IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology
Vol. 3, Issue 5, May 2016

Experimental Investigation on Variation in Compressive Strength & Mechanical Properties of Concrete by Adding Human Hairs and Polypropylene

Anil Kumar Mehta[1], Sujit Singh[1], Mr. R.S. Chaudhari [2]

Student of Bachelor of Civil Engineering, PCCOE, Nigdi, Pune[1]

Assistant Professor, PCCOE, Nigdi, Pune[2]

Abstract: The fiber reinforced concrete is one of the important topics as it is a means to replace conventional concrete ingredients by considering new ideas and materials. In this attempt, we tried to replace the cement by some percentage of human hairs & coarse aggregate by Polypropylene (PP). The length of the human hair used in this experiment varied from 3 cm to 6 cm and the first class polypropylene were used. The idea behind this selection is to use such a material which is harmful to the nature and also non degradable. The various combinations of percentages used in this study are 1) 4%hair +0%PP 2) 4%hair +1%PP 3) 4%hair +2%PP 4) 4%hair +3%PP. For testing all those proportions, M-25 grade Concrete was used. The compressive strength of the specimens were tested & it was observed that the Compressive strength of the composite concrete was maximum at combination 4%hair +2%PP and then it started reducing. In this paper, the details of the work done are discussed in detail.

Key word: Human hairs, PP, Composite concrete.

INTRODUCTION

The ingredients of a conventional concrete are Cement, FA, CA & water. Since human hair is a non-degrading material and creates environmental pollution therefore it was decided to use human hair in our composite concrete along with polypropylene fiber. For each proportion six cubes were casted hence total 30 Cubes were tested for compressive strength.

In this study, human hairs and pure Polypropylene fiber were mixed in various proportions in the M-25 grade concrete. Some percentage of cement was replaced by the weight of hair. The specimens were casted for the various proportions and were tested after 7 and 28 days. The results obtained were compared with the conventional M-25 grade Concrete. The details of the strength obtained are discussed in this paper.

Reasons to prefer the Composite concrete:-

i. To control cracking due to both plastic shrinkage and drying shrinkage.
ii. They also reduce the permeability of concrete and thus reduce bleeding of water.
iii. Some types of fibers also produce greater impact resistance and abrasion resistance in concrete.
iv. The fineness of the fibers allows them to reinforce the mortar fraction of the concrete, delaying crack formation and propagation. This fineness also inhibits bleeding in the concrete, thereby reducing permeability and improving the surface characteristics of the hardened surface.

ABOUT THE PROJECT

A. Objectives of the Proposed Project

1. To substitute cement & CA by human hairs and Polypropylene and check the effect of these materials on strength of M-25 concrete.
2. To find correct combination of Human hairs & PP for maximum compressive, flexural & split tensile strength.

B. Importance of the present project

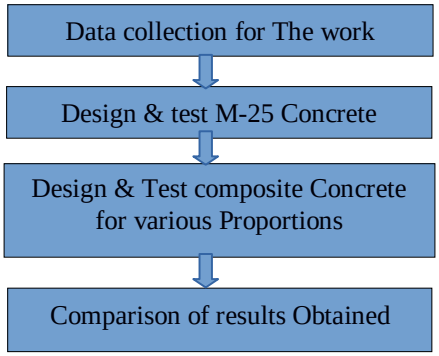
The problem of disposing the materials like human hairs has become one of the major environmental, economical, and social issues. The techniques like reuse, recycling, land-filling and incineration need money along with land which is highly valuable resource these days. The purpose of this project is to find whether it is feasible to use those materials in the concrete as this will reduce the consumption of cement & C.A up to some extent.

C. Methodology:

1. To Extract Relevant data from various international, national papers and journals
2. To perform various test on Aggregates and cement & Prepare mix design for M-25 grade concrete.
3. To test specimens for the above mentioned concrete and check their compressive, Flexural & Split tensile strength.
4. Comparison of result.

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Vol. 3, Issue 5, May 2016

The flow chart of work done is as follows:-



D. The mix design

The mix design for M25 grade concrete is calculated Using IS 456:2000, IS 10262:2009 etc. The materials required as per design are given in following table,

Table 1:-Quantity of materials for conventional concrete

w/c ratio	Quantity of Materials(Kg)		
	Cement	FA	CA
0.45	462.93	635.985	1276.48

The properties of materials used are:

Specific gravity of cement =3.15
Specific gravity of fine aggregate =2.70
Specific gravity of coarse aggregate =2.92
Water absorption of fine aggregate =0.80%
Water absorption coarse aggregate =1.06%

Various proportions for the composite concrete
(i) 4%hair +0%PP (ii) 4%hair +1%PP
(iii) 4%hair +2%PP (iv) 4%hair +3%PP

Material calculations for cube:-

Table 2:- Quantity of materials for Composite concrete

E. Testing:-

Proportions	**4%+0%**	**4%+1%**	**4%+2%**	**4%+3%**
Water (Kg)	4.218	4.218	4.218	4.218
Cement (Kg)	8.998	8.998	8.998	8.998
FA (Kg)	12.878	12.878	12.878	12.878
CA (Kg)	25.848	25.589	25.331	25.072

The curing was started after 24 hours of casting the specimen for a period of 7 to 28 days. The specimens were subjected to compression, split tensile and flexural test under universal testing machine and flexural testing machine respectively.

For each proportion we casted 3 cubes for 7 days and 3 cubes, 3 beams and 3 cylinders for 28 days. Hence altogether 60 specimens were casted and tested.

F.MATERIALS USED AS FIBRE:-


Fig1: - Polypropylene


Fig2:- Human Hair

Table 3:- Properties of Polypropylene Fiber

Sr. No.	Parameters	Value
1	Specific Gravity	0.90-0.91
2	Water Absorption (%)	0.01-0.03
3	Tensile Strength (MPa)	31.03-41.37
4	Hardness (R)	80-102
5	Impact Strength (J/m)	21-75


Fig3:- Testing of cubes


Fig4:-Testing of beams and cylinders

G. Results Obtained:-

Comparison of Compressive strength after 7 days.

Conventional concrete (MPa)	**4%H+0%P** (MPa)	**4H%+1%P** (MPa)	**4%H+2%P** (MPa)	**4%H+3%P (MPa)**
17.09	17.99	18.95	20.03	19.25

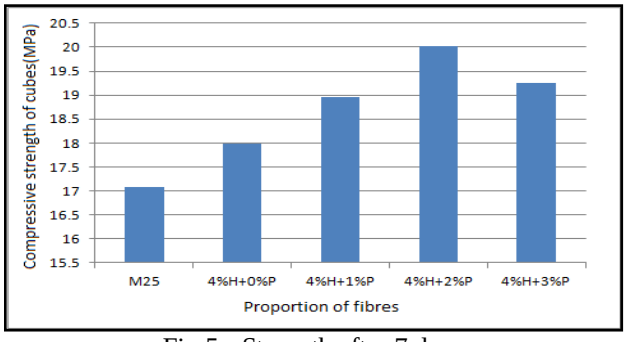


Fig 5:- Strength after 7 days

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Vol. 3, Issue 5, May 2016

Comparison of Compressive strength after 28 days.

Conventional concrete (MPa)	**4%H+0%P (MPa)**	**4%H+ 1%P (MPa)**	**4%H+ 2%P (MPa)**	**4%H+ 3%P (MPa)**
33.80	33.02	33.92	34.86	32.97

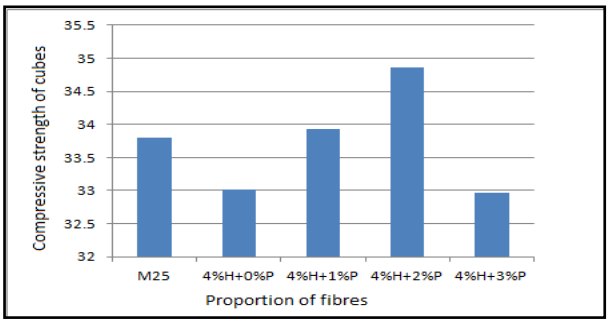


Fig 6:- strength after 28 days

H. Split tensile strength test:-

The split tensile strength of the cylinder specimen is calculated using the following formula:

Split Tensile Strength, $f_{sp} = 2\ P\ /(\pi*L*d)\ N/mm^2$

Where, P = Load at failure in N
L = Length of the Specimen in mm
d = Diameter of the Specimen in mm

Comparison of Split Tensile strength after 28 days.

Conventional concrete (MPa)	**4%H+ 0%P** (MPa)	**4%H+ 1%P** (MPa)	**4%H+ 2%P** (MPa)	**4%H+ 3%P** (MPa)
2.88	2.85	2.89	3.30	2.75

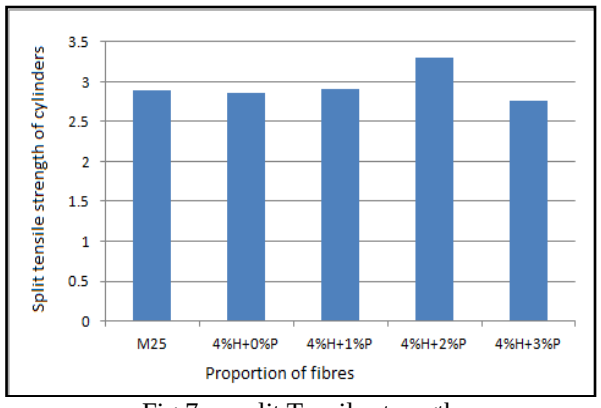


Fig 7:- split Tensile strength

I. Flexural strength test

The flexural strength of the beam specimen is calculated using the following formula:

$fb=Pa/(\ bd^2)$

Where,
b = measured width of specimen in cm
d = measured depth of the specimen at the point of failure in cm.
a = distance of the crack from the nearer support in cm
P= maximum load applied to the specimen in N.

Comparison of Split Tensile strength after 28 days.

Plain concrete (MPa)	**4%+ 0%**	**4%+ 1%**	**4%+ 2%**	**4%+ 3%**
4.00	3.75	4.08	4.58	3.50

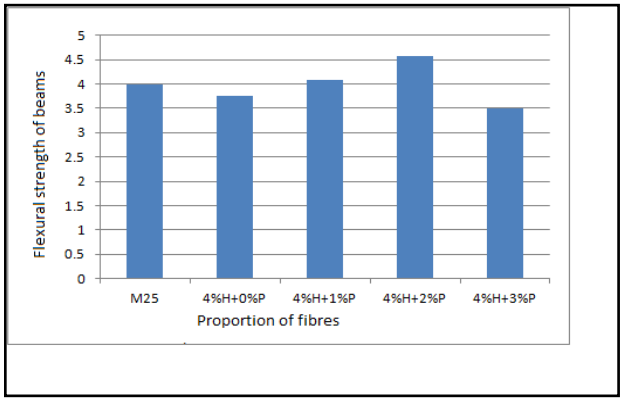


Fig 8:- for flexural strength of beams

CONCLUSION

1. The maximum strength of conventional concrete cubes for 7 days and 28 days were 17.09 MPa and 33.80 MPa respectively, whereas the maximum strength of composite concrete were found at the combination of 4% hair and 2% P.P fibre and the corresponding strength were 20.03 MPa and 34.86 MPa respectively. Hence the maximum increase is found to be 17.21% and 3.11% respectively.
2. The maximum strength of conventional cylinders for 28 days were found to be 2.88 MPa,whereas for the above mentioned combination of fibers it was found to be 3.30MPa hence giving an increase of 14.62% increase.
3. The maximum strength of conventional beams for 28 days were found to be 4 MPa , whereas for the above mentioned combination of fibres it is obtained as 4.58 MPa hence giving an increase of 14.58%.

FUTURE SCOPE

1. Combination of human hairs & polypropylene increases the strength of concrete and can be used in concrete.
2. The use of that material shall reduce the environmental pollution.
3. Plastic fibers along with steel fibers can be used to improve the strength of concrete.
4. It paved the way for new research in future where more combinations cam be adopted with different fibres and. varying proportions.

REFERENCES

1. Ms. K.Ramadevi, Ms. R. Manju "Experimental Investigation on the Properties of Concrete With Plastic PET (Bottle) Fibres as Fine Aggregates", International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, Volume 2, Issue 6, June 2012)

2. Jain D. and Kothari A."Hair Fibre Reinforced Concrete",Research Journal of Recent Sciences ISSN 2277 – 2502,Vol. 1(ISC-2011), 128-133 (2012).
3. Yadollah Batebi, Alireza Mirzagoltabar, Seyed Mostafa Shabanian and Sara Fateri, "Experimental Investigation of Shrinkage of Nano Hair Reinforced Concrete", Iranica Journal of Energy & Environment 4 (1) Special Issue on Nanotechnology: 68-72, 2013,ISSN 2079-2115,IJEE an Official Peer Reviewed Journal of Babol Noshirvani University of Technology DOI: 10.5829/ idosi.ijee.2013.04.01.11
4. J. Simson Jose, Mr. M. Balasubramanian, "Experimental Investigation on Characteristics of Polythene Waste Incorporated Concrete" Department of Civil Engineering, SRM University Chennai, India M Tech, Assistant professor, International Journal of Engineering Trends and Technology (IJETT) – Volume 10 Number 7 - Apr 2014
5. B.Harini &K.V.Ramana," Use of Recycled Plastic Waste as Partial Replacement for Fine Aggregate in Concrete", International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007,Certified Organization) Vol. 4, Issue 9, September 2015.
6. Rafat Siddique, Jamal Khatib, Inderpreet Kaur," Use of recycled plastic in concrete: A review", Science Direct, R. Siddique et al. / Waste Management 28 (2008) 1835–1852, hapar Institute of Engineering and Technology, Deemed University, Patiala – 147 004, India School of Engineering and the Built Environment, University of Wolverhampton, City Campus, Wolverhampton, West Midlands WV1 1SB, United Kingdom.
7. Zainab Z. Ismail , Enas A. AL-Hashmi," Use of waste plastic in concrete mixture as aggregate replacement", Waste Management 28 (2008) 2041–2047, Science Direct, Department of Environmental Engineering, College of Engineering, University of Baghdad, Iraq.
8. Nabajyoti Saikia,Jorge de Brito, "Use of plastic waste as aggregate in cement mortar and concrete preparation: A review", elsevier, Construction and Building Materials 34 (2012) 385–401, Department of Civil Engineering, Architecture and Georesources, Instituto Superior Técnico, Technical University of Lisbon, Av. Rovisco Pais, 10 49-001, Lisbon, Portugal, ICIST Research Institute, Instituto Superior Técnico, Av. Rovisco Pais, 1049-001,Lisbon, Portugal.