EFFECTIVE UTILIZATION OF E-WASTE AS A WALL TILES

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Abstract— In this project we use E - Waste as wall tiles. Defective Motherboards as a raw material and it is one of the alternative methods of disposing the E-waste. We had replaced ordinary ceramic tiles by waste PCB (Printable circuit board) on mother board. Mother boards are cleaned to remove the external parts. Then the PCB boards are coated with paint for sufficient finishing and good appearance. And last it is to be placing on the interior portion of the wall. Placing is to be done by using the cement mortar. We got best results for alternating of wall decorating tiles and it minimize the Electronic waste also. It also reduces the pollution caused by the E-waste. It is initial process and low level of production so the cost of E-waste tile is increases but after the increases of production in some years to minimize the cost and also simple process.

Keywords— **E-waste, tiles, motherboards.**

I. INTRODUCTION

In India, the quantity of E-waste or electronic waste has now become a major problem. In the last 10 to 15 years, rapid growth and technology changes in electronics have led to an increasing turnover of computers, tablets, phones, display screens, printers and other electronics. Consequently, businesses and households have seen steady growth in the volume of their electronics needing safe and cost effective end-of-life management. Electronics being disposed of are commonly referred to as e-waste. The word e-waste, however, is a misnomer because it implies that such electronics have no value. The term e-scrap may be more appropriate since up to 99% of the materials making up an electronic product are recyclable and have monetary value in secondary markets. Most of the e-scrap contains PCBs which consist of approximately 26% metals, made up mainly of copper, lead, aluminum, iron and tin, as well as other heavy metals such as cadmium and nickel. Hence by processing the E-waste, valuable materials are recovered and waste minimization is achieved.

II. WHAT IS E-WASTE?

E-waste can be defined as the disposal created by discarded electronic devices and components as well as substances involved in their manufacture and production. E-waste is a term used to cover almost all types of electrical and electronic equipment (EEE) that has or could enter the waste stream. Although e-waste is a general term, it can be considered to cover TVs, computers, mobile phones, white goods (e.g. fridges, washing machines, dryers etc), home entertainment and stereo systems, toys, toasters, kettles – almost any household or business item with circuitry or electrical components with power or battery supply.

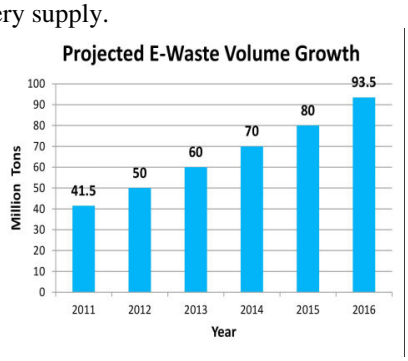

Figure 1: Year wise e-waste growth chat

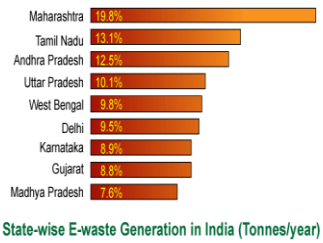

Figure 2: State wise e-waste growth

III.MOTHERBOARD

- A Motherboard is the main printed circuit board (PCB) found in the general purpose microcomputers and other expandable systems.
- It is made up of fiber glass material.
- PCB is the board consists of one or more sheets layers of copper laminated onto and or between sheet layer of a non Conductive substrate

Figure 3: Motherboard.

IV.TILES

A **tile** is a manufactured piece of hard-wearing material such as ceramic, stone metal, or even glass, generally used for covering roofs, floors, walls, showers, or other objects such as tabletops. Alternatively, tile can sometimes refer to similar units made from lightweight materials such as perlite, wood, and mineral wool, typically used for wall and ceiling applications. In another sense, a tile is a construction tile or similar object, such as rectangular counters used in playing games (tile-based game).

V.EXPERIMENTAL INVESTIGATION

Collection & Cleaning of Motherboard

- E-waste comprises of wastes generated from used electronic devices and house hold appliances.
- Motherboards are collected from the place of e-waste disposal units.
- Use of chisel , cutter and hammer to easily remove the components and grinding machine to use for smooth the surface.
- Grinding is especially for the removal of toxic content present in to board surface and its give smooth finish.
- From the grinding process it gives best bonding with the wall surface.

VI.CLEANED MOTHERBOARDS

Figure 6: PC Board after grinding

VII (i) WATER ABSORPTION TEST

The increase in mass of tiles which after determination of the dry mass are placed under water, then boiled and afterwards cooled during specified times while still completely immersed, taken out from water and reweighed after removing excess of water. When water absorption is less than 3 percent, the test has to be carried out in vacuum.

VII (ii) RESULTS

$$\text{Water absorption}(\%) = \frac{M2 - M1}{M1} \times 100$$

Where,

M1=Mass of dry tile in g

M2=Mass of wet tile in g

Water absorption of tile is 13.5%

Water absorption of PCB is 0.172%

THEREFORE,

The PCB Board absorbs less water than normal tile.

VIII.DURABILITY TEST

- This test is used to the durability properties of the material. Acid resistant test is used to find the durability of material.
- As the results the PCB gives better results when compared to normal tiles.

IX.BONDING TEST

- Mix ratio of fine aggregate and cement is 1:2 for bonding the tiles as per IS code
- The quality of bonding is exposed by this mix ratio when compared to normal tiles bonding.

Figure 10: Placing on wall

X.THERMAL RESISTANCE

Thermal resistance of motherboard is 65˚C. so, we increasing the thermal resistance by coating of paint whenever thermal resistance of paint is 600˚C. Finally the thermal resistance of PCB tiles is 650˚C

XI.TESTS CONDUCTED FOR BONDING MATERIAL

FOR CEMENT AND SAND

11.1. Specific gravity of fine aggregate.
11.2. Specific gravity of cement.
11.3. Sieve analysis of fine aggregate.
11.4. Consistency of cement

11.1. SPECIFIC GRAVITY OF FINE AGGREGATE

- Specific gravity is the ratio of the density of a substance to the density of a reference substance; equivalently, it is the ratio of the mass of a substance to the mass of a reference substance for the same given volume.
- The value of specific gravity of FA is 2.62

Figure 11: Specific gravity test for fine aggregate

11.2.SPECIFIC GRAVITY FOR CEMENT

- The value of specific gravity of cement is 3.72.

Figure 12: specific gravity test for cement

11.3. SIEVE ANALYSIS TEST

- A sieve analysis (or gradation test) is a practice or procedure used (commonly used in civil engineering) to assess the particle size distribution (also called gradation) of a granular material. The size distribution is often of critical importance to the way the material performs in use.
- The sand is generally passing through 4.75mm IS sieve and retaining in 2.36 IS sieve is 1.5.
- The cumulative value of sand is 90.3 and its present in zone II.

Figure 13: sieve analysis test

11.4. CONSISTENCY OF CEMENT

- The standard consistency of a cement paste is defined as that consistency which will permit the vicat plunger to penetrate to a point 5 to 7mm from the bottom of the vicat mould
- The consistency of cement is 32%

Figure 14: consistency test for cement

XII.EFFECTIVE COATING OF MOTHERBOARD TILES

Clear and smooth surface appearance for the tiles to given by this coating of enamel paints and quality of glassy materials for good appearance.

Figure 16: Coating with primer

Figure 17: Coating with enamel paint

XIII.FINAL FINISHING

Figure 18: Final coating with paint

XIV.PLACING OF TILES

- The surface of placing should be first patching
- Then the motherboard tiles are placed efficiently. And coated with enamel paints for smooth surface and aesthetic look.

XV.MERITS

- In this project mainly for **Reuse** of motherboards.
- This process should be minimizing the **E-waste.**
- Motherboard tiles are **cost** effective, when compared to the ordinary wall tiles.
- In the following years, E-waste management is considered as a major role at that time these E-waste tiles will plays an effective role.

XVI.CONCLUSION

From this project, there is a Better and perfect alternating solution for reusing of e-waste in easiest way is to be found and new creative wall tile to be introduced. Tests are carried out successfully and results are to be obtained in perfect manner as per standard specifications. The characteristics and properties of e-waste tiles are similar to the normal tiles and cost of the E-waste tile is greater than when compared to normal wall tile. In future it will reduce by increasing in large level of production. And it will be a good solution for reducing the E-waste.

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