Deepak Aradhya S M ,2023, 11:6
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

Environmental Friendly Brick Blocks Using E-Waste

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Abstract-In this study, an effort was made to reuse more e-waste substances (e-waste) as fillers to increase the structural integrity of concrete bricks, which are frequently used in construction. Here, a typical brick molding technique is used to create novel concrete brick designs. Cathode ray tubes are where e-waste is most concentrated. Due to premature obsolescence of CRT equipment and rapid technological adoption, which is deemed dangerous to the environment when they are discarded of improperly, managing old beam tube (CRT) technology is a significant issue around the globe. In the past, their output rose in tandem with the requirement for computers and televisions, but not with the pace of technical advancement. Product innovations like plasma displays (PDPs) and liquid crystal displays (LCDs) have taken the role of televisions and computer monitors. In affluent nations, this change generates a disproportionate amount of outmoded CRT garbage, and in the generations to follow, poorer nations will overtake them as the primary CRT waste generators. In addition, CRT glass has a high silica content, a low tidal absorbance, and a fair intrinsic toughness, allowing it an appropriate filler for building materials. The structural analysis of the created concrete bricks demonstrates that e-waste conversion into coarse aggregates offers superior flexural strength and compressive compared to bricks made from standard sources. A quick summary of the present worldwide e-waste situation is given in this assessment, focusing on CRT waste and the magnitude of the demand for and available choices for processing, dumping, and current reclamation.

Keywords- CRTs,Intrinsicstrength, Compressivestrength,Flexuralstrength.

I. INTRODUCTION

The industrial sector's exponential expansion in innovation, particularly in electronics, has been a significant shift in human society's way of life. This transition has updated individuals and sparked a huge desire for new advancements, which has led to the purchase of new devices that are enhanced editions. This in turn caused a slow decline in the use of outdated technology, which was eventually replaced by more modern devices. These outdated devices are now accumulating at the waste yards and represent a very severe problem. This is a difficult position, and a smarter answer is required. E-waste management is a developing public health and environmental concern in India now since the amount of garbage is increasing quickly and building up in the waste stream.

What exactly is e-waste?
E-waste is the sparsely dumped, completely broken electronic or electrical equipment. This rapidly growing waste is extremely complex and takes years to decompose, impacting soil fertility and leading to soil contamination. This circumstance, particularly in

the developing world, is harmful because India generates about 1.5 lakh tonnes of EVS yearly and almost everything ends up in the internal sector because there is currently no organised substitute.

II.E-WASTE TYPES

Major (refrigerators, washers, geysers), and little devices (Irons, Blenders, Vacuum cleaners), equipment for computers and communications (Laptops, PC, Mobile phone, Telephone, Mobile phone, etc.), Lighting apparatus (Incandescent lights, Fluorescent, Bulbs) (All medical instruments, except for implants).

Figure. 1

III.COMPOSITION OF E-WASTE

Batteries, which contain components like epoxy resins, lead, cadmium, mercury, PCB, fibreglass, thermosetting plastic, silicon, polyvinyl chloride, tin, copper, iron, beryllium, carbon, aluminium, etc., are materials that are widely available. Consumer lighting equipment like CFC bulbs, tube lights, and other mercury-containing devices are examples of e-waste, as are household appliances like refrigerators and air conditioners that contain freons. Cadmium, mercury, and thallium are used in medical equipment including MRI, CT scanning, and monitoring equipment like diabetes monitors.

The scenario is concerning since India produces over 1.5 lakh tonnes of e-waste each year, and virtually all of it ends up in the domestic sector because there is currently no structured alternative. The risk of contamination of the environment is at its greatest right now, especially in the major regions. As per NGO Toxic Link, the extraordinary amount of 19000 tonnes of e-waste created and imported in Mumbai poses an environmental concern as well as a health risk to the city's high population density. Chittaranjan National Cancer Institute of Kolkata study. Due to the vast quantity of electronic trash produced in Delhi, it has been shown that residents there are more prone than those in other regions of the country to suffer from lung cancer diseases. As a result of the rise in this behaviour, e-waste must be carefully handled and successfully used.

IV.REUSE

One of the crucial methods for e-waste disposal is this one. The major obstacle to being green is the growing need to reduce waste streams and maximize the reuse of electronics in already-existing installations. It is possible to make several items, including inkjet cartridges, printers, laptops, computers, tablets, and cell phones, reusable. Electronics that are five years old may typically be repurposed. For producers of electronic devices to be able to purchase back used items from customers and handle the correct management or disposal of wastes using environmentally friendly methods, rules and regulations should be in place. Along with repurposing, giving e-waste to resellers, recommendations, or non-profit organizations should be prioritized.

V.RECYCLING

The most effective method for handling e-waste is recycling. Microprocessors, computers, laptops, notebooks, video recorders, stereos, fax machines, TVs, photocopiers, mobile phones, and other items are frequently utilized. Recycling is simple for the following items: processor, monitor, cable, monitor, phone card modem, floppy drive, keyboard, laptop, hard drive, CRT, floppy disc, fax machine, compact disc (CD) and memory chip. Disassembling the equipment in the metal frame, power supplies, plastics, and other components—which may be done either manually or mechanically with a shredder—is the first stage. Components like plastic, metal, and even valuable metals may be reduced and separated with the aid of chopping. Electrostatic separation, which allows metals and nonmetals to be recovered and reused, is the process of separating intractable mixtures caused by the detachment of metals and nonmetals. The best general principle is to recycle the basic materials from old devices. Recycling can help cut down on pollution and greenhouse gas emissions. The recycling of e-waste allows the materials used in rebuilding to be transformed into reusable items.

VI.ACID BATH METHOD

Copper is extracted using this technique from electronic waste. To dissolve the copper, the printed circuit board is submerged in strong sulfuric acid for over 12 hours. Instead of sulfuric acid, we may instead employ concentrated mixtures of HCl or nitric acid. The solution was heated, the blue copper sulphate deposit was discarded, and the residual solution was mixed to the granules after the electrical circuits had been soaked in it. The copper streaks were then removed with water. As a result, the printed circuit's electrical channels will be used to remove the metals. Lead is dissolved with this technique, and gold and silver are also extracted. A few further goods will be made with the obtained metal.

VII.INCINERATION

A regulated combustion reaction is incineration. This is a controlled approach that uses pyrolysis as one of the e-waste treatment processes. Temperatures between 900 and 2000 degrees Celsius are used to repair e-waste. When compared to typical chemicals, the byproducts of incineration are harmful. Limited air is supplied during gasification to transform materials into ash, tar, and smoke. As a result, it generates significant amounts of e-waste for combustion in incinerators with unique construction. Aerobic fumes, such as polychlorinated dibenzofurans (PCDFs), polycyclic aromatics (PCAs), and carcinogenic polychlorinated dibenzo-para- dioxins (PCDDs), as well as gases like nitrogen oxides, CO2, SO2, and others, are released while heating PVC or plastic circuit boards. The smoke contains very small quantities of heavy metal oxides that were finally reduced to ashes, including mercury, nickel, lead, arsenic, antimony, thallium, manganese, copper, and others. This approach has certain drawbacks, such as the release of hazardous gases into the atmosphere that contain cadmium and mercury. In addition, gas filtering and burning produce emissions into the environment.

The majority of emerging nations, including China, Pakistan, Nigeria, Africa, India, etc., use it. We tried to offer a more effective solution to this new issue in our evaluation. The review clarifies two situations, one of which has a polychlorinated biphenyl (PCB) foundation as a crucial component. owing to its non-combustibility, high boiling point, chemical stability, and electrical and thermal insulating qualities. Cathode ray tubes (CRTs), essential parts of computers and displays, are another case. The pattern has since altered. Due to the introduction of new technologies, such as Liquid Crystal Display (LCD) and LED via CRT, these CRTs are now being disposed of in landfills, which might represent a hazard to the environment in the coming days. Lead - based glass and other dangerous substances including cadmium, fluorescent powders, and barium are present in large quantities in these old devices that are hitting the trash stream.

If Cathode Ray Tube recycling is not done properly, these substances might be discharged into the environment. Because these substances are so poisonous and because IOT emerging waste has a high PCB content and will be discharged more concurrently than even CRT are piled against other wastes, the test primarily concentrates on two hazardous wastes. Thus, just these two contaminants are focused and considered. The following example will highlight the benefits and drawbacks of e-waste.

VIII.SCENARIO – 1

The world's fastest-growing trash issue is e-waste. The labor conditions for recycling are appalling, and imports typically go to such markets. Many electronic products include batteries that frequently contain cadmium, nickel, and other heavy metals, and electronic and tin materials used in inter-element solder and traces on the board. 42 million desktops were disposed out in 2005, whereas 4 million of them have been recycled. Prior to 2006, lead-containing solders may be used with Sn65% and Pb37% [8].

However, following the implementation of the RoHS regulation [9] in 2006, the amount of Ag used in welding has grown while the usage of Pb has declined. However, following the implementation of the RoHS regulation [9] in 2006, the amount of Ag used in welding has grown while the usage of Pb has declined. The printed circuit board comprises plastic and copper as well as trace levels of chromium, lead nickel, and other elements. The innovative lead-free solder is primarily composed of Sn 95.5 percent, Ag 3.8 percent, and Cu 0.7 percent Sn.United Nations University, 2007.

HUISMAN J. Study of WEEE Directive 2002/96, Final Report. Polychlorinated biphenyls are nonflammable, chemically stable, have a high boiling point, and are electrically and thermally insulating. Using PCB as a plasticizer E-waste utilized in building has been mentioned in incredibly few research. The glass component had a limited impact on the suspension rate, toughness density, water absorption rate, and damping would reduce when the particle size is greatest, according to M. Dondi et al., who utilized glass instead of clay to create bricks.

Using E-waste as a partial substitute, Balasubramanian et al. (2016) developed concrete that has the strength and durability of regular concrete. This experimental endeavor uses varied percentages of e-remove to partially replace coarse aggregate to test the compressive and tensile strengths of concrete. Balasubramanian and colleagues (2016). (2016) (Kulkarni, et al.). Look into using e-waste in concrete to substitute some of the coarse material. Aniket Ingole and colleagues from the International Journal of Earth Sciences studied environmentally friendly brick blocks made from collected, finely chopped e-waste. The mixture contained these components. The findings indicate that electronic bricks have a 100% water absorption capability, which makes them unsuitable for external walls and water system. Provide a waterproof covering, nevertheless. It may also be utilized as a wall outside. These bricks may be the perfect building material for earthquake-prone locations because of their lighter weight and great flexibility.

Because of their moderate weight, these bricks can assist to lower the overall cost of building. Cement sand and appropriate aggregates, such PCB, are used to make concrete, which may then be transformed into precast concrete units and normal, lighter, and denser concrete blocks of the right sizes for usage in building construction, retaining walls, and other load-bearing structures. Compressive strength of concrete with PCB composite block tested; bulk strength is dependent on concrete's compositional characteristics, curing time, physical dimensions and density, light weight, and PCB's bearing power.

IX.RAW MATERIALS AND COMPOSITION

Fly ash, water, coal dust, quick lime, Portland cement, lime sludge, aluminum powder, gypsum, and the needed amount of e-waste are the main components of brick. Fly ash makes about 60% of the mass of the raw material for brick, while sand and stone dust make up roughly 30%. In terms of bulk, Portland cement makes up 10% of E trash. Due to the superior toughness of cement bricks, it offers strong fire insulation or protects against fire, resulting in virtually no breaking during transit or storage. The stronger the pozzolanic activity, which results in better fly ash brick hardness, the higher the content of calcium oxide (CaO) in flash bricks describes the fly ash as being more attributable to calcium oxide.

X.PULVERISATION

To liberate the metallic component from the plastic component of the device, it is employed to isolate the various elements. the e-waste segregation is improved by the components. According to the quantity of the coarse aggregate in the reference mixture, the total E-waste content was estimated. created from a variety of e-waste-related items. The e-waste particulates can be compared to a retention mixture made up of partial replacements for coarse aggregates with the same proportions. It is presumed that there are divided particles. It is too tight a link in between the resin and fine clay, however as the clay gets finer, it loosens up. The brick lost its form due to the use of 50% plastic waste. Rough surfaces characterize tiles made 80% of plastic.

XI.MANUFACTURING

Being robust, waterproof, light, easy to mold, and recyclable, PCB waste has incredible qualities and durability, which is great for buildings but a significant issue when it is flooding in the environment. After that, wooden blocks are stamped into the mold to form a compact brick. A month later of air curing, the brick is strong. It provides better heat and soundproofing and is more resilient than clay bricks. PCB has better adhesion than harder concrete, and strain stiffness diminishes as temperature rises. Further study and development are required for waste-derived brick that contains PCBs, not only in based on the technical, economical, and environmental considerations but also in considerations of governmental waste recycling legislation.

XII.SCENARIO – 2

What is CRT?

CRTs are vacuum tubes with one or even more electron cannons within, whose controlled beams are used to project pictures onto phosphorescent screens. Around 6.3 MT of CRT trash was produced worldwide in 2014 [blade 2015 et .al]

Nearly 12% of all e-waste is made up of CRTs. It often consists of glass frameworks and a variety of other compounds, with lead typically present in certain metals. An electron gun and three distinct types of glasses are within a conical-shaped tube called a CRT. It is the part of TVs and monitors that weighs the most. According to Andréola et al. (2007), it makes up between 60 and 85 percent of the weight of all TVs and monitors. CRTs typically have a front panel that serves as a display screen, a neck, and a funnel. The funnel and neck of the CRT are particularly hazardous and are known to have major health effects. [Hamsavathi]. CRT trash disposal is increasing daily because of flat panels like LCD and LED replacing CRT [Shaw environmental Inc. 2013]. Waste from electronics and electrical appliances has led to issues. Since 1990, these issues have existed [45].

In addition to having a respectable native strength and a lower hydrophilicity, CRT glasses are a better choice for making cement blocks than other forms of e-waste. (Zhitong yao).

XIII. METHOD OF PULVERISATION

Due to the challenges of powdering CRT waste, it was lowered to a size lesser than 12 mm using a shredding equipment [k Hamsavathi]. Either the CRT e-waste must be finely ground to be used as substitute for fine aggregate or it should be shred to a size lesser than 12 mm to be used in part as coarse aggregate.

XIV. MATERIALS REQUIRED

1.Cement

Here, common Portland cement, a fundamental component of concrete, is used to create concrete blocks. To manufacture concrete, mortar, etc., Portland concretes are frequently utilized.

2.Fine And Coarse Aggregate

The compressive strength of the concrete is mostly determined by the filler material known as aggregate. It is crucial in figuring out things like toughness, density, shrinkage, etc. Fine aggregate is made up of filler materials that are considerably smaller, whereas coarse aggregate is made up of additive material that are bigger in size and is utilized in building. When river sand was analyzed, it was discovered that its size was around 4.75 mm. Here, CRT e-waste has partially replaced the coarse aggregate, a large-sized filler element.

3.Water

Water is a crucial component in the ecofriendly concrete blocks made from e-waste. Cement and aggregate are frequently combined using it. The most important component in concrete mixing is the ratio of water to cement.

4.Mixing

Cement, sand, and aggregate must be mixed in the ratio (1:1:2) during mixing. Cement, sand, and aggregate are used in M25 grade concrete at the conventional ratio of (1:1:2).However, coarse aggregate was used in place of some of the CRT e-waste when mixing in the very same ratio as M25. Manual mixing was employed.

5.Mould Preparation

To guarantee that there will be no leaks, the mixture must be properly examined before being poured into the mould. It must also be greased to facilitate easy removal once the mixture has dried. The concrete block must be taken out of the mould once it has dried.

XV.RESULTS AND DISCUSSIONS

To ascertain the compression and flexural strengths of the concrete block, numerous tests must be carried out. Compression strength tests are to be done on three distinct samples on days 7, 14, and 28. The outcomes on the 7th day clearly shown that the impact strength grows as the proportion of CRT e-waste is raised, but that the impact strength progressively diminishes if the proportion of CRT e-waste is raised by more than 15%.The results on day 14 were identical to those on day 7. Additionally, the burden with reduce if the proportion of CRT electronic waste.With a rise in the proportion of e-waste on the 28th day, the concrete block's compressive strength and load-supporting capacity declined.

After performing a compression test, it could be concluded that CRT e waste concrete structures have less strength than regular concrete blocks. There are two causes for the decreased compressive strength.

1. The cement and CRT e-waste have a weak bond.
2. The porosity of the block of concrete may rise owing to the existence of CRT e-waste, which may subsequently lead to a drop in density.

Flexuaral Strength

The ductility of the block of concrete is improved by CRT e-waste addition to the concrete mixture, increasing the concrete block's capacity to bear loads. The concrete block's flexural strength is affected by the fluidity of CRT e-waste. Because CRT e-wastes have greater ductility, they are equally dispersed within concrete blocks, increasing the ductility of those blocks. improving the flexural strength at the end. The findings demonstrate that CRT e-wastes can boost concrete block flexural strength by up to 15%. The flexural strength declines beyond 15%.

XVI.CONCLUSION

An alternate design that integrates a fingerprint scanner with the Arduino microcontroller has been suggested to enhance the device's security mechanisms. The suggested concept provides a more comprehensive solution to system control. The schematic diagram of the suggested design is shown in Fig.5.1. To monitor the equipment and allow access to a user in a distant region, the suggested technique utilizes a GSM/GPS-based unit. The best technique to safeguard a car from numerous sorts of theft is to use a vehicle locking system. It is a car security device that provides a more comprehensive and luxurious insurance for one's vehicle.

Recycling of electronic trash has grown to be a significant global problem. Electronic devices are employed today for everything from alarm clock setup to satellite management. Electronic devices have developed from large, outdated CRT televisions to more modern, thinner LCDs and LEDs. The rate of outdated electronic devices being dumped is increasing every year because of the rapid speed of technological advancement.

The two primary components of these discharged electronic wastes are:

1. PCBs, which are frequently found in all other electronic devices.
2. In the 20th century, TVs and monitors were mostly made of CRTs (cathode ray tubes).

In this review, an attempt has been done to offer a more effective remedy for this issue. PCB (polychlorinated biphenyl) was chosen because of its chemical stability, non-flammability, electrical insulating characteristics, and thermal insulating capabilities.Cathode ray tubes (CRTs) are useful for making concrete blocks because they have a low water absorption capacity and adequate native durability. The following findings were reached after conducting numerous tests:

FOR SCENARIO - 1

E-waste may replace concrete up to 20% of the time. We can cut the cost of purchasing concrete by between 10% and 20% if we partially substitute it with e-waste [S Prakash Chandar].

Only non-load sustaining walls can use blocks comprising e-waste.

FOR SCENARIO - 2

It was made abundantly evident that adding CRT e-wastes approximately to 15% enhances compression strength, but that doing so exhibits a decremental pattern that lowers load-bearing capacity. Flexural strength is also enhanced by the application of CRT e-waste approximately to 15%, at which point it diminishes. Comparing the two instances, it can be concluded that because electronic waste is lightweight, the overall weight of the structure is decreased. Due to its light weight and flexibility, it is also appropriate for earthquake-prone areas.

The cement block's compressive and flexural strengths are both increased when up to 15% of e-waste is added. However, because to its small weight, it cannot be used for exterior walls. The concrete block may develop cracks as a result of the link involving cement and e-waste breaking. E-waste cannot be put in excess of 15% without noticeably reducing compressive strength. It may be concluded that e-waste is a suitable replacement element for coarse aggregate concrete, which can also be called add-ins as it declines, taking into account both the advantages and disadvantages of these blocks.

Concrete's weight makes it economically viable. Further study and development are required to achieve waste management, not only on the technological, economical, and environmental implications but also on governmental policy associated with sustainable growth and waste recycling. This demonstrates that it can be successfully recycled and reused along the right and effective path.

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