

PARTIAL REPLACEMENT OF COARSE AGGREGATE BY PLASTIC WASTE IN CONCRETE

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Abstract – Recycling of plastic waste by using them as coarse aggregate in concrete without evaluate the properties of concrete. Plastic due to its properties such as durability, light weight and its ability to be moulded into any desired shape has enhanced its popularity. However, its excessive production has become a serious threat to the environment and human health.. Then the main issue are disposal of plastic waste. Plastic waste are degrades land fertility, deteriorates aesthetic value of a place and human health . Therefore, this paper discusses on method of reducing plastic waste as well as safeguarding natural aggregates by incorporating it into cement concrete . As 100% replacement of natural coarse aggregate is not feasible, then optimum percentage replacement of natural coarse aggregate with plastic coarse aggregate which can give the same or more strength compared to nominal concrete. This experiment revealed that partial replacement of natural aggregate with plastic aggregate achieves the maximum strength of concrete in 28 days compare to other percentage of plastic replacement at various percentage were examined and optimum percentage is investigated.

Keyword: *Plastic Waste, Non-Biodegradable Material, Coarse Aggregate, compressive Test*

1. INTRODUCTION

Plastic waste is one of the dangerous pollution on earth. Plastic are light in weight, colorful, versatile material ever invented, and have become a universal material, used for everything from water bottles to wing, and then use of plastic are increased. However, its excessive production has become serious threat to environment and human health. The material plastic is a widely used synthetic polymer all over the globe. Approximately 90% of solid waste constitutes of plastic efficient disposal of plastic is the major problem faced today around the globe. Chemically plastic is most non-biodegradable material man has ever produced. although plastic, as a finished product, is non-toxic, the production process involves many dangerous and toxic chemicals. Therefore, burning of plastic is considered very dangerous. Then the 3-R method used to disposed plastic they are Reduction, Reuse and Recycling. Recycling is the common process to disposal of plastic. Recycling is the temporary solution. Then for this issue searching for a permanent disposal method, we arrived at an idea of incorporating the waste plastic in concrete, which can be used for construction purpose of permanent structures. If it is possible to replace any constituent of concrete by plastic without altering or changing the desirable properties of concrete then there lies a solution for the permanent disposal of plastic waste. The large amount of E-waste and plastic used in replace in concrete in the place of coarse aggregate. By depending upon the chemical and physical composition of concrete E-Waste and plastic waste material are replaced in place coarse aggregate and fine aggregate. Then the waste are utilize it as a partial replacement of coarse aggregate in mix concrete since the coarse aggregate economic cost also reduced. The partial replacement of plastic by natural coarse aggregate are not easy then we can use the some levels 10%, 15%, 30% by volume of aggregates were used for the preparation of the concrete on earth.

2. OBJECTIVE AND SCOPE

The main objective of this research proposal was to evaluate the possibility of using shredded plastic waste material as partial replacement for the coarse aggregate in concrete. To determine the percentage of plastic waste which gives the more strength when compared to control concrete was an important parameter to be determine by this investigation. As plastic waste can be used as partial replacement of coarse aggregate in concrete, there will be reduction in volume of plastic waste which in terms result in reduction of bad impacts of plastic waste on human health as well as an environment. There will be reduction in air, soil, water pollution.

3. LITERATURE REVIEW

Concrete is most common building material which has excellent characteristic of durability and high strength. Use of plastic involve heavy environment impacts such as change in animal habitats, high energy consumption and land degradation. Disposal of plastic waste in environment is considered to be a big problem due to its every low biodegradable

and presence in large quantity. Although some of these material can be beneficially incorporated in concrete, both as part of the cementitious binder phase or as aggregates, it is important to realize that not all waste are suitable for such use.

P. M. Subramanian (vol.4) described the need for an integrated waste management approach to be considered involving efficient use plastic material, recycling and disposal mechanisms.

Chen Vol.36, (pp. 449-456) reported the scope for utilization of waste plastic in concrete in several forms, including fine and coarse aggregate.

S. Chand (1960) has defined concrete as “concrete is a composite material composed of fine and coarse aggregate bounded together with a fluid cement (cement paste) that hardens over the time”.

4. MATERIALS USED

4.1 Cement

Cement is binding material in the project. OPC is suitable for normal concrete. For preparation of concrete 53 grade OPC cement conforming to requirements of IS: 12269-1987.

4.2 Plastic Material

Plastic material from electrical, electronic and house application of size 20mm are used in cement concrete as replacement of coarse aggregate. The industrial by products are to be used in concrete by the partial replacement of aggregate or partial cementitious material according to their chemical composition and grain size.



Fig.4.1 - Plastic Wastes

4.3 Aggregate (Coarse Aggregate and Fine Aggregate)

Aggregate provide strength to the concrete. Sand as a fine aggregate which come from basically river fine aggregate consist of particles 600micrometer or less in size is provide. Coarse aggregate are MSA 10mm and 20mm size of coarse aggregate was used according to IS:383-1970. The material were tested according to ascertain their properties.

4.4 Water

Water used is most important to mixing in the concrete. In every construction work water is vital role for the mixing and curing of concrete as per IS: 456-2000.

5. METHODOLOGY

The main research of that project is to permanent use of plastic waste as partial replacement of coarse aggregate to the production of concrete.it is fundamental to know the substitution of plastic aggregate in cement is satisfy. The collection of plastic waste from house, industrial plastic waste, E-waste they are crusher manual method and made 20mm sized particals. Then crushed plastic was passed through the 20mm size of sieve, mechanical sieve shaker was used. Then normal waterway sand, cement, aggregate and plastic waste crush partical are used for the making of cube. In concrete with 15% of plastic proportion, 5% fly ash was used to improve the properties of cube. A mix design produced in according with the properties obtained from test results. Concrete is then produced with replacement of 10%, 15%, 30% of plastic aggregate replacement of plastic aggregate with same mix proportion.



Fig. 5.1 - Crushed Plastic

The fresh concrete was cast into the moulds immediately after mixing, then moulded cube are wrapped during curing at evaluated temperature in dry environment to prevent excessive evaporation. Compressive strength test specimen shall be tested immediately after removal from water and while they are still in wet condition. At the time of testing, each specimen must keep in compressive testing machine. The maximum load at the breakage of concrete block will be noted. From the noted value compressive strength may calculated by using below formula.

$$\text{Compressive Strength} = \text{Load} / \text{Area}$$

$$\text{Size of the test specimen} = 150\text{mm} * 150\text{mm} * 150\text{mm}$$



Fig.5.2 – Compressive strength testing of cubes

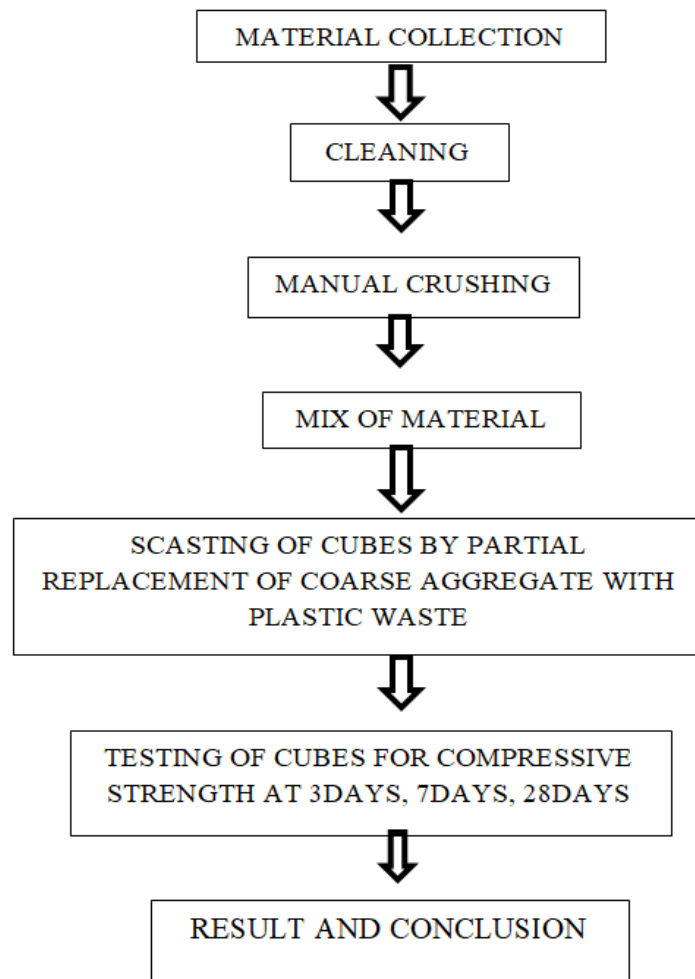


TABLE 5.1 PERCENTAGE OF PLASTIC AND WEIGHT OF CUBE :

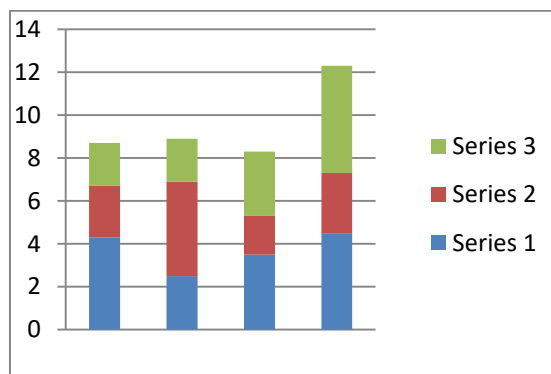
Sr. No.	Percentage of plastic	Weight of cube(kg)
1	0%	8.60
2	10%	8.10
3	15%	7.43
4	30%	7.05

TABLE 5.2 COMPARISION OF COMPRESSIVE STRENGTH:

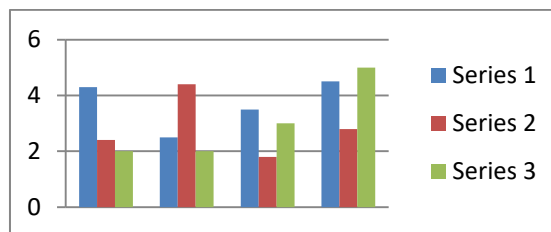
Sr. No.	% of plastic	7 days			14 days			28 days		
		Ultimate Load (KN)	Average load (KN)	Average compressive strength (N/mm ²)	Ultimate Load (KN)	Average load (KN)	Average compressive strength (N/mm ²)	Ultimate Load (KN)	Average load (KN)	Average compressive strength (N/mm ²)
1	0%	490			510			760		
		500	501.97	22.29	550	526.66	23.40	790	766.67	34.07
		515			520			750		

2	10%	275			450			680		
		290	263.4	11.70	470	461.66	20.51	680	678.33	30.15
		285			465			675		
3	15%	235			440			665		
		240	240	10.66	460	448.33	19.92	675	666.67	29.67
		245			445			660		
4	30%	180			210			285		
		190	185	8.22	220	218.33	9.70	300	291.67	12.96
		185			225			290		

GRAFICAL ANALYSIS



Graph. 5.1 – Comparison of Weight



% of plastic replacement of coarse aggregate and relative days

Graph 5.2- Comparison of compressive strength

6. FUTURE SCOPE

As plastic waste can be used as partial replacement of coarse aggregate in concrete, there will be reduction in plastic waste. There will be reduction in air, soil, water pollution. It will be helpful in increasing the life span of landfilling site. It is a source of revenue generation as useful material. It provide employment facilities. Since the concrete is being widely used material day by day, the requirement of natural coarse aggregate also getting increased. In such situation use of plastic waste essential for conserving the natural resources.

7. RESULT

As compared to conventional concrete cubes, there is reduction in weight of concrete cubes containing plastic waste.

1. For 10% partial replacement, there is reduction of 6%.
2. For 15% partial replacement, there is reduction of 14% (Plastic + Fly ash)
3. For 30% partial replacement, there is reduction of 18%

8. CONCLUSION

The test conducted on material like Cement, Sand. Conventional aggregate having all the results within permissible limit as per IS codes. As compared to conventional concrete cubes, there is reduction in weight of concrete cubes containing plastic waste. For 15% partial replacement, there is less reduction and good strength. The compressive strength also decreases with increase in plastic contain in concrete. There is a reduction in cost of construction if plastic waste is use in some contain in place of coarse aggregate. It has been concluded that acceptable strength are 15% of plastic and 5% of fly ash in concrete is recommendable.

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