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# ENHANCING CONCRETE QUALITY THROUGH E-WASTE RECYCLING TECHNIQUES

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**Abstract -** The growing environment-and-economy-related problems due to electronic waste (e-waste) are creating an increased interest in evolutionary recycling solutions. One possibility is the inclusion of e-waste byproducts into construction materials: concrete. This work examines the advantages and disadvantages of applying recycled e-waste materials in concrete to enhance its quality, performance, and sustainability.

Much of the e-waste comprises valuable materials such as metals, plastics, and glass that can be repackaged as substitutes for conventional mixtures in concrete manufacture. Sheared circuit boards, plastics, and metals are the various e-waste materials studied in regards to their impact on some concrete properties, namely compressive strength, durability, and resistance to chemical degradation. Preliminary results suggest that appropriate processing and treatment of certain e-waste materials can contribute positively to concrete mechanical properties and minimize its environmental burden.

Apart from that, the incorporation of e-waste into concrete really does offer double duty in both solving the growing e-waste disposal crisis and promoting sustainable building materials. However, there are challenges including material compatibility, potential toxicity, and imposing technologies that need to be carefully considered.

***Key Words***: concrete, compressive Strength, Ecological pollutant, Tensile Strength

## 1.INTRODUCTION

For the last few years, environmental and economic sustainability pressures have attracted significant interest toward greener construction practices. From among numerous possible solutions, the most promising could be the integration of waste materials in concrete production, which stands to enhance the sustainability of the construction industry. One of the most common and large-growing waste streams is electronic waste (e-waste), which consists of redundant electronic devices like smartphones, computers, televisions, and household appliances. When we think of the challenges connected to the e-waste, it becomes such an important sustainability issue as it consists of a number of hazardous materials that could pose health risks where metals, plastics, and glass could become valuable and yet are commonly dumped in a landfill.

Innovative recycling techniques that repurpose e-waste materials could benefit construction, the major consumer of natural resources and energy. Concrete, the most widely used construction material in the world, is primarily made up of cement, water, sand, and aggregates. The integration of recycled e-waste components into concrete allows us to mitigate the environmental threat of e-waste and brings an improvement into the quality and performance of concrete.

### 1.1 METHODS OF DISPOSAL OF E-WASTE

E-waste disposal includes an issue that has begun to receive more and more attention; e-waste is a waste stream, whereby certain components are valuable and some are toxic. Given the improper disposal of this waste, it could lead to pollution of the environment, posing health hazards to the population and loss of recyclable materials. Various methods exist for the disposal of electronic waste; they can be informal and illegal or more controlled and more highly regulated. Below is a brief introduction to the major current practices of e-waste disposal:

1. Recycling

2. Reusing

3. Donating

4.Landfiling

5. Incineration

## 1.2 CHARACTERISTICS OF E-WASTE

Electronic waste being retired includes discarded electronic devices and components that can no longer be used or have reached the end of their life cycle. It is fast becoming a big environmental concern because of its large volume, poisonous substances, and potential for recovery of materials. The salient features of e-waste are in regard to its composition, environmental influence, and pack-up handling difficulties. The important features are as follows:

The e-waste includes a wide variety of materials, some of which are valuable and recyclable and others that are toxic. Some main components of e-waste include:

## 2. Literature Review

(1)"Salman Siddique1, Sikandar Shakil, Mohd. Shadab Siddiqui **-** Scope of utilisation of e-waste in Concrete (2015). literature show that there is a high chance of the E-waste being used as substitute or replacement of aggregate. In view of the gradual depletion of natural aggregate sources, it is of prime importance that substitute formulation be explored in concrete. This paper provides an overview of the published literature regarding the use of E-waste in concrete. The role was also to study the effect of E-waste on concrete properties such as compressive strength, split tensile strength, and durability. Study of various reviewed literature shows that E-waste has the potential to be the lesser replacement material for concrete."

(2) Sunil Ahirwar, Pratiksha malviya vikash patidar ,Vikash kumar singh The progress of strength in E-waste concrete resembles that for conventional concrete, albeit with lowered values-the strength reduction occurs at every age of curing." The immoderate content of mineral admixtures provides optimum compressive strength." Nature and development of strengths in E-waste concrete were similar to those in conventional concrete but marked with a decrease in all strengths at different curing ages. The use of mineral admixtures may be utilized for compressive strength enhancement. From the available studies, it can be concluded: E-waste could be a potentially viable material for use as fine aggregate to produce durable concrete. Its use as fine aggregate would overcome the likely existence of a problem for dwindling natural resources, and it would act to preserve the enclosed environment, so on and so forth. Up to now, a very few investigations planned toward using E-waste as aggregate in concrete have been accomplished. Hence, arduous research should be done on the matter.

(3) Vijay N. Bhoi et al. (2014), most of the waste is inherently dangerous. It will degrade to provide leachate, which can contaminate water, and make lowland gas, that is explosive. Moreover, because there are risks associated with lowland sites, the requirements placed upon the development, operation, and medical care of such sites are terribly strict at the moment. Most design authorities want a numbered out pit to be used for landscaping rather than a lowland web site which nobody wants in their "back yard". Product style should be used to assist reduce not only the character and quantity of waste, but also to maximize end-of-life use. Producers, distributors, users, and disposers should share responsibility for reducing

(4) Kuehr and Williams (2003) stated that an increasing market for reused PCs in developing countries is allowing people to own PCs and access technology at more affordable prices. In addition, charitable organizations, such as Computer Mentor, Computer Aid, World Computer Exchange, Computers for Schools and others are expanding their boundaries and providing used and refurbished computers to organizations (e.g., schools) around the world. In addition, reuse also minimizes the environmental impacts of technological artefacts by increasing the lengths of life of technological artefacts and hence making a dent in new pieces of equipment required. Vijay N. Bhoi et al. (2014), most of the waste is inherently dangerous. It will degrade to provide leachate, which can contaminate water, and make lowland gas, that is explosive. Moreover, because there are risks associated with lowland sites, the requirements placed upon the development, operation, and medical care of such sites are terribly strict at the moment. Most design authorities want a numbered out pit to be used for landscaping rather than a lowland web site which nobody wants in their "back yard". Product style should be used to assist reduce not only the character and quantity of waste, but also to maximize end-of-life use. Producers, distributors, users, and disposers should share responsibility for reducing

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## 3. METHODOLOGY

E-waste can be used in concrete, as it will be mixed with aggregates and partly replace one of the aggregate constituents of concrete. This will be efficient and economical in the reduction and mitigation of e-waste to the environment.

Some ways of recycling e-waste are provided below for use in concrete:

3.1.1 Chemical modification
E-waste can be recycled by chemical modification or depolymerization via hydrolysis or pyrolysis.

3.1.2 Mechanical recycling
E-waste plastics can be recycled through heating, shredding, or granulation.

3.2 Thermal processing
E-waste plastics can be heated to a very high temperature so that they may become plasticated and then cooled so that it may form a new product.
Here are some ways e-waste can be used in concrete:

3.2.1 Partial replacement
The aggregate form of e-waste can partly replace the coarse or fine aggregate components of concrete.

3.3Alternative to bitumen
Plastic from e-waste may substitute as bitumen in flexible pavement structure
Few reports have shown that concrete might gain strength when it consists of e-waste materials. For instance, researchers who tested the tensile strengths of sulfur-cured concrete beams made of e-waste reported that their beam had a maximum tensile stress at 6.23 MPa.


| S.N. | Properties |
|---|---|
| 1 | M25 concrete |
| 2 | Grade 53 Portland Cement |
| 3 | Gravity of Cement = 3.15 |
| 4 | Maximum size of E-waste = 25mm |
| 5 | Curing days = 7, 14, 28 days |
| 6 | Cube size = 150mmSpecific |
| 7 | Specific Gravity of E-waste = 1.1 |
| 8 | Total Water absorption of E-waste = 0% |

## 4.CALCULATIONS

| | |
|---|---|
| 492-480 * 100 | 506-494 * 100 |
| 480 | 494 |
| =2.5% | =2.42% |
| Water content | water content |
| 0.5 * 2.5 | 0.5 * 2.42 |
| 100 | 100 |
| =0.0125 lit | =0.0121 lit |
| =12.5 ml | =12.1 ml |

## 5. CONCLUSIONS

The integration of e-waste materials into concrete presents a promising avenue for advancing both sustainable construction practices and effective waste management. Recycling electronic waste and incorporating it into concrete mixes can significantly achieve environmental benefits, such as reducing landfill accumulation, conserving raw materials, and lowering carbon footprints.

According to research, e-waste may be utilized to improve concrete properties like durability, strength, and resistance

to corrosion and cracking in the environment. The materials from e-waste, including plastics, metals, and even crushed circuit boards, not only can solve the electronic waste disposal problem but also create opportunities for manufacturing more durable and environmental-friendly building materials.

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