"Study of E-Waste Concrete"

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-Utilization of E-Waste Materials and by Products in Concrete as Replacement of Sand is Partial Solution to Environmental and Ecological Problems.

Abstract – *The management and recycling of E plastic waste is rapidly growing as it is a valuable resource of IT industries and it is very hazardous substances and with low recycling rate. The utilization of e-waste materials is a partial solution to environmental and ecological problems. As the use of E plastic waste will reduces the aggregate cost and provides a good strength for the structure and roads. It will reduces the landfill cost and it is energy saving. The plastic used in this project is e-waste plastic which consists of all plastic materials used to make electronic equipments. This plastic is grinded and then used as a filler material in concrete.*

The plastic which has been partially replaced by fine aggregate in the project is ***Acrylonitrile butadiene styrene (ABS).*** *Four trials had been taken in which plastic was added in various proportions and compression strength was tested and compared with M20 nominal concrete. The scope of this project is to study the effect of variation in percentage electronic waste plastic as a filter material on the strength of concrete of certain mix. The compressive strength of concrete with different percentage of plastic was carried out at the edge of 3 days, 7 days and 28 days.*

Keywords – Concrete, E-Wastes, Sand, Acrylonitrile butadiene styreneCompressive strength.

1. INTRODUCTION –

Concrete is the first choice for the construction many countries today. This has increased the fast vanishing of natural resources. On the other hand new electrical and electronic products have become an integral part of daily lives providing us with more comfort, security, easy, and faster acquisition. Due to technological growth, there is a high rate of obsolescence in the electronic equipment which leads to one of the fastest growing waste stream in the world.

Although principally Favourable from a life cycle environment impact perspective, recycling of plastic from waste electrical and electronic equipment (WEEE) is not uncontested because of the potential dissipation of hazardous substance into new products. This study attempts to give a contribution to the effective use of domestic wastes (plastic in electronic waste) in concrete in order to prevent the environmental strains caused by them, also to limit the consumption of high amount of natural resources.

1.1 Objective of the study –

The main objectives are;

- To detect an alternative material for river sand (fine aggregate) in the production of cement concrete
- The valuable cost shortage of rive sand has persuaded to crisis where in a novel material has to be established out in order to boon the structure corporation.

2. METHODOLOGY –

The step by step procedure for testing the concrete cube with various admixtures is presented in below fig. 1

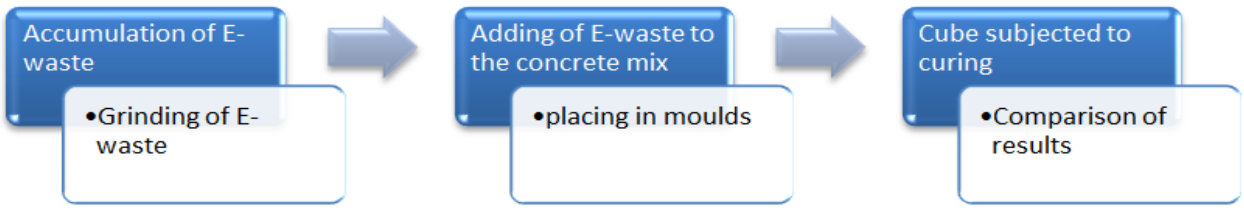

Fig 1 The schematic diagram

2.1 Concrete casting:

Steel moulds were used to mould the samples. The casting were packed with concrete in three courses and consolidated aptly. Congruent with 24 hours the paradigms were blustered and bathed in water for curing. The curing is done for 28 days. The tests are done after 7, 14, and 28 days.

3. EXPERIMENTAL DETAILS –

3.1 Materials –

Cement - OPC , 43 Grade

Fine aggregate – Crushed Sand

Coarse aggregate – good quality 10 mm nominal size

Design mix – M20 N/mm^2

Water cement ratio – 0.5

Plastic granular variation – 0.72%(0.5kg), 1.44%(1.0kg), 2.16% (1.5kg), 2.88%(2.0kg) Pulverised fly ash

Admixture – Sikaplast 5201NS, Sikament 5204NS and sika viscocrete5210

3.2 Concrete mix –

The concrete mix design is using M20. The mix design as per D. O. E. Method. The mix design as shown in below table no.1

M_{20}	Per meter cube	%
C	253.7	75.54
Pfa	91.3	26.46
MS	0	34.5
Crs	456.67	22.67
10	588.62	29.22
20	969.16	48.11
W	163	
Plastic	0	0.00
Admixture	2014.46	
Aggregate/cement	5.839	
Water/cement	0.470	

Table no. 1 : Mix Design

3.3 Tests –

Compressive test –

Out of various test carried out on concrete, this is the utmost important which gives an idea about various characteristics of concrete. Based on this test one judge that weather concreting has done properly or not. It was conducted to evaluate the strength development of concrete containing various e-wastes contains at the age of 7, 14, 28 days respectively.

Concrete with Plastic granules	3 Days (N/mm^2)	7 Days (N/mm^2)	28 Days (N/mm^2)
0.72% (0.5 kg)	15.08	19.78	26.96
1.44% (1 kg)	14.19	19.73	26.02
2.16% (1.5 kg)	16.63	21.11	27.17
2.66% (2 kg)	7.88	11.93	15.48

Table no. 2 : compressive strength result

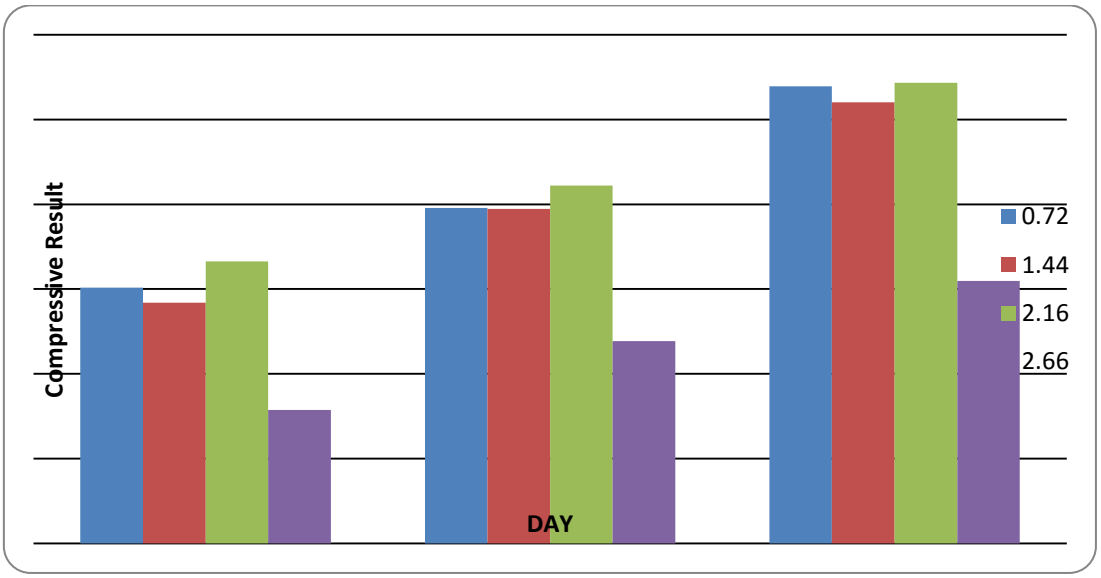

Chart no. 1 – compressive strength results

4. Conclusions -

1. It is observed that there is decreased in strength of concrete with 1.44 % (1kg) of plastic granules than 0.72% (500g) of plastic granules. With 2.16% (1.5kg) plastic granules increase in strength is found. However further increase in granules i.e. with 2.66% (2kg), reduction in strength at 3,7 and 28 days is observed .

2. It is observed that e-waste mix concrete prepared with 2.16% (1.5kg) plastic granules is found to give maximum compressive strength compared to other concrete mixes

3. From the failure pattern of concrete cubes in compression it was found that, the failure was because crushing of cement paste rather than crushing of aggregate.

4. It is observed that for concrete with 2.165 (1.5kg) plastic granules, the rate of gaining strength at various ages is found to be more than for the concrete with other percentage of plastic granules.

5. It is difficult to ensure uniform dispersion of plastic granules throughout the mass of concrete. Further it is observed that some of the plastic fibres were found to be floating on the surface of cube due to load density of plastic .

6. It is observed with increase in percentage of plastic granules concrete was found to loose cohesiveness

7. Electronic plastic can be effectively used in concrete.

5. Future scope

1. E-waste granules can be used partial replacement to coarse aggregates

2. With variation in small percentage range of e-waste plastic granules, It is effect on concrete strength can be studied.

3. Effect on flexural strength and durability of concrete can be studied.

4. Along with Destructive tests certain non-destructive test can be carried out. E.g. – rebound hammer test, ultrasonic pulse velocity test. Also Durability tests such as water permeability and RCPT (Rapid Chloride Penetration Test) can be carried out.

5. Different types of plastic can be combined and can used for project.

6. References-

Kang et al (2005) discussed the various possibilities of recycling the plastic such as coke oven process, thermal recycling, mechanical recycling etc. They concluded that the major challenge for the plastic waste recycling is the need for a continuous and stable supply of materials to be recycled and lack of cost effective technologies for recycling.

Lakshmi and Nagan (2011) suggested the use of E-Plastic particles as partial replacement of coarse aggregates in M20 concrete with and without fly ash. The results revealed that 20% replacement of e-waste as coarse aggregate in concrete shows improvement in compressive and tensile strength.

Atul (2012) suggested the use of plastic (polyethylene) bags in concrete to improve its mechanical properties. He found experimentally that up to 0.8% addition of polyethylene pieces to concrete shows improvement in tensile strength.

Taha et al (2009) and park et al (2004) carried out works to examine the possibility of reusing waste recycled glass in concrete and construction applications, as an alternative solution to the growing quantity of waste recycled glass as well as to meet the demand of natural aggregates.

Tung-chai Ling and chi-sun Poon suggested the feasibility of using treated CRT glass as 100% substitution of fine aggregate in making heavy weight concrete, and untreated glass should be limited to below 25% due to its potential lead leaching.

Huang et al (2006) assessed the feasibility of utilizing resin powder and glass fibres recycled from PCB waste as a partial replacement of fine aggregates in cement mortar. They suggested PCB resin powder replacement to less than 10% and addition level of glass fibre to less than 2% to achieve the needed strength. Numerous researches are being conducted to find the use of e-waste in concrete not only to improve its properties but also to find solution for a safer and economical e-waste disposal method.

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Concrete technology by M.S. Shetty

IS:456-2000

IS:10262-1982