribed quantities. There are some compounds like cyanides, thiocyanides, phenolic compounds, fluorides, radioactive substances, etc which are harmful for humans as well as animals [6].

3.3 Toxic element and Soil

Soil pollution occurs when soil contains chemicals that are toxic or otherwise dangerous for humans and other living things. The chemicals may be foreign to the area, or they may be naturally occurring materials that pollute the soil by being present in dangerously high amounts. Soil pollution can have a number of harmful effects on human health. The harmful effects of soil pollution may come from direct contact with polluted soil or from contact with other resources, such as water, that have come in direct contact with the polluted soil [7].

Heavy metal pollution of surface and underground water sources leads to significant soil pollution and pollution will increase once deep-mined ores are dumped on the ground surface for manual dressing (Gabardine et al., 1995 INECAR, 2000) [8]. Surface dumping exposes the metals to air and rain thereby generating much AMD. When agricultural soils are polluted, these metals are taken up by plants and consequently **accumulate in their tissues (True by, 2003)**.

Animals that graze on such contaminated plants and drink from polluted waters, as well as marine lives that breed in heavy metal polluted waters also accumulate such metals in their tissues, and milk, if lactating. In summary, all living organisms within a given ecosystem are variously contaminated along their cycles of food chain. [9].

3.3.1 Bioaccumulation

Soil that is not significantly polluted may still harm humans indirectly, according to Pollution Issues. One way such soil pollution can harm humans is by bioaccumulation. Plants that are grown in lightly polluted soil continuously absorb molecules of the pollutants. Since the plants cannot get rid of these molecules, they accumulate in the plant, causing higher amounts of pollution to exist in the plant than in the soil. Table 2 shows about the list of toxic elements and its usages.

Animals that eat many of these polluted plants take on all the pollution those plants have accumulated. Larger animals who eat the plant-eating animals take on all the pollution from the animals they eat. Humans who eat plants or animals that have accumulated large amounts of soil pollutants may be poisoned, even if the soil itself does not contain enough pollution to harm human health. [10].

3.4 Economic Losses

The human beings in India mostly depend on agriculture land for their wealth creation.

In addition to endangering human health, soil pollution can also cause economic damage. For example, soil that is polluted with heavy metals is nevertheless used to grow grain. India is an agriculture-based country. If soil and water polluted, they can't produce good quality food grains. Due to this it also results economic degradation occurs. [11]

The individuals in Asian nation largely depend upon agriculture land for his or her wealth creation. In addition to endangering human health, soil pollution can even cause economic injury. As an example, soil that's contaminated with serious metals is even so accustomed grow grain. Asian nation is associate degree agriculture based mostly country. If soil

and water contaminated, they can't manufacture sensible quality food grains. Because of this it additionally results economic degradation happens.

4. E-WASTE DEGRADATION

Degradation of waste by microbic consortia is extremely important. It reduces the time span of degradation and produces no foul odour. Members of microbic consortia communicate and differentiate; consortia will perform a lot of complicated tasks and may survive in additional changeable environments than can uniform populations. To date, engineers have with success made microbic consortia by implementing cell-cell communication and differentiation of operate in ancient, laboratory microbes. As on date the foremost reliable strategy is biodegradation by eco-friendly microbe that is usually accepted as associate environmentally sound and economically possible protocol for the treatment of risky waste and effluents. The microbes square measure the tribute for clean atmosphere [12].

Domestic unsafe and waste material includes batteries, paints, broken lights, terminated medicines, electronic waste. They must be unbroken singly within the bins placed in numerous elements of the town should be collected once in a while by the waste management authority and disposed of as per the unsafe waste management rules and specifications.. Table 4.1 lists out the Waste collection methods and its advantages, disadvantages[13].

Table 4.1: Waste Collection systems- Advantages and Disadvantages

| System | Description | Advantages | Disadvantages |
|--------------------------------|--|---------------------|--|
| Dumping at designated location | Residents and other generators are required to dump their waste at a specified location or in a masonry enclosure. | Low capital costs | Loading the waste into trucks is slow and unhygienic. Waste is scattered around the collection point. Adjacent residents and shopkeepers protest about the smell and appearance. |
| Shared container | Residents and other generators put their waste inside a container which is emptied or removed. | Low operating costs | If containers are not maintained they quickly corrode or are damaged. Adjacent residents complain about the smell and appearance. |

4.1. RECYCLING

Recycling of e-waste is associate rising trend and was initiated to guard human and environmental health due to the extensive environmental pollution impacts of e-waste [14].

Recycling of e-waste has several steps like Picking Shed, Disassembly, First Size reduction method, Second size reduction method, Over band Magnet, Non metallic and Metallic parts separation, Water Separation are followed when utilization of e-waste a number of the things may be reused like plastics, metal, glass, Mercury, Printed Circuit Boards, and Hard drives, Ink and Toner Cartridges and Batteries.

Zero waste management schemes separate the fabric for utilization. The remaining materials are once more drop into the soil on "deep burial" technique.

4.2 DIFFERENT WAYS TO REDUCE E-WASTE:

There are different ways to reduce the accumulation of e-waste. Some of them are [15]:

- Sell the old Electronic items :
- Donate the old Electronics items
- Recycle and Dispose the E-Waste Properly
- Maintain the Electronics by Extending the life of electronics devices
- Repurpose or Re-evaluate the need
- Store the Data Online using Cloud services
- Buy Energy Star Rated Electronics
- Learn to Repair the broken Electronics at Home
- Rent Electronic Equipment instead of Buying.

Though also the accumulation of the e-waste will not be avoided fully. So to reduce the adverse effects in the environment, it is better to buy environmentally friendly electronics. This says about **Green Computing**.

4.2.1 Green Computing

Green computing is the environmentally responsible and eco-friendly use of computers and their resources. It is also defined as the study of designing, manufacturing/engineering, using and disposing of computing devices in a way that reduces their environmental impact.

The goal of green computing is similar to green chemistry. Green Computing is used to reduce the use of hazardous materials, and maximize energy efficiency during the product's life time, promote the recyclability or biodegradability [16].

CONCLUSION

The main aim of this paper is to provide awareness to all related to e-waste and its impacts to human health and environment. "Use of waste to treat waste" – quote should be used to treat the e-waste and innovative technology should be identified by the scientists. This hazardous waste is accumulated enormously time to time and day to day due to the advancements in the technology. There is no one person is responsible for this. Everyone is responsible for the environment, our earth. A proper degradation procedure and awareness of adverse effect of e-waste to environment are necessary to overcome this issue.

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