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EXPERIMENTAL INVESTIGATION BY PARTIALLY REPLACING RECYCLED PLASTIC WITH AGGREGATE TO INVESTIGATE STRENGTH OF CONCRETE

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ABSTRACT
As one of the greatest inventions in 20th century, plastic has brought huge benefit in human life. Numerous plastic products are being consumed with the development of society. However, large amounts of plastic waste give much pressure on the environment due to the very low biodegradability of plastic. It is necessary to develop a rational approach for the waste disposal indicating both the economy and environmental protection. The productive use of waste material represents a means of alleviating some of the problems of solid waste management. The recycle of wastes is important from different points of view. The paper aims towards studying the effects of partial replacement of aggregates by plastic granules. Test samples will be casted for conventional concrete and then 6%, 12% and 18% of the aggregates will be replaced by plastic granules. Test samples will be tested for compression test, Split tensile test and flexure test. The test result of the conventional concrete will be compared with plastic imbedded concrete**.**

Key words: recycle aggregate, compression test, flexural test

INTRODUCTION

Every year more than 500 billion plastic bags are used (nearly one million bag per minute). Hundreds of thousands of sea turtles, whales and other marine mammals die every year from eating discarded plastic bag for mistaken food. On land many animals suffer from similar fate to marine life. Collection, hauling ad disposal of plastic bag waste creates an additional environmental impact. In a landfill or in environment, Plastic bags take up to 1000 year to degrade. Many researches were conducted to use industry by products such as fly ash, silica of concrete. Flume, glass cullet, coir fibers,e-plastic waste in concrete to improve the properties. (17%) is higher than for the plastic industry elsewhere in the world. India has a population of over 1 billion and a plastic consumption of 4 million tonnes. One third of the population is destitute and may not have the disposable income to consume much in the way of plastics or other goods. The virgin industry does not target this population to expand its markets. However, one third of the population is the middle class whose aspirations could be molded to increase consumption. Plastic manufacturers create needs for this segment of population. The rising needs of the middle class, and abilities of plastics to satisfy them at a cheaper price as to other materials like glass and metal, have compared.

OBJECTIVES:

To make a productive use of waste plastic which has harmful effect on envoirrment.to reduce the pressure on naturally available materials by replacing it with Recycled plastic aggregate

1. To study the physical characteristics of natural aggregate with Plastic recycled aggregate.
2. To study properties of wet concrete using recycled plastic aggregates as partial replacement of

aggregates

3.To test compressive strength of cubes, cylinder& flexural strength of beams as per IS Code Specifications.

Scope of Work

The project aims towards studying the effects of partial replacement of aggregates by plastic granules. Test samples will be casted for conventional concrete and then 6%, 12% and 18% of the aggregates will be replaced by plastic granules. Test samples will be tested for compression test, Split tensile test and flexure test. The test result of the conventional concrete will be compared with plastic imbedded concrete.

Material and Properties

Cement

Ultra-tech OPC 53 grade cement is used for experimental study. Basic test like specific gravity, normal consistency, initial setting time and fineness test has been performed on the cement. Specific gravity = 2.89, Normal consistency = 34, Initial setting time = 35 min & Fineness= 3%.

Sand

The sand used for this experiment is locally available kathojodi river sand the grade of sand is zone 4 and the sand is free from mud and organic materials. The particles size is less than 4.75 mm. The basic test where conducted and the results are as follows: Specific gravity = 2.65 & Water absorption = 1.01.

Coarse aggregate

The crushed basalt stone of size 20 mm and down size is used. The crushed stone is free from dust and mud particles. The basic test is also performed like special gravity, water absorption, crushing value and particle size distribution. The test results are 2.80, 0.54, and 15.26% respectively.

Plastic Recycled Aggregate

The Plastic recycled aggregates are available in brick manufacturing unit in a large quantity. This Plastic recycled aggregates is taken and crushed into small pieces of 20 mm and downsize. The crushed recycled aggregates are sieved to remove the dust and fine particles. These recycled aggregates are lighter than the coarse aggregate. After crushing the loose or muddy particles are removed. The crushing can be done with a hammer or crushing machine whichever is required. The water absorption and special gravity test have been performed on crushed particles and the test results are 12% and 2.19 respectively.

Fig. 1 plastic recycled aggregates

Results & Discussions

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Compressive strength

The cube specimen is of the size 150 x 150 x 150 mm. casted in Metal moulds. They are made in such a manner as to facilitate the removal of the molded specimen without damage. Three specimens are casted for each of with and without replacement of plastic aggregate. In case of replacement it is done for 0%, 6%, 12% and 18% replacement of natural aggregate. And test compressive test are carried out for 7 and 28 days of curing for above all conditions.

Table-1 Results of Compressive strength of recycled plastic aggregate replacement in concrete for 7 and 28 days of curing.

Centage of recycled plastic aggregate (%)	Compressive strength of concrete with plastic aggregate for 7 days (N/mm^2)	Compressive strength of concrete with plastic aggregate for 28 days (N/mm^2)
0	17.22	28.15
6	16.36	26.87
12	15.06	26.44
18	14.12	25.05

The Compressive strength of Plastic granules concrete decreases as we increases Plastic granules in concrete mix, for 28 days of strength it decreases slightly in range of 0-1%. This can get better results by adding fly ash small percentage as Fly ash delays the rate of strength gain. So we may get better results as the concrete ages.

Flexural strength

The beam specimen is of the size 150 x 150 x 100 mm. casted in Metal moulds. They are made in such a manner as to facilitate the removal of the molded specimen without damage. Three specimens are casted for each of with and without replacement of plastic aggregate. In case of replacement it is done for 0%, 6%, 12% and 18% replacement of natural aggregate. And test flexural test are carried out for 7 and 28 days of curing for above all conditions.

Table-2 Flexural strength of recycled plastic aggregate replacement in concrete for 7 and 28 days of curing

Percentage of recycled plastic aggregate (%)	Flexural strength of concrete with plastic aggregate for 7 days (N/mm^2)	Flexural strength of concrete with plastic aggregate for 28days (N/mm^2)
0	2.88	4.16
6	2.01	3.08
12	2.02	2.86
18	1.91	2.71

The tensile strength of Plastic granules concrete affects drastically as we increases Plastic granules in concrete mix, for 28 days of strength it decreases from 0-40%. After increasing percentages of plastic granular it even educes more by more than 25%.

Splitting tensile strength :

The cylindrical specimen is of diameter 150mm and depth 300mm. casted in Metal moulds. They are made in such a manner as to facilitate the removal of the molded specimen without damage. Three specimens are casted for each of with and without replacement of plastic aggregate. In case of replacement it is done for 0%, 6%, 12% and 18% replacement of natural aggregate. And test tensile test are carried out for 7 and 28 days of curing for above all conditions.

Table- 3 Split tensile strength of recycled plastic aggregate replacement in concrete for 28 days of curing.

Percentage of recycled plastic aggregate (%)	Split tensile strength of concrete with plastic aggregate at 7 days (N/mm^2)	Split tensile strength of concrete with plastic aggregate at 28 days (N/mm^2)
0	2.32	3.6
6	2.19	3.19
12	2.10	2.93
18	1.95	2.86

The Flexural strength of Plastic granules concrete decreases as we increases Plastic granules in concrete mix, for 28 days of strength it decreases suddenly up to 25%. After increasing percentages of plastic granular it even reduces more but only with small changes. Sudden change is only observed at initial stage only. The strength reduces because plastic granular do not absorb water which leads to improper curing.

CONCLUSIONS :

The following conclusions are drawn from the results obtained from this experimental investigation.

1. Fresh concrete becomes more workable when we increase the percentage of plastic as plastic do not absorb any water.
2. Compressive strength decreases slightly upto 10% after replacing by plastic granules 18% with compare to no replacement. Because of very less crushing value of plastic granules it seems to be decreased.
3. The flexural strength of concrete containing plastic aggregate with 18% replacement at 28 days is almost half flexural strength of normal concrete. To be specific strength decreases by almost 40%. Also values shows that even by replacing small percentage of plastic granules to concrete causes drastic decrease in flexural strength.
4. Even though Compressive strength decreases after constantly increase in replacement of plastic granules it manages strength above 25 N/mm^2 for M25 concrete. But flexural strength and split tensile does not such nature.
5. Plastic Recycled aggregate concrete can be used for normal structural purposes with 5% to 10% replacement of natural aggregates.

From the above results it is clear that with this strength of concrete, this concrete can be used in P.C.C work which will save cost. If concrete as of M25 is to be manufactured, then 15% to 20% replacement of natural aggregate.

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