

EXPERIMENTAL STUDY ON E-WASTE UTILIZATION IN CONCRETE BY PARTIAL REPLACEMENT OF FINE AGGREGATES

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Abstract:

In the world solid waste is increasing day by day and harms the environment of the earth, the waste from Electric and Electronic equipment's are part of the solid waste management. The usage of electronic gadgets is increasing day by day and the other hand that's effect is increasing an e-waste. The e-waste is also problem for the recyclers of e-waste in the company after the e-waste recycle remaining materials are dumped and not use any kind of work. In our project we present an experimental work have been done to determine the effects of recycled concrete fine aggregate under the curing conditions. We replace the sand from concrete in percentage and add e-waste percentage of sand like 5% 10% and 15%. The present our project aspires that the major work has been replacing of E-waste in the production of low cost concrete in civil engineering society.

Keywords — waste problem, replacement with sand, make concrete, test on e-waste material concrete

I. INTRODUCTION

It's time to think about to Mother Nature because of the human's harms a nature for our self profits and things. E-waste problem is not present from the past its new problem which is growing very fast and difficult to solve. An electronic gadgets act major roles in development of world. Day by day the usage of electronic gadgets uses are increases. After the usable life span of the electronic gadgets it's becomes a waste and it's called an e-waste. That's why increasing in use of electronic gadgets as well as increasing an amount of e-waste. The e-waste problem is faced by world in 2020 around 50 million ton e-waste are generated.

In India only 12% of the e-waste is recycle and other is dumped as land filler. The recyclers of the e-waste are collecting the e-waste door to door and process on e-waste for recycle. In e-waste recycling all parts of e-waste are not recycle. Remaining part is not use and dumps as a land filler. The remaining e-waste is transported to the dumping site. In land fill the e-waste harm for the ground water and also harm full for the agriculture land. In our project we take e-waste from Galaxy recycling at Gondal. PCBs or other e-waste materials are remaining which is not use in any kind of work. In e-waste many harm full chemicals and toxics are available which is harm full the humans and also for our environment. In galaxy e-waste recycling e-waste

recycle in formal sector and all heavy and harmful chemicals are removed and after the remaining part of e-waste is dumped at Kutchh or other dumping site. Transportation cost of unusable material is also not affordable.

II. OVER VIEW OF E-WASTE

A. E-waste contains

In the world million of tones e-waste is producing per year and this problem is also increasing day by day. All we think that E-waste contains only plastics but that's not true. E-waste contains harmful chemicals and heavy metals like brass, iron, lead, cadmium, arsenic etc. e-waste also contain valuable materials like gold, copper other ordinary materials.

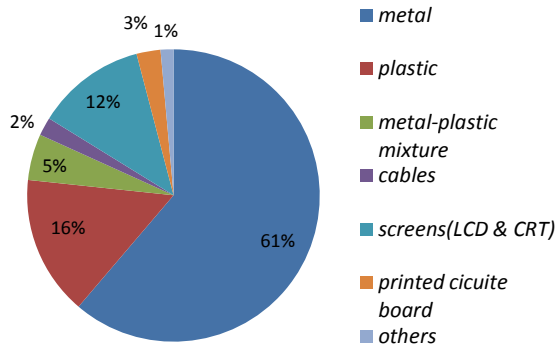


Fig.-1 contains in e-waste diagram

B. Types of e-waste

Mainly three types of e-wastes are available

- Large house appliances (refrigerator, washing machines etc.)
- Small house appliances (toasters, fans etc.)
- Information technology and telecommunication equipments (mobiles, laptops, computers etc.)

C. Types of recyclers

1) **Informal Sector Recyclers:** In the informal sector the e-waste recycle at local level recyclers. In the informal recycling e-waste are recycling by manually and e-waste part by cutting and usable parts are reuse. In informal recycling sector harmful chemicals and heavy materials are remaining in e-waste. This is the low cost and easy method to recycle the e-waste. But by this method labour health

safety is less because of the lack awareness about safety from e-waste and not availability of equipment.



Fig.-2 informal sector recyclers

2) **Formal sector recyclers:** In the formal sector e-waste recycle by the machinery and remove all heavy metals and harmful chemicals by step by step method. This method is costly than informal sector because of the machinery are need to be recycle of e-waste.



Fig.:3 formal sector recyclers

III Objective

- 1) To experiment compressive strength of e-waste concrete with partial replacement of fine aggregates.
- 2) To experiment workability of e-waste concrete with partial replacement of fine aggregates

IV Methodology

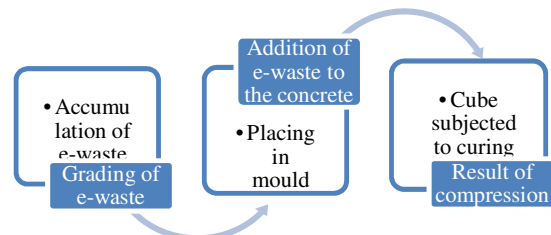


Figure:-4 methodology diagram

We take the e-waste for our study from the industrial area of Galaxy recyclers at Gondal. Galaxy recyclers are formal sector recyclers recycle all type of e-waste and remove the heavy materials and harmful chemicals by acids and sell the heavy materials. After the recycle of e-waste remaining part is form of dust and that type of waste are not use any kind of work and dump the Kutchh. Remaining part of e-waste contains most of PCBs.



Figure:-5 galaxy recyclers



Figure:-6 meeting with owner of galaxy recyclers

D. Galaxy e-waste

e-waste taken from the galaxy recycling which is recycled in formal sector and form of the e-waste is powder form and most of part is pcbs and plastic all heavy metal and harm full chemicals are removed.

E. Concrete mix design as per IS 10262(2019)

We take M25 mix design of concrete because of the M25 is standard mix as per latest code provision. And design the M25 mix design as per our study and needs. We mix an e-waste in concrete by some percentage (5, 10, and 15) % removing of fine aggregates.

F. Difference between our research and previous researches

PERAMETERS	PREVIOUS RESEARCH	OUR STUDY WORK
Source of e-waste material	In previous research papers purchase a e-waste at local markets	We take a e-waste from recyclers at free of cost
Aggregate replacement	Previous researchers replace a coarse aggregates	We replace a fine aggregates
Presence of heavy metals and chemicals	At local recyclers recycle e-waste informal method that's why the heavy metals and chemicals are present in e-waste and effect the strength of concrete	In the formal sector recyclers recycle the e-waste by machines so heavy metals and chemicals are removed
Grade of concrete	Use M20 grade concrete	We take M25 grade of concrete

Table:-1 difference between previous research and our study

V. Tests

G. Particle distribution test on e-waste

Test is carry as per IS 2386 (part 1) – 1963. We carry a sieve analysis test on e-waste for knowing an e-waste fineness modulus property and compare with a sand. So we take 500gm e-waste sample for test. In the particle size distribution test for e-waste performed by sieves which is recommended by IS code.



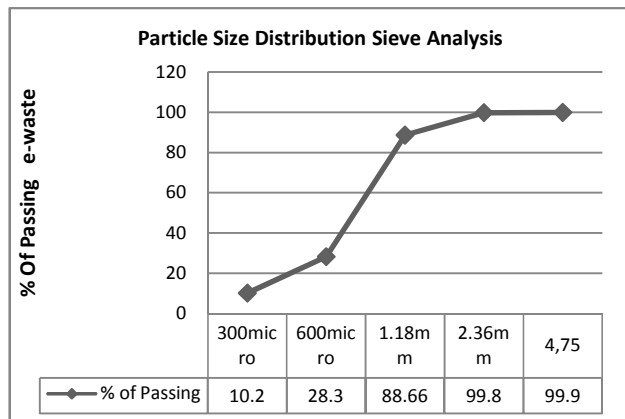
Figure:-7 image of test shaking the sieve for test



Figure:-8 image of test weighting of e-waste retained each sieve

IS sieve size	Cumulative Wt retain (kg)	Cumulative % of retain	Wt of passing (kg)	% of passing
4.75mm	0	0	100	90-100
2.36mm	1	0.2	99.8	75-100
1.18mm	72.1	14.4	85.6	55-90
300micro	358.5	71.7	28.3	8-3
150 micr0	449	89.8	10.2	0-10
<150micro	491.4	0	0	

Table:-2 particle size distribution test data



Graph:-1particle size distribution graph

h. Moisture content test by oven dry method

The test is performed as per IS 2720 – 2 (1973). The moisture content is important property of the concrete material because of the by moisture content of the e-waste we know that how much water absorb by the e-waste. In the case of the e-waste the water absorption is 0.we find the moisture content in the e-waste as compare to the sand.

Sample no.	Moisture content %		
	Sample no 1	Sample 2	Average %
Sand	8.79	7.15	7.97
e-waste	<0.2	0	<0.1

Table:-3 moisture content

i. Specific gravity test

Test performed as per IS 2386 – 3 (1963). In case of material to be replaced for the fine aggregate the value of specific gravity at least greater than 1 because the nominal specific gravity of the fine aggregate used in the concrete ranges from (2.4-2.6). So we have performed the specific gravity test on the e-waste material.

Specific gravity of e-waste = 1.3

j. Physical property of E-waste

Properties	Fine aggregate	E-waste
Specific gravity	2.57	1.3
Water absorption	0.7	<.2
Color	Dark brown	Green pcbs color
shape	Angular	Angular, powder

Table:-4 physical properties of e-waste

VI. Mix design of M25 concrete

Proportioning:

- 1) Grade designation– M25
- 2) Type of cement – OPC 53 grade conforming to IS 8112
- 3) Max .nominal size of aggregate – 20mm

- 4) Minimum cement content – 360 kg/cm³
- 5) Maximum w/c ratio – 0.55
- 6) Workability – 100mm (slump)
- 7) Exposure condition–severe

k. Property of materials

- 1) Cement used– OPC 53
- 2) Specific gravity of cement –3.15
- 3) Specific gravity of coarse aggregate –2.77
- 4) Specific gravity of fine aggregate – 2.46

l. Material

According to mix design as per IS; 10262-20109 mix proportion is:- 1:0.84:1.20 for M25
 Volume of cement = 375 kg/m³
 Volume of fine aggregates = 416.82 kg/m³
 Volume of coarse aggregates =586.68 kg/m³
 Water = 0.197 m³
 We replace the e-waste by volume of sand because of the making light weight concrete
 So we make 15 x 15 x 15 cm³ cubes for test.

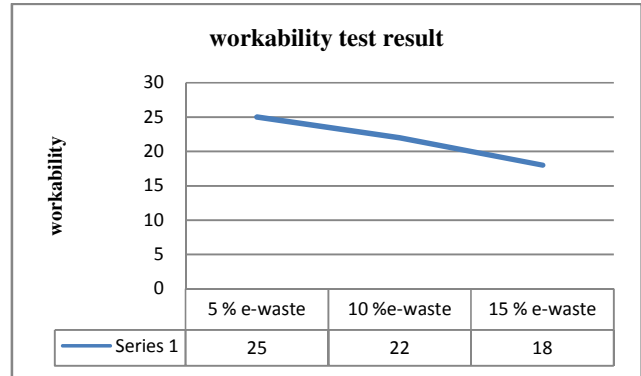
% of add	Cement (m ³)	Sand (m ³)	Aggregates (m ³)	Water (m ³)	e-waste (m ³)
0	0.00170	0.00140	0.00200	0.00085	0
5	0.00170	0.00133	0.00200	0.00200	0.00007
10	0.00170	0.00126	0.00200	0.00200	0.00014
15	0.00170	0.00119	0.00200	0.00200	0.00021

Table:-5 quantity of material per cube as per calculation of material per m³

VII. Results

m. Workability of e-waste concrete

Figure:-11 slump of concrete



Graph:-2 workability graph as per IS 1199:1959

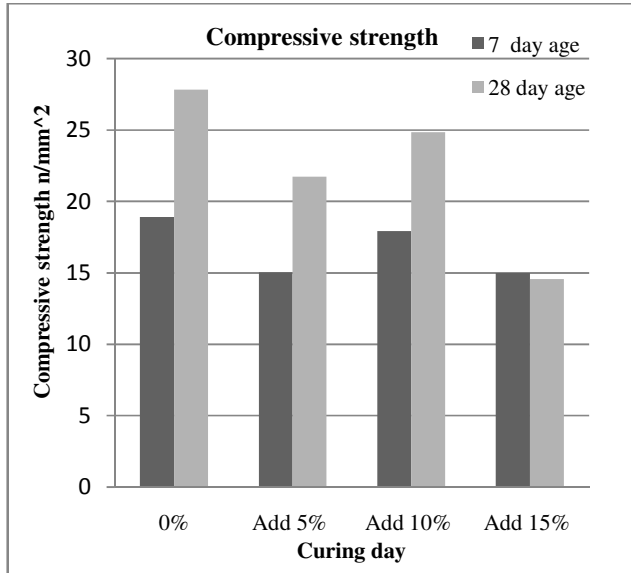
n. Compressive strength result



Figure:-13 compressive strength test as per IS 456-2000

Sr. no.	% of adding e-waste	Average Compressive @ 7 days strength N/mm ²	Average Compressive @ 28 days strength N/mm ²
1	0	18.9	27.83
2	5	15.03	21.72
3	10	17.92	24.85
4	15	14.98	22.07

Table:-6 average compressive strength result as per IS 456-2000



Graph:-3 compressive strength graph

VIII Conclusion

From our practical **Experimental study on E-waste utilization in concrete by replacing fine aggregates** we knew that if e-waste are use without formal recycling its cause problem in strength of concrete. If some chemicals are present in concrete its reaction with material of concrete. We had taken e-waste from formal recyclers and give the solution of dumping of e-waste as per our knowledge and study. And the result is according to particular e-waste which is taken from **Galaxy e-waste recycling**.

We state following conclusion:-

- 1) From our study we observed that the workability of the e-waste concrete is slightly decreased.
- 2) The compressible strength of e-waste concrete is given high strength at a 10% of e-waste by replacing of fine aggregate after that compressible strength is decreased.

We have carried a test on particular e-waste sample which is taken from Galaxy e-waste recycling. Our testes results are accordingly on our e-waste sample. The chemical compositions are varying sample by sample of e-waste and it may be effect on test result.

Acknowledgement

We the members of project are highly thankful for introducing such an existing way of developing our knowledge regarding the project development. We take a great pleasure in presenting the report for our project work entitled **“EXEPERIMENTAL STUDY ON E-WASTE UTILIZATION IN CONCRETE BY PARTIAL REPLACEMENT OF FINE AGGREGATES”**. This paper is made by help of Microsoft word. And we present all data and technical terms regarding to our research work. This research is work is completely work on the idea of the how to we solve the problem of the dumping of the e-waste. And we think that our research work is provide that kind of information for the e-waste concrete.

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