iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4522

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

Parametric Study of Concrete with Partially Replacement of Aggregate with Plastic Aggregate

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Abstract: ***Demand for coarse aggregate and fine aggregates continues to grow, and also increase in the cost of conventional building materials; for this objective, the use of industrial waste products and agricultural by products are very constructive. These industrial and agricultural by products such as Fly Ash, marble dust, plastic aggregates etc can be use. Disposal of large quantity of plastic causes land, water and air pollution etc.., so a study is conducted to recycle the plastic in concrete. This work investigates about the replacement of natural aggregate with non-biodegradable plastic aggregate made up of mixed plastic waste in concrete. Several tests are conducted such as compressive strength of cube to identify the properties and behavior of concrete using plastic aggregate. Replacement of natural aggregate by weight 5%, 15%,25% and 35% with plastic coarse aggregate. To identify the compressive strength and tensile strength Casted specimens are tested at 7 and 28 days. The identified results from concrete using plastic aggregate are compared with conventional concrete. Result shows that reduction in mechanical properties of plastic aggregate added concrete.***

Keywords: Plastic Aggregates, Light weight concrete, plastic Waste minimization, Compressive strength, Tensile strength.

I. INTRODUCTION

Concrete is one of the widely accepted construction material in the development of infrastructure. It perfectly matches with several requirements like strength, durability, impermeability, and fire-resistance and abrasion resistance with this advantages it has some shortcomings like shrinkage and cracking low tensile and flexural strength poor toughness, high brittleness, low shock resistance that restricts its application. To overcome these deficiencies additional material called fibers are used to improve the performance of concrete. Fiber reinforced concrete is cement based composite material. It has been used in construction to improve tensile and flexural strength of concrete. India produces around 960 million tons of solid wastes which pose a major environment and ecological problem. The environmental impact can be reduced by making more sustainable use of this waste. On the other hand, recycling waste without properly based scientific research and development can result in environmental problems greater than the waste itself. One of the logical means for reduction of this waste is utilizing them in building industry itself. Emission of co2 can also decrease by replacing cement by appropriate material from this waste.

A. Definition of Plastic Aggregate

A material which contains one or more number of polymers having large molecular weight" Solid in its finished state or same state manufacturing or processing into finished articles is known as Plastic. Looking to the global issue of environmental pollution by post-consumer plastic waste, research efforts have been focused on consuming this waste on massive scale in efficient and environmental friendly manner. Researchers planned to use plastic waste in form of concrete ingredient as the concrete is second most sought material by human beings after water. The use of postconsumer plastic waste in concrete will not only be its safe disposal method but may also improve the concrete properties like tensile strength, chemical resistance

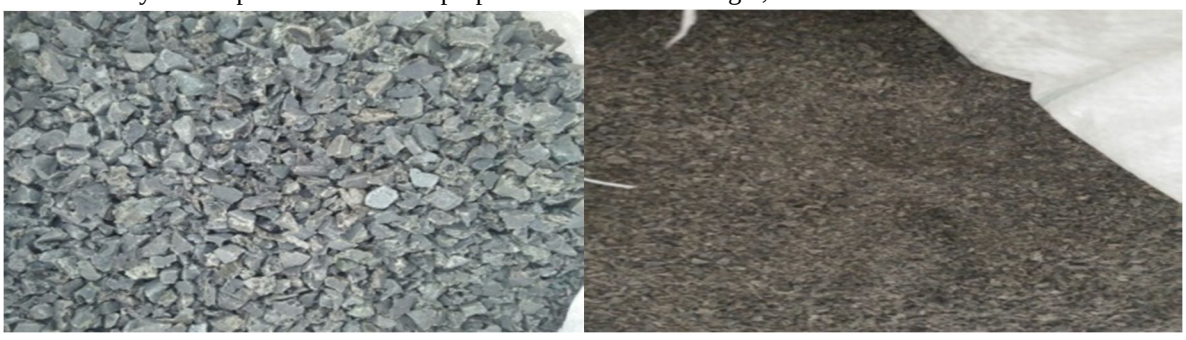


Fig3:- Plastic aggregates.

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II. METHDOLOGY

Recycled Plastic Aggregate (RPA) in concrete is acceptable there are for the making of concrete used coarse aggregate and fine aggregates having size 10mm & 20mm, natural river sand used for making a concrete and plastic aggregate and plastic fibers used in concrete. Test carried out on aggregate specific gravity, sieve analysis, water absorption, Impact value test, all these test conduct on Recycled plastic aggregate sample. Conventional aggregate and compressive strength and tensile strength of concrete at 05%, 15%, 25%, 35% replacement of plastic aggregate in concrete.

III. MATERIALS

A. Cemen
B. Water.
C. Fine aggregate (sand),
D. coarse aggregate
E. Recycled Plastic aggregate

1) Cement

Initial setting time	25min
Final setting time	540min.
Fineness (90umsieve)	1.7%
Standard consistency	31.5%

2) Water: Portable tab water is used for preparation of specimens and curing of specimens.

3) Fine Aggregate: As per IS 383-1970, table4 sand used for experimental program was locally produced and was conforming zone II. The specific gravity of fine aggregate was found to be 2.63.

Gradation Silt content 0.78%	Fall in Zone II
Fine modulus	2.56
Specific Gravity	2.638
Moisture content	1.4%

4) Coarse Aggregate: Locally available coarse aggregate passing from 20mm sieve and conforming IS 383-1970 were used in present work. The specific gravity of coarse aggregate was found to be 2.836

Aggregate Impact value	12.4
Aggregate Abrasion Value	16.3
Specific Gravity	2.92
Water Absorption	0.98
Combined Flakiness Index, Elongation Index	22.9%

5) Plastic Aggregates: Plastic aggregates are made from locally available plastic aggregates collected size6.75mm to 10mm.

Aggregate Impact value	9.20
Water Absorption	0.02
Specific Gravity	0.92
Density	0.84

a) Mix Design: The mix was designed as per IS 10262:2009 for M25 grade concrete with 0.5 water cement ratio. Concrete mixes are prepared by partial replacement of natural Aggregates by plastic aggregates with different percentages (05%, 15%,25%, 35%) respectively.

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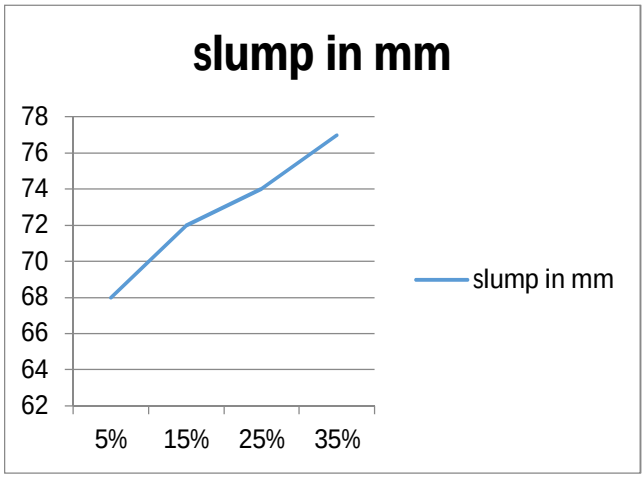
water	cement	Fine aggregate	Coarse aggregate (10mm)	Coarse aggregate (20mm)
27.91	50	93.87	105.49	86.25
0.55	1.0	1.68	2.11	1.73

b) Test Specimens and Test Procedure: Cement, sand and aggregate were taken in mix proportion as per mix design M25 grade of concrete respectively. The 150mm x 150mm x 150mm size concrete cubes were used as test specimens to determine the compressive strength, split tensile respectively. Cast the cubes with different mix proportion and put in water curing tank for 28days. After complete curing done the compressive and tensile strength.

IV. RESULTS AND DISCUSSION

A. Slump Test

Slump test is done before casting of each mix, Slump of concrete is increase respectively increase of PCA in concrete. Reason of slump increase was less water absorption of plastic aggregates and plastic fibres. The slump test results are shown in chart-1.



B. Compressive Strength

The compressive strength results of different mixes are given by fig 2.In the present investigation compressive strength of concrete produced by replacing natural Aggregates by plastic aggregates is goes on increasing up to 20% replacement of PCA. In compressive strength results mix2 increase compressive strength because of using plastic aggregates, after decreasing because of increases PCA content in concrete. The percentage in the compressive strength at this 0% to 20% replacement of PCA found to be seen in chart-2.

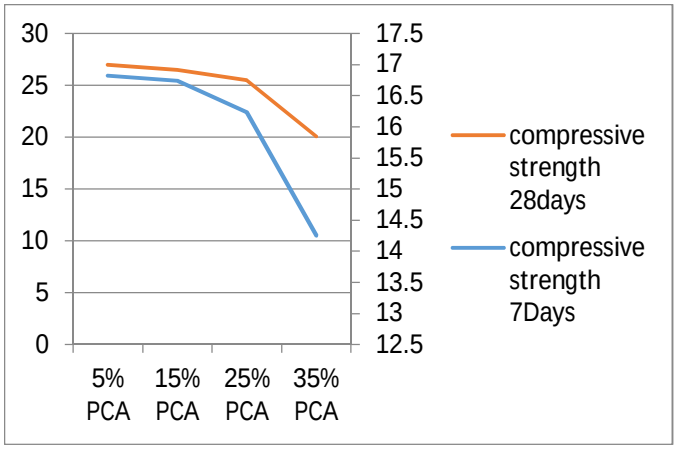


Chart2:- Compressive strength

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C. Tensile Strength

Similarly for split tensile strength up to 30% replacement of PCA, in tensile strength tensile strength increase. After all mixes decrease tensile strength of Concrete because of increase in PCA content in concrete.

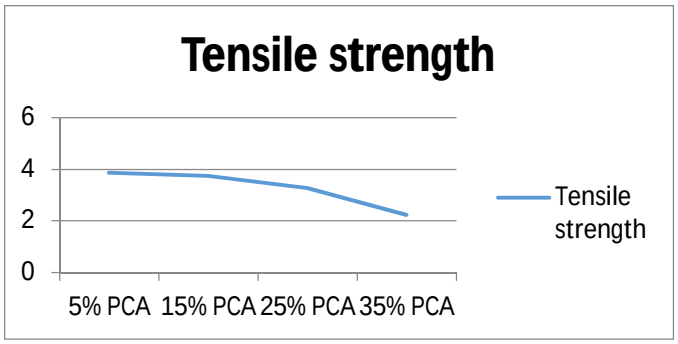


Chart3:- Tensile strength

V. CONCLUSION

A. It is identified that plastic waste can be disposed by using them as construction materials in concrete which is eco friendly.
B. The workability property of concrete was affected in PCA
C. The dry density was also reduced and made concrete light weight.
D. However Strength noticeably decreased when the plastic content was more than 2o% as aggregates in concrete.
E. In a concrete. From this experimental investigation, the composites would appear to be low cost materials which would help to resolve some solid waste problems and preventing environment pollution.
F. Optimum replacement of PCA is 1% to 15% replacement of aggregates

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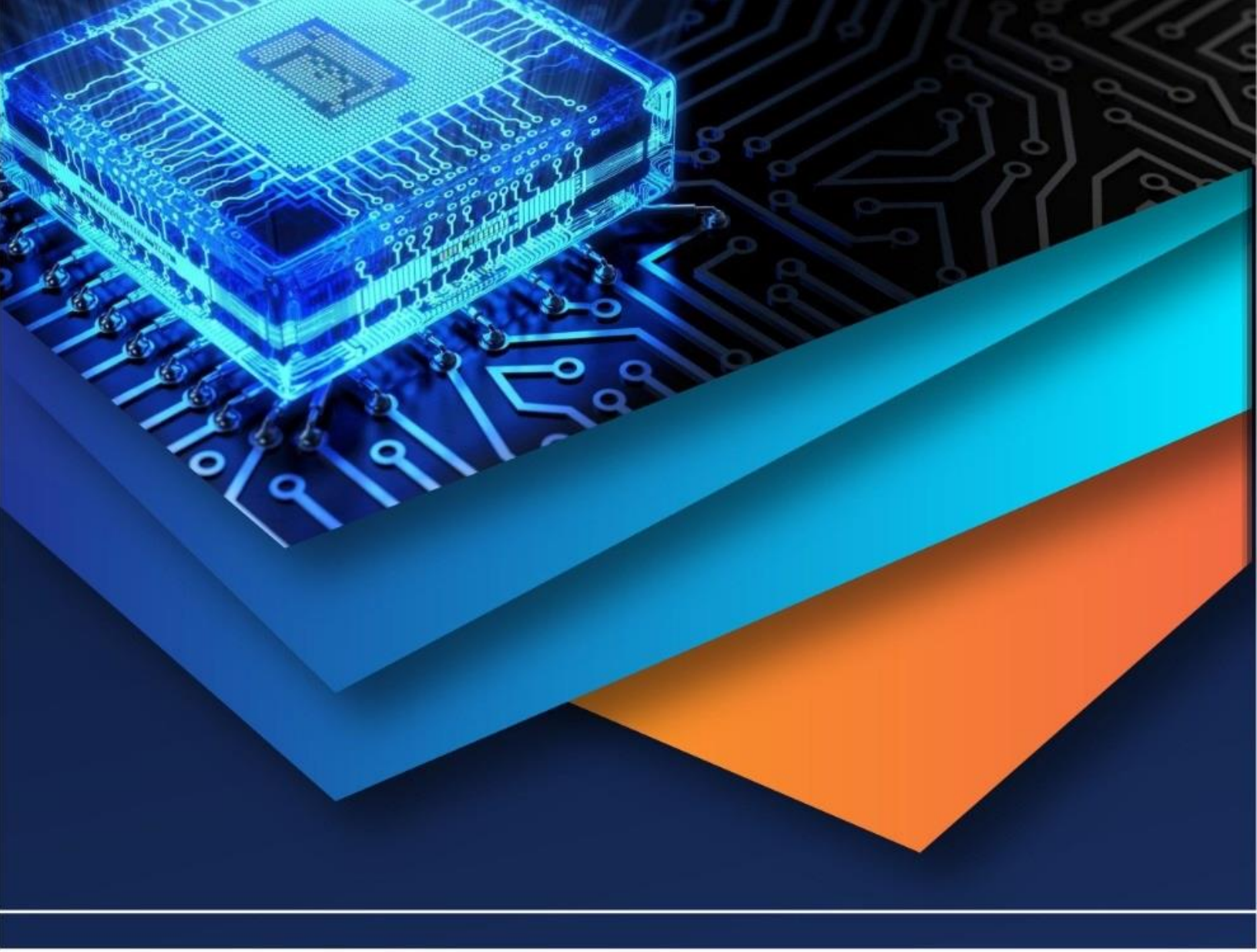
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