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A Review Paper on Partial Replacement of Fine Aggregate by Recycled Plastic Waste

Koushik Das[1], Dr. Biman Mukherjee[2]

[1,] M. Tech students, Department of Civil Engineering, Narula Institute of Technology, Agarpara, Kolkata
[2,] Professor, Department of Civil Engineering, Narula Institute of Technology, Agarpara, Kolkata,

ABSTRACT

Recycling of plastic waste by using them as fine aggregate in concrete without evaluate the properties of concrete. Plastic due to its properties such as light weight and durability, we invent and create different technologies in different field by using the raw materials in our earth for human benefit. But as we do so, there are leftover by products (disposable materials) which are of no use and moreover, they pollute the earth from which we are getting the materials for production of technology.

However its excessive production has become a serious threat to the environment and human health. Then the main issues are disposal of plastic waste. Plastic waste are degrades land fertility, 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.

So, in this thesis, we will be trying to use disposable material, specifically plastic in the concrete. We will be taking plastic as aggregates and will be mixing it in the concrete to find out the compressive strength in the mixed concrete using IS code and compares it with the normal mix concrete. The general design mix concrete to be taken will be M25.

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.

KEYWORDS: *Plastic Waste, Non-Biodegrable Material, Fine Aggregate, coarse aggregate, recycled plastic waste, Compressive test.*

1. INTRODUCTION

Plastic waste is one of the dangerous pollution on earth. Plastic are light in weight, colourful, 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 5% 10%, 15% 20%, 25% by volume of aggregates were used for the preparation of the concrete on earth.

Burning of plastics releases a variety of poisonous chemicals into the air, including dioxins, one of the most toxic substances.

2. OBJECTIVE

The primary objective of this study is to evaluate the possibility of using plastic aggregate as coarse aggregate in concrete. Specific objectives of this work include:

- To determine the properties of plastic aggregate.
- To conduct a comparative study of plastic aggregate (PAC) and natural aggregate(NAC).
- To study the effect of replacing natural aggregate with plastic aggregate on workability, compressive strength,
- Splitting tensile strength and flexural strength of concrete.
- To study the effect of replacing natural aggregate with plastic aggregate on weight of concrete.
- This can help the environment and earth from being polluted and can reduce further pollution also reducing its rate of pollution.
- The weight of concrete per unit volume will be reduced resulting in light weight concrete.
- The cost of constructing concrete can be reduced resulting on economical concrete.
- The area required for the landfilling will be less.
- This can open a new scope for reusing of disposable materials.

3. LITERATURE REVIEW

1.Elango A and Ashok Kumar A in 2018 performed study concrete with plastic fine aggregates. They used OPC 53 grade, River sand and crushed aggregates. They used plastic in place of fine aggregates in proportion of 10%, 20% and 30%. They test mechanical and durability properties on their concrete samples. They found the decrease in strength of concrete. [3] But found that the concrete shows good results against acid attacks and increase in elasticity. So they concluded that the plastic aggregate concrete can be used in place where we need less compressive strength but more durability.

2.LhakpaWangmoThinghTamanget [4] A in 2017 performed experiment on Plastics in Concrete as Coarse Aggregate. They performed the testing of mechanical properties of concrete containing Plastic aggregates They use plastic aggregates in proportion of 10%, 15%, and 20%. They found marginal reduction in strength and suggested the optimum result as 15% replacement.

3.B Jaivignesh and A Sofi A in 2017 performed Study Properties of Concrete with Plastic Waste as Aggregate. They used the plastic place of fine aggregates as well as coarse aggregates in proportion of 10%, 15 % and 20%. They also added steel fibre to the concrete. Their research concludes to the reduction in strength but suggested its use in favor of reduction of waste material and eco friendly materials.

4.MB Hossain A in 2016 performed work on Use of waste plastic in concrete as a constituent material. They replace coarse aggregates in proportion of 5%, 10% and 20%. They found that the concrete was lighter in weight. But the compressive strength was lesser than that of conventional concrete. [1] They also found that the concrete with 10% plastic aggregates shows strength nearly similar to the conventional concrete. So, the optimum result was 10% plastic aggregates.

5.RaghatateAtul M. A in 2012 performed study on use of plastic bags in form of fiber in concrete and test it properties. He adds fiber in proportion of 0.2%, 0.4%, 0.6%, 0.8% and 1% by weight of concrete. [9] He found that there was reduction of compressive strength with increase in plastic content, but there was increase in tensile strength with optimum strength at 0.8% addition.

6.Praveen Mathew A in 2013 study the use of Recycled Plastics as Coarse Aggregate for Structural Concrete. They performed test on concrete with various proportions of plastic aggregates in replacement of coarse aggregates and found the optimum result at 22% replacement of coarse aggregates with plastic aggregates. They further performed the test for other properties on concrete with 22% plastic aggregates and found that concrete with plastic aggregates was weaker in fire resistance.

7. S.Vanitha A in 2015 performed studies on use of waste plastic in Concrete Blocks. Paver Blocks and Solid Blocks of size 200 mm X 150 mm X 60 mm and 200 mm X 100mm X 65 mm were casted for M20 grade of concrete and tested for 7, 14 and 28 days strength. [10] Plastic was added to a proportion of 2%, 4%, 6%, 8% and 10% in equal replacement of aggregates. They found the optimum result for paver block at 4% replacement of aggregates with plastic aggregates. And 2% of plastic in case of solid blocks.

8.Baboo Rai A in 2012 study of Waste Plastic in Concrete with Plasticizer. They prepared M30 grade of concrete with varying proportion plastic pallets and then test the concrete with and without plasticizers. They add plastic pallets in proportion of 5%, 10% and 15% by weight of concrete. They found that there was reduction in density that can help in achieving low density or light weight concrete. they also found that there was reduction in slump and hence affects the workability but addition of plasticizers resolves the problem. They found reduction in compressive and flexural strengths but it was very low and can be allowed.

9.Daniel Yaw Osei A in 2014 performed experiments on plastics aggregate in concrete. He replace the coarse aggregates in concrete of ratio 1:2:4 by 25%, 50%, 75% and 100% with plastic. He found that there was reduction in strength of concrete as well as density of concrete. They suggested that replacement of aggregates more than 36% is not suitable for structural concrete. They also suggested plastic as a medium for production of light weight concrete. [7]

10. T.Subramani and V.K.Pugal A in 2015 performed an experiments on plastic waste as coarse aggregatesin concrete. They prepared the concrete with 5%, 10% and 15% replacement of aggregates in concrete with plastic. [8] They found the optimum results at 10% replacement of aggregates with plastic. Further increase in plastic content decreases the strength of concrete.

11. NabajyotiSaikia and Jorge de Brito A in 2012 study use of plastic in cement mortar and concrete. They found that workability decreases on use of angular plastic aggregates but increases with use of smooth aggregates. Irrespective of type of plastic, there was reduction of compressive strength, [14] but the reduction of flexural and tensile strength was low as compared to compressive strength.

12.Amalu.R.Get. A in 2016 performed the study the use of waste plastic as fine aggregate in concrete. [5] They use plastic as substitute of fine aggregates in proportion of 10%, 15%, the reason it shows higher workability and reduce environmental waste.

4. MATERIALS USED

A. Cement

Cement is binding material in the project. OPC is suitable for normal concrete.

For preparation of concrete 53 grade OPC cement confining to requirements of IS: 12269-1987. The fineness of cement is 3%, specific gravity of cement is 3.12, standard consistency of cement is 31%, Initial setting time is 60 minutes and final setting time is 250 minutes.

B. Plastic Material

Recycle Plastic used in this investigation is PET (polyethylene Terephthalate).The water absorption capacity is 0.12%, specific gravity is 1.32, size is below 4.75 mm,

C. Aggregate (Coarse Aggregate & 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.

Water

It plays an important role in the chemical reaction with cement. Water Contributes in the strength development of concrete. And that is why quantity and quality if water required is looked into very carefully. The water should be free from undesirable organic and inorganic substance. In every construction work water is vital role for the mixing and curing of concrete as per IS: 456-2000. The water was clean and free from visible impurities. For this thesis work potable water is used.

Admixture

It helps to increase the workability of concrete without increasing the water concrete. As Rice Husk Ash (RHA) is very fine and it has high specific surface area, it requires more water to form workable mixture. Adding more water will reduce the strength of concrete. So super plasticizer CHRYSO Delta G820R is used up to 1% to increase the workability of concrete keeping water- cement ratio constant.

5. METHODOLOGY FOR WORK

- Collection of materials required i.e OPC (Ordinary Portland Cement),Fine aggregate i.e Sand, Course aggregate i.e Gravels and plastic aggregates (plastic waste).
- First concrete to be casted is M25.
- 5 batches of concrete will be cast. In first batch, 3 concrete cubes will be cast with plastic aggregates exchanged with fine aggregates for 5% by weight of fine aggregate of M25 concrete.
- In second batch, 3 cubes will be cast with plastic aggregates exchanged with fine aggregate for 10% by weight of fine aggregate of M25 concrete.
- In third batch, 3 concrete cubes will be cast with plastic aggregates exchanged with fine aggregate for 15% by weight of fine aggregate of M25 concrete.
- In forth batch, 3 concrete cubes will be cast with plastic aggregates exchanged with fine aggregate for 20% by weight of fine aggregate of M25 concrete.
- Similarly in five batches, 3 concrete cubes will be cast with plastic aggregates exchanged with fine aggregate for 25% by weight of fine aggregate of M25 concrete.
- Compressive strength test and workability test (slump test) will be performed for all the concrete mix.
- All the values of the results will be compared and a graph will be plotted.

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