Influence of E-Waste and Chemical Admixture in Concrete

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Abstract:
E-waste is from the electrical and electronic devices such as computers, laptops, phones and television and home appliances. It can be used for reuse, resale, salvage, recycling or disposal. It becomes a very hazardous thing in our daily life. So to reduce this effect we made a project on concrete with E waste. This may reduce the effect of E waste and its dangerous gases.

Our project deals with the usage of E waste along with the chemical admixtures in concrete. The hazardous substances in E waste are PCB (polychlorinated biphenyls), CFC (chloro fluro carbons), PVC (polyvinyl chloride), Arsenic, barium, etc…When these E wastes are used in the concrete mix it will not emit their gases.

We replaced the E waste for coarse aggregate. Initially E wastes were broken into small pieces. The mix design was done by M40 grade of concrete by IS method. Ordinary Portland cement of 43 grades was used. The broken pieces of E-waste were replaced by 0%, 10%, 20%, 25%, 30% to the coarse aggregate along with the chemical admixture. Compressive strength and Tensile strength were tested and compared with control concrete. Experiments done shows the increase in strength when E waste is used in concrete. Thus the usage of E waste also decreases the cost of construction.

I. INTRODUCTION

Use of e-waste material is a partial solution of environmental and natural problems. Around 50 million tons of E-wastes are produced each year. It has a numerous indirect benefits such as reduction in landfill cost, saving in energy and protects the environment from possible pollution effects. The Environmental Protection Agency estimates that only 15-20% of e-waste is recycled, the rest of these electronics which is not suitable for recycle go into landfills and incinerators.

Land filling and incineration are currently adopted in India for the disposal and management of e-waste. But all the methods which are currently in practice has some ecological problems created by it. For that reason to find a immediate solution for reduce the e-waste.

The total e-waste generated in India amounts to 1, 46,180 tons per year. E-waste sources in the form of useless electrical or electronic devices from commercial informal recyclers have been collected which were crushed and ground to the particle size.

Physical and chemical properties of e-waste particles are calculated. Specific gravity, water absorption. Impact value, Abrasion test, Sieve analysis are calculated. General Experimental investigation for the material is performed based on the experiments done. The materials were mixed in hand mixer.

Lakshmi.R, Nagan.Sre[1] reported that e-waste can be used by crushing and grounding to the particle size. The particle size was assumed to be between 1.18mm – 2.36mm. The compressive strength of the mix was reported to get reduced as the percentage of the e-waste increases.

Ankit Arora, Dr. Urmil V. Dave[2] reported that e-waste and plastic bottles were crushing and grounding to the fine aggregate size. The divided particle size was found to be less than 2.36mm and above 600micron. They concluded that e-waste aggregate of 4% can be incorporated as fine aggregate replacement without any long term detrimental effects and with acceptable strength development properties.

II. MATERIALS AND METHODS

2.1. Materials Used
1. Cement: Ordinary Portland cement of 43 grades with 28 percent normal consistency conforming to IS: 8112-1989 was used. The specific gravity of cement 3.15 was used in this experimentation conforming IS: 12269-1987.
2. Sand: Locally available sand was used.
3. Coarse aggregate: Locally available coarse aggregate of maximum size 12.5mm was used.
4. Chemical Admixture type: Conplast SP430 was used.
5. E-waste: Components from TV, refrigerator, computer, etc… broken into size of 12.5mm was used.
6. Water: Portable water was used for the experimentation

2.2 Moulding of Specimen

The moulds of cubes, cylinders were cleaned thoroughly. A thin layer of oil was applied to inner surface of the moulds to avoid the adhesion of concrete with the inner side of the moulds. In these study M40 grade standard concrete cubes of size 150 X 150 X 150mm, cylinder of size 150mm diameter and 300mm height were cast for determining the compressive strength, split tensile strength. The cast specimens were demoulded at the end of 24±2 hours and cured for the required number of days.

III. EXPERIMENTAL DESCRIPTION

3.1 Waste collection

E waste was collected from the local electronic shops itself of about 50kg. It was broken into small pieces in our concrete lab. We took broken pieces as 12.5mm size by using sieve machine.

3.2 Physical properties of E-waste and Coarse aggregate

Table.2 shows the physical properties of E-waste and Coarse aggregate.

<table>
<thead>
<tr>
<th>Properties</th>
<th>E-waste</th>
<th>Coarse aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific gravity</td>
<td>1.79</td>
<td>2.79</td>
</tr>
<tr>
<td>Absorption (%)</td>
<td>&lt;2</td>
<td>0.5</td>
</tr>
<tr>
<td>Color</td>
<td>Multi color</td>
<td>Grey</td>
</tr>
<tr>
<td>Shape</td>
<td>Irregular</td>
<td>Angular</td>
</tr>
</tbody>
</table>

3.3 Concrete mix

Cement concrete of grade M40 is used in this work; details about proportion of e-waste are shown in Table.2. The coarse aggregate used in the present work is 12.5mm.

Table.4 shows the average strength of compressive strength and split tensile strength test

![Figure 1 shows different test specimen](image)

IV. RESULT AND DISCUSSION

4.1. Compressive Strength Test

The Compressive strength test for the cubes was conducted to evaluate the strength development of concrete containing various e-waste contents at the age of 7, 14, 28 days respectively.

<table>
<thead>
<tr>
<th>Mix specification</th>
<th>Control concrete</th>
<th>10%</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 days</td>
<td>31.64</td>
<td>32</td>
<td>32.5</td>
<td>33.54</td>
<td>31.02</td>
</tr>
<tr>
<td>14 days</td>
<td>36.18</td>
<td>37</td>
<td>39.1</td>
<td>41.23</td>
<td>40.1</td>
</tr>
<tr>
<td>28 days</td>
<td>43.5</td>
<td>45.54</td>
<td>46.98</td>
<td>49.29</td>
<td>47.23</td>
</tr>
</tbody>
</table>

4.2. Split Tensile Strength Test

The Split Tensile strength test for the cylinders was conducted to evaluate the strength development of concrete containing various e-waste contents at the age of 7, 14, 28 days respectively.
V. CONCLUSION

This study intended to find the effective ways to reutilize the E-waste particles as coarse aggregate. Analysis of the strength characteristics of concrete containing recycled E-waste and admixture gave the following results.

- We achieved the minimum strength of M40 concrete mix by adding admixture with e-waste.
- The strength development of admixture based e-waste concrete increase at 25% of replacement of coarse aggregate with e-waste. The compressive strength and split tensile strength showed good result.
- We concluded that 30% of e-waste can be replaced as coarse aggregate in concrete with acceptable strength development properties.

REFERENCE
