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E-Waste Management

Sakshi Sharma[1], Jignesh Brahmbhatt[2], Dr. Reshma Patel[3]
[1]M.Tech. Environmental Engineering student, [2]Assistant Professor, [3]Associate Professor
[1,2,3]Department of Civil Engg., Birla Vishwakarma Mahavidyalaya (BVM), Anand, Gujarat, India

ABSTRACT: Refused electrical or electronic equipments refer to E-waste. Developing countries are not much aware of this growing e-waste pollution, which if not handled properly can be hazardous to life and environment. E-waste if recycled can be beneficial as it contains materials which have good economic value. This paper reviews e-waste as a potential hazard and will discuss its management methods and Indian scenario.
Keywords: *Electronic waste, E-Waste, Sustainable development, Pollution, Green computing.*

I. INTRODUCTION

E-waste comprises of computers, laptops, household appliances (induction, geyser, refrigerators, air conditioners, television, washing machine, toaster, iron, dishwasher, etc), mobile phones, electrical wires, rejects from manufacturing, repair, etc. With rapid technology advancement, e-waste is a global concern and threat to environment as it contains some toxic components. Valuable materials like iron, copper, gold, aluminium etc is around 60% and toxic components are 2.70% [1]. E-waste is the fastest growing part of the overall waste stream at 3–5% per year. Global generation of e-waste is about 50 million tonnes. Most of the materials can be recycled, refurbished and reused from e-waste. Industrial revolution has changed everything in the past century but is also the reason behind the pollution today. E-waste has toxic materials like cadmium, lead, cobalt, chromium, barium, bromine, plastic, poly vinyl chloride (PVC), polychlorinated biphenyl (PCB), mercury, barium, beryllium, etc. Unawareness of handling and management of waste leads to burning of e-waste and as a result dioxins, toxic fumes, furans are released into the atmosphere that causes serious diseases like asthmatic bronchitis, cancer, mercury can enter through food chain due to bio accumulation of fishes, cadmium is carcinogenic and it gets into surface water and groundwater through dust, heart and liver are affected due to barium etc. Improper management leads to landfill of the waste thereby contaminating soil and groundwater. Waste treatment and material recovery is equally important for e-waste management. Although, the process is very complex and it takes a lot of time to dispose and recover. [1]. Developed countries transport large amount of e-waste to undeveloped and developing countries where recycling techniques are only burning and dissolution of materials in strong acids with hardly any measures to protect life and environment. Exporting of E-waste to developing countries and recycling methods without proper measures to protect human health and environment are illegal according to the Basel Convention [2]. The objective of this paper is to focus on the electronic waste issues in India, its present reality and e-waste management methods.

II. E-WASTE MANAGEMENT METHODS

Metal recovery from e-waste in sustainable manner is a challenge. Chemical and mechanical methods are usually used, but it leads to secondary pollution for which another treatment is mandatory or the methods are costly. Whereas biological treatment is an environmentally sound approach. Microbial

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metabolisms are used to apply the potential microorganisms to extract metals and converting pollutants or metals from harmful or hazardous to non-hazardous or less hazardous form. The following are some of the microbial metabolisms; biomineralization, biosorption, bioleaching, biotransformation, bioaccumulation, and bioelectrochemical methods [7].

Around 20 million household appliances and 70 million mobile phones reach to the end-of-life each year. Methods to dispose e-waste in reasonable size or capacity are there but due to increasing waste generation, waste disposal is challenging. There are strategies which can help to reduce the e-waste production. Life Cycle Assessment (LCA): It is a tool used for designing eco-friendly electronic appliance so as to minimize E-waste issue. Multi-Criteria Analysis (MCA): This Tool is used to select best strategy and manufacturing method for a specific product by analyzing different scenarios and has varied criteria that results in the most convenient and beneficial method for a product. Extended Producer Responsibility (EPR): According to this policy approach the producer's responsibility is extended to the treatment and disposal for post-consumer products. Producers are asked to substitute hazardous material with harmless and efficient material. Customers should be given incentive by manufacturer at exchange of old product with new one [2]. Material Flow Analysis (MFA): A tool used to study the route of e-waste flowing into recycling centers, or disposal areas by linking sources, pathways, intermediate and last destinations of the waste. The assessment is carried out in terms of environment, economic, social values [3]. Recycle: Recycling prevents hazardous materials like lead, mercury, etc out of landfills. It can also replace product which requires to be manufactured for saving further energy and emissions.

Green Computing, green IT, or ICT sustainability: This technology's aim is to achieve highest possible environmental sustainability for the best possible operating of the computer and other peripheral devices to minimize their harmful effects; the aim is also at achieving paperless office. The approaches for green computing are as follows: Green use: Reducing the electricity consumption of computers and their peripheral devices and utilizing them in an environmentally sound manner. Green manufacturing: By minimizing waste during the production of computers and other subsystems to reduce the environmental impact. Green design: To design energy-efficient computers and their peripherals like printers, projectors, etc. Green disposal: It can be achieved by following the three principles: Reuse by donating the computers to those in need. Refurbish by upgrading the computer despite of discarding them by replacing RAM or Hard disk. Never discard a computer instead recycle them [4].Virtualization, cloud computing are also some of the approaches towards green computing [5].

III. INDIAN SCENARIO

India ranks fifth in producing e-waste among all the countries in the world. 80 % of e-waste produced in the United States, contributes to the global "hidden flow" of e-waste. The 20% of e-waste produced in the United States which is recycled includes the "official" export of e-waste to India and China [6]. The e-waste imported unofficially is generally handled by informal sector which is the main problem behind improper e-waste management in India. Prohibited wastes are also imported in India annually around 50 lakh tonnes [2]. Maharashtra produces highest amount of e-waste in India.

The following are the issues related to e-waste in India: No definite official data is available for the amount of waste generated and disposed of in India, only estimations exist. Most of the

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e-waste activities are done manually in India [2]. Waste management, dominated by informal sector is a huge hurdle in India. Involvement of child labor that too without appropriate protection and safeguard. Ineffective legislation (failure in successful implementation of E-waste management rules). Lack of incentive schemes; incentive should be given to people working for handling e-waste. Working conditions in informal sector is only a little worse than formal sector. Lack of infrastructure; waste generation compared to recycling facilities is too high. Awareness is too limited as involvement of women and child labor is seen as well as schools are situated near dumping yards and children are affected severely. High cost of setting up recycling facility as cost of technologies for recycling are high and thus requires high investment therefore, formal sector has a lot to work on this management issue. Research in e-waste management should be primary concern to the government [1].

III. CONCLUSION

Awareness, training programs, proper implementation of E-waste management rules should be the top priority to manage e-waste in India. Children and women are adversely affected due to lack of awareness. Awareness for Waste Prevention should be given more importance. Accurate e-waste generation must be known first to carry out significant waste management. Research on green computing and metal extraction through biotechnology approach should be encouraged in this field. Stringent rules and regulations ought to be imposed on the illegal import and inappropriate waste management. Improper segregation of solid waste management is also one of the reasons behind the unsound e-waste management. Effectuation of sustainable waste management from collection, recycling to disposal of e-waste needs to be goal of India.

IV. REFERENCES

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