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Experimental Investigation of Properties of Fresh and Hardened Concrete Containing Waste Plastic

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Abstract: ***Now a day the disposal plastic is being manufactured in huge amount. According to (Ministry of Environment and Forests)is stated that 15, 000 tons of plastic waste is generated every day, out of which 9, 000 tons is collected and processed, but 6, 000 tons of plastic waste is not being collected and many research are going on to find out the its alternative solution because it's have low biodegradability and it is very big issue to the sustainability of the environment and the plastic if burnt it is emitted the toxic gases and the plastic if decomposing it is decreases the fertility of the land and construction industry are best solution of using waste plastic and it is use in Different percentage (i.e.0, 0.5, 1.5 and 2.5) by the weight of cement and also using the conplast SP430(G) super plasticizer were used for improving the workability of concrete at the dosage of 0.2% by the weight of cement the studies is conduct on concrete M20 tests have been carried out as per the recommendation procedure of relevant codes the result are show on 3days, 7days and 28 days compressive strength .The samples with added waste plastic polypropylene of 0.5% showed better results after 28 days in comparison with other.***

Keywords: compressive strength, waste plastic, polypropylene (PP), super plasticizer 430(G)

1. Introduction

Disposal of plastic waste in the environment isconsidered to be a big problem due to its very low biodegradability and non – decaying material. The waste plastic generated in India is approximately 150 million tons/year and polypropylene plastic produced approximately 5.37 million tons/year (**According to survey of central pollution control board) 18 march 2016**. Plastic are used due to their characteristics like versatility, lightness, hardness, chemical resistance, etc.In that respect is a major possibility of utilizing the waste plastic in the construction industry, by mixing plastic waste in concrete batch.And we can consume large quantities of waste plastic by mixing in concrete mass.[1]BabooRaiET.Al (2012) - stated that use of virgin waste plastic mix in concrete with and without super plasticizerisincreasingthe compressive strength by 5% after addition of super plasticizer and the Flexural strength decreases with increase in percentage of waste plastic and effect of super plasticizer is irrelevant on flexural strength. [2] MalekBatayneh et al. (2006)-Stated that the use of Selected wastematerial in concrete mixes. The main finding of this research work is that the waste materialcould be reused as partial substitutes for sand or coarse aggregate in concrete mixers. [3] M. muzafarAhmed et al' (2013)-stated that the recycled plastic is partial replacement of C.A.The compressive as well as tensile strength are reduced and thermal strength also recorded with the addition of plastic. [4] Kali Ramuje (2013) -stated that when polypropylene fiber is added with different percentage of waste plastic fiber is used in FRC the optimum solution is established when 1.5% of polypropylene fiber is added in concrete.

2. Materials

The materials used are given below.

2.1Cement

Portland Pozzolana Cement (Ultratech) Fly ash based conforming to (IS: 1489-1991). The physical properties of cement were obtained by conducting appropriate tests.
Specific gravity is 2.9
Fineness-2% retaining on a 90 micron sieve

2.2 Coarse Aggregate

Locally available 20mm and 10mm size crushed granite with specific gravity is 2.87 and water absorption 0.13%.

2.3 Fine Aggregate

River sand was used and found to be Zone I with its specific gravity 2.66 and water absorption 1.7%

2.4 Water

Water used was clean drinking fresh water (pH value 6-7) which is free from impurities and therefore, can be used for concrete mixing.

2.5Waste Plastic

Disposal cup used as the waste plastic polypropylene (PP). Its specific gravity –0.91

Picture- waste plastic polypropylene

2.6 Admixture

Super plasticizer improves workability of concrete and water reducer
Conplast SP430 (G) complies with IS 9103:1999
Specific gravity – 1.21

3. Experimental Procedure

3.1 Concrete Mix Design

The concrete mix design is made-
The36 cube specimens for M20 grade of concrete with four different volume percentages of plastic (0%, 0.5%, 1.5% and2. 5%) were cast. Nine cubes were cast for each Percentage of plastic pallets with super plasticizer CONPLAST SP430 at the dosages of 0.2%. Cube specimens of size 150mm×150mm×150mm are prepared.

Table 1: Mix Proportion

		Material by weight (kg)					
	Mix Waste plastic %	cement	FA	CA	waste plastic	w/c ratio	Mix proportion
	O	394.30	755.44	1222.62	0	0.40	1:1:915: 3.10:0
	0.5	394.30	755.44	1222.62	1.97	0.40	1:1.915: 3.10:0.005
M20	1.5	394.30	755.44	1222.62	5.91	0.40	1:1.915: 3.10:0.015
	2.5	394.30	755.44	1222.62	9.85	0.40	1:1.915: 3.10:0.025

FA- Fine Aggregate
CA-Course Aggregate

4. Result and Discussion

4.1 Workability Test Result of Concrete

The slump value determines the workability of concrete. Each sample of concrete was tested for workability. The super plaster was added as per IS: 1999 -1959. The super plasticizer was used in concrete at the dosages of 0.2 by the weight of cement. The test should be performed in 2-5 min after mixing of concrete and the slump value should be held between 100 to 120 mm.Workability also tested at each mix proportion. The slump was considered in mm and the sample result was noted.

Table 4.1: shows the workability test result of concrete.

Percentage of waste plastic added in concrete	*Slump in mm With super plasticizer*	*Slump in mm without super plasticizer*
0%	86	75
0.5%	79	71
1.5%	74	67
2.5%	71	62

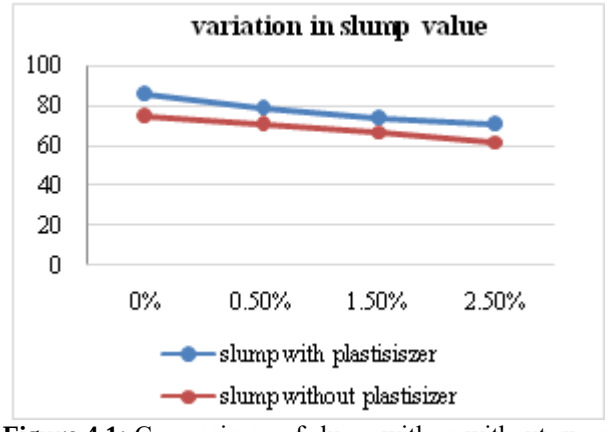

Figure 4.1: Comparisons of slump with or without super plasticizer

Discussion
Result shows that the workability is low when super plasticizer is not mixed into the concrete and workability increases waste when super plasticizer is mixed. The value of the slump is decreasing with increasing waste plastic ratio. The reduction is found due to the waste plastic content, but in spite of slump reduction, the waste plastic concrete mixtures show easy workability since plastic increases the flow of concrete.

4.2 Compressive strength of concrete cube-

The compressive strength was determined to find out the behavior of waste plastic in compression. Preparation of the specimen and testing were done as per IS: 516-1959. The specimens of size 150×150×150 mm were caste with the required mix proportion and were cured for 28 days Compressive testing machine of loading rate 10 KN/Sec was used for the test.The loading was continued gradually and maximum load applied on the specimen was noted figure 4.2 shows the compressive strength of waste plastic. Compressive strength was obtained by dividing the maximum load by the area of cross- section of the specimen.
Compressive strength =F/A N/mm^2
Where- F= Failure load in Newton
A= Area of cross – section of specimen in mm^2

Table 4.2: Compressive strength test results in N/mm^2

Plastic %	3days	7days	28 days
0%	17.92	21.33	27.55
0.5%	15.84	25.77	31.85
1.5%	17.93	23.40	26.21
2.5%	17.62	20.88	24.44

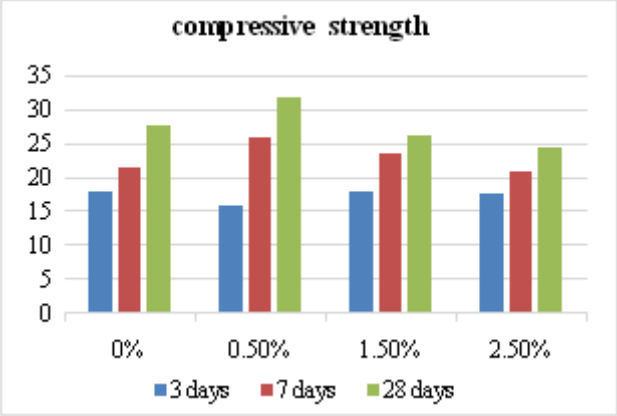

Figure 4.2: Comparisons of Compressive strength with design strength

5. Discussion

3days compressive strength at 1.5% and 2.5%plastic were higher than 0.5% plastic concrete. Almost equal to general concrete and about 20%.The compressive strength values of waste plastic concrete were maximum at 0.5 % after the 7 and 28 days of curing. The results of compressive strength test are shown in the figure 4.2 for comparative analysis. It is observed here that, with increasing amount of waste plastic results.The reduction in strength is observed at the 1.5% and 2.5% compares to 0.5% after the compare of compressive strength results and the maximum reduction are found in 2.5 % of the waste plastic mix in concrete.

6. Conclusion

The major conclusions based on the results obtained in the experiments are as follows.

1) Slump value decreases withan increase in waste plastic content
2) The workability increases by 10 to 15% when super plasticizer is added to thecontrol and waste plastic mix compared to concrete without super plasticizers.
3) 3.3days compressive strength at 1.5% and 2.5% plastic were higher than 0.5% plastic concrete. Almost equal to general concrete and about 20%.
4) The maximum compressive strength was found in 0.5% of waste plastic concrete after the 7 and 28 days of curing.

References

[1] Rai, B., Rashad Tobin S., Kr,Bhavesh andDuggal, S.K, 2012.Study of Waste Plastic Mix Concrete with Plasticizer, International Scholarly Research Network ISRN, pp. 1to 5.
[2] Batayneh, M., Marie, I., Asi, Ibrahim, 2007. Use of selected waste materials in concrete mixes, Science Direct,Waste Management, pp. 1870–1876.
[3] Ahmed, M., Muzafar, Dr., Raju, S., Siddi, 2013. Properties of Concrete by the Addition of Plastic Solid Waste, International Journal of Science and Research, pp1170 -1173
[4] Rummage, Kali, 2013.Strength Properties of polypropylene Fiber Reinforced Concrete, International Journal of Innovative Research in Science, Engineering and Technology, pp.3409-3413.
[5] Suryanarayan, Raju, J.N.S, PandialM. Senthil, 2013. Mechanistic study on Concrete with waste plastic, International journal of research In Civil Engineering, architecture and design, pp. 62-67.
[6] Nidhi, M., Bini, Prof. Kumaran, M., 2015. Evaluation of Strength and Durability of Waste Plastic MixConcrete, International Journal of Research in Advent Technology,pp.34-40.
[7] Vanitha S., Natarajan, V and Praba, M., 2015.sUtilization of Waste Plastics as a Partial Replacement of Coarse Aggregate in Concrete Blocks, Indian Journal of Science and Technology, pp1 to 6.
[8] Nibudey., R.N, Nagarnaik, P., B, Parbat, D.K, Pandes, A.M, 2013. Cube and cylinder compressive strengths of waste plastic fiber reinforced concrete, InternationalJournal of Civil and Structural Engineering, pp. 176-182.
[9] Nibudey R.N, Dr. Nagarnaik. P.B., Dr. Parbat, D.K, Dr. Pandey, A.M, 2013.Strengths Prediction of Plastic fiber Reinforced concrete, International Journal of Engineering Research and Applications,pp.1818-1825.
[10] Raghatate, Atul, M., 2012.Use of Plastic in a Concrete to Improve It Properties,International Journal of Advanced Engineering Research and Studies (IJAERS) pp109-111.
[11] Kathe,Vikram, Gangurde,Akshay, andPawar, Abhijit, 2015.Green Concrete using Plastic Waste, International Journal of Engineering Trends and Technology (IJETT),pp.214-216.
[12] Chandana,Sukesh, Katakam, Bala Krishna, Saha, P and Chamberlin,K.,Shyam, 2012.A Study of Sustainable Industrial Waste Materials as Partial Replacement of Cement, Coimbatore Conferences IPCSIT, Singapore, pp162-166.
[13] Gawatre,D.W,Damal,S.,Vivek,Londhe,sourabh,SandMane,B,Ajikiya,Ghawate,Hrishikesh, 2015.Environmental Issues of Plastic waste use in Concrete, International Journal of Innovative Research in Advanced Engineering (IJIRAE), pp115-117.
[14] Kumar, Singh,Vijay, 2014.Effect of Polypropylene Fiber on Properties of Concrete, InternationalJournal of Engineering Science& Research Technology, December, 2014, pp312-317
[15] Ghernouti, Yousef, Rabehi, Bahia, Safi,Brahim and Chaid,Rabah, 2015.Use of Recycled Plastic Bag Waste in the Concrete, Journalof International Scientific publication material, method and technology, pp. 480-487.