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APPLICATION OF PLASTIC WASTE IN CONCRETE

Anuradha P. Modak
Assistant Professor, Department of Civil Engineering, Mauli Group of Institutions, Shegaon, India

ABSTRACT

The rapid industrialization and urbanization in the country lead lot of infrastructure development. This process leads to several problems like shortage of construction materials, increased productivity of wastes and other products. In recent time use of such, Industrial wastes from plastic bottles, pallets, carry bags, polypropylene (PP) and polyethylene Terephthalate (PET) which are commonly used for packing, carrying vegetables, meat etc. creates a serious environmental problem. Plastic bag last in environment up to 1000 years because of plastic bag last so long the number of plastic bag accumulated increases each year. Disposal of large quantity of plastic bag may cause pollution of land, water bodies and air. Regarding the consumption the use of plastic is increasing day by day, although steps were taken to reduce its consumption. This creates substantial garbage every day which is much unhealthy. Disposal of plastic waste in an environment is considered to be a big problem due to itslow biodegradability and presence in large quantities. Industrial activities in Iraq are associated with significant amounts of non-biodegradable solid waste, waste plastic being among the most prominent. The study of this reusing waste in the production of concrete involved 86 experiments and 254 tests to determine the efficiency of reusing waste plastic. Amount of waste plastic being accumulated in 21st centuries has created big challenges for their disposal, obliging the authorities to invest in felicitating the use of waste plastic as a partial replacement of coarse aggregate, fine aggregate in a concrete is fundamental to the booming construction industry, an in this study a reuse of waste plastic is done in various forms. Plastic recycling was taking place on a significant scale in an India, as much as 60 % of both industrial and urban plastic waste is recycled which obtained from various sources. People in India have released plastic wastes on large scale have huge economic value, as a result of this, recycling of waste plastics plays a major role in providing employment.

Keywords- *Polyethylene Terephthalate , Plastic bags, Fine aggregate, Course Aggregate.*

I. INTRODUCTION

The largest component of the plastic waste is polyethylene, followed by polypropylene, polyethylene Terephthalate and polystyrene. The waste plastic bags available in the domestic waste mainly consist of low density polyethylene (LDPE). Plastic bags dumped in the dustbins find their way into the drainage system and clog them. In a landfill or in environment, Plastic bags take up to 1000 year to degrade,often these are burnt along the roadside, which produces fumes causing air pollution. The largevolume of materials required for construction is potentially a major area for reuse of waste materials. Recycling in concrete has advantages since it is widely used and has a long service life, which means that the waste is being removed from the waste stream for a long period. Because the amount of mineral aggregates required in concrete is large, the environmental benefits are not only related to the safe disposal

of bulk waste, but also to the reduction of environmental impacts arising fromthe extraction of aggregates. With the increase in development, there is an increase in cost of construction and the maintenance of pavements. So, the Engineers and Designers have been looking for a new concept of using waste plastics in cement concrete. There are many recycling plants across the world, but as plastics are recycled they lose their strength with the number of recycling. So these plastics will end up as earth fill. Most of the failures in concrete structures occur due to the failureof concrete by crushing of aggregates. PCAs which have low crushing values will not be crushed as easily as the stone aggregates. These aggregates are also lighter compared to stone aggregates. Use of plastic in construction materials has a dual advantage cost of material is low also it solves the problem of disposal of plastic up to some extent. The present study focused on various application of waste plastic in different forms in concrete.

II. LITERATURE REVIEW

Nithiya Kurup [2016]1 . This study presents the behavior of the concrete which made up of recycled plastic waste. In this study, the M20 grade concrete specimen casted by addition of 10% to 25% of plastic as a partial replacement of fine aggregate and tested for 28 days compressive as well as the flexural strength of concrete. From this study, it's concluded that the increase in the plastic percentage decrease in the compressive as well as the flexural strength of concrete. The main benefit of this study workability it will be increased because the plastic has been less absorbing water content, and reduce the pollution of the environment deficiency of fine aggregate and also reduce the cost of the materials.

Gaurav Verma [2016]2 . This paper represents a collection of waste plastics materials in concrete mixes. From this study, it's concluded that the fine aggregate can't be replaced by plastic materials so only the course aggregate is used. The strength decreases drastically after replacing more than 20% plastic waste.

T. Subramani [2015]3 . This study is intended to find the effective ways to reuse the hard plastic waste particles as course aggregate. From this study it has been concluded that the plastic waste is not suitable to use as a fine aggregate, it is used to replace as a course aggregate. However, the strength noticeably decreased when the plastic content was more than 20%.

Raghatate Atul M4 . The paper is based on experimental results of concrete sample casted with use of plastic bags pieces to study the compressive and split tensile strength. He used concrete mix by using Ordinary Portland Cement, Natural River sand as fine aggregate and crushed granite stones as coarse aggregate, portable water free from impurities and containing a varying percentage of waste plastic bags (0%, 0.2%, 0.4%, 0.6% 0.8% and 1.0%). The compressive strength of concrete specimen is affected by the addition of plastic bags and with increasing percentage of plastic bag pieces, compressive strength goes on decreasing (20% decrease in compressive strength with 1% of addition of plastic bag pieces). On other hand increase in tensile strength of concrete was observed by adding up to 0.8% of plastic bag pieces in the concrete mix afterward it start decreasing when adding more than 0.8% of plastic bags pieces.

Praveen Mathew et al.[2013]5 . They have investigated the suitability of recycled plastic as a partial replacement to coarse aggregate in concrete mix to study the effect on compressive strength, modulus of elasticity, split tensile strength and flexural strength properties of concrete. Coarse aggregate from plastic was obtained by heating the plastic pieces at the required temperature and crushed to the required size of aggregate after cooling. Their test results were based on 20% substitution of natural coarse aggregate with plastic aggregate. Increase in workability was reported when slump test for the sample was carried out. Volumetric substitution of natural aggregate with plastic aggregate was selected best in comparison with grade substitution. An increase of 28% was observed in compressive strength but a decrease in split tensile strength and modulus of elasticity was observed. They recommended that with use of suitable admixture @0.4% by weight of cement will improve the bonding between matrix and plastic aggregate; however, they demand more research to address the tensile behavior of concrete prepared with 20% plastic aggregate.

Khilesh Sarwe. [2014]6. This study presents the results of addition of waste plastics along with steel fibers with an objective to seek maximum use of waste plastic in concrete. Two different categories of mix were casted in cubes (150mm x 150mm x 150mm), one with varying percentages of plastic wastes (0.2%, 0.4%, 0.6%, 0.8% and 1% weight of cement) and another mix of plastics waste/steel fibers (0.2/0.1, 0.4/0.2, 0.6/0.3, 0.8/0.4 and 1/0.5 % by weight of cement) to study the compressive strength at 7 and 28 days strength. The combined mix of plastic waste and steel fibers has shown more strength as compare to concrete mix prep only with plastic waste. He has reached the conclusion that a plastic waste of 0.6% weight of cement when used with steel fiber of 0.3 % (weight of cement), has shown the maximum compressive strength. This study has really focused on addressing the issue of reduced compressive strength with the addition of plastic waste. Steel fibers, when used along with plastic wastes, will affect all the properties of concrete but the researcher only focused on compressive strength property which is insufficient to give a clear picture of concrete behavior.

Pramod S.Patil.et al.7 . This study presents the use of plastic recycled aggregate as replacement of coarse aggregate for production of concrete. They used forty eight specimen and six beams/cylinders casted from variable plastic percentages (0, 10, 20, 30, 40 and 50%) used as a replacement of coarse aggregate in concrete mixes. They have conducted various tests and observed a decrease in density of concrete with increase percentage of replacement of aggregate with recycling plastic concrete.

III. MATERIAL

Aggregate: Coarse Aggregate (CA) Fine Aggregate (FA)

Coarse Aggregate (CA**):**
They should have following properties

1) The Los Angeles Abrasion value shall not be more than 25 % (ASTM C131).
2) The weighted average weight loss in magnesium sulphate soundness test shall not be more than 18% (AASTHO T 104).
3) Flakiness index shall not be more than 25% (MS 30).
4) The water absorption should not be more than 2% (MS30)
5) The polished stone value should not be less than 40%.

Fine Aggregate (FA):

1) They should have the following properties
2) The angularity should not be less than 45% (ASTM C 1252).
3) The absorption of water, should not be more than 2% (MS30)

Plastic Aggregate (PA):
This is made up from waste plastic and can be prepared by following steps

1) Collection and Cleaning, Classification.
2) Shredding and Cleaning.
3) Heating and Melting.

Table: - I material specification

Physical properties	CA	FA
Specific gravity	2.85	2.433
Bulk density	1600 kg/cm2	1700 kg/cm2
Fineness modulus	4.65	2.2
Water absorption	0.49%	0.22%
Free moisture	NIL	2

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IV. METHODOLOGY

The size of the polythene sheets, road waste, raw plastics, and plastic straws was cut in to the size of course aggregates. The percentage of addition of plastics was varied from 0%-10% by weight and the specimen was cast. The compression testing samples were cast in cubes of 150 X 150 X 150 mm cast iron mould. The flexural members were cast in the standard 700 X 150 X 150 mm mould. The specimens were systematically placed in curing tanks after 24 hours for 7 and 28 days respectively. For each given percentage of glass fibers, six cubes and six beams were cast. Similarly, the workability for each of the given percentage of glass fiber is reported by taking the average of three slump test results. The Specimens were tested according to IS 516-1959 and are 1199-1959.

V. RESULTS & DISCUSSIONS

In order to compare the results obtained by adding varying amounts of plastic, plain cement concrete with 0% of the fiber is also prepared with the same material. The results of the compressive strength after 7 days and 28 days of curing are as presented in Table-II.

Table:-II compressive strength.

Sr.No.	% of plastic used	7 days (MPA)	28 days (MPA)
1	0%	15.3	23.3
2	2%	15.5	23
3	4%	14.5	19
4	6%	12	16
5	8%	9	14.5
6	10%	7	11

Table:-III flexural strength

Sr.No.	% of plastic used	28 days (MPA)
1	0%	4.15
2	2%	4.60
3	4%	5.10
4	6%	5.25
5	8%	5.40
6	10%	5.95

VI. CONCLUSION

The large volume of materials required for construction is potentially a major area for the reuse of waste materials. Recycling in concrete has advantages since it is widely used and has a long service life, which means that the waste is being removed from the waste stream for a long period. From the above study we have seen the various application of waste plastic in concrete like partial replacing the waste plastic with aggregates.

REFERENCES

1. *D.J. Cook, R. P. Pama, S.A. Damer."The behavior of concrete and cement paste containing rice husk ash" Proceedings, Conference of Hydraulic Cement Pastes, Their Structure and Properties, University of Sheffield (April 1976), pp. 268–283.*
2. *A. Sales. S. A. Lima,"Use of Brazilian sugarcane bagasse ash in concrete as sand replacement", Waste Management 30 (2010), 1114-1122. 248*
3. *J. Jones, M. Driver, Nippon Electric Glass America Inc., Dallas, TX"an evaluation of the use of finely ground e – glass fiber as a pozzolana in gars composites", Washington University, St Louis, MO, (2009), pp.1-7. Vishnu Gate et al, International Journal of Advance Research, Ideas and Innovations in Technology.*

4. *K. Chandramouli, Srinivasa Rao, N. Pannirselvam, T. Seshadri Sekhar and P. Sravana, "Strength properties of glass fiber concrete ", ARPN Journal of Engineering and Applied Sciences, vol. 5, no. 4, (2010) pp.1-5.*
5. *IS 4031(Part 10)-1988 "Method of physical test for hydraulic cement", First Revision, Second Print, Bureau of Indian Standards, New Delhi.*
6. *IS 1489 (Part 1):1991 "Portland Pozzolana Cement Specification Part 1 Fly Ash Based", Third Revision, First Reprint, Bureau of Indian Standards, New Delhi.*
7. *IS 383-1970 "Specification for Coarse and Fine Aggregates from Natural Source for Concrete", Second Revision, Ninth Reprint, Bureau of Indian Standards, New Delhi.*