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PERFORMANCE OF CONCRETE WITH PET FIBERS

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ABSTRACT- **Zero plastic waste is a philosophy for the 21 st century. Waste to energy technologies can address to sets of environmental issues. The reduction, reuse and recycling of plastic wastes (PET bottles) helps in prevention of green gas emissions. For this reason this study has been conducted through basic experimental research in order to analyse the possibilities of reusing the waste in the construction industries and thereby to make it cost effective. This paper is focused on determining the strength parameters of PET fibers in concrete of M25 mix proportion and to check the effect of various aspect ratios (AR 2.5, AR 7.5 AR10) and varying volumes (0.4%, 0.9%, 1.4% of cement) of fiber along with concrete and to compare the results with the strength characteristics such as compressive strength, split tensile strength, flexural strength and impact strength of fiber reinforced concrete with crimped fibers. The test results are compared with normal concrete after 28 days of curing.**

KEY WORDS; **Poly Ethylene Terephthalate (PET), aspect ratio, compressive strength, split tensile strength, flexural strength and impact strength**

1. INTRODUCTION

The concrete is an integral element in determining the structural design of the building. With increase in the global population, there has been a rise in the amount of waste being generated. Plastic waste poses a threat to the environment and causes the serious health issues Land filling using plastic material preserve harmful material forever .Hence focus is towards reuse of waste rather than its disposal.

The waste polyethylene terephthalate (PET) bottles are recycled and used in industries for different purposes. Energy efficient method is required to be developed which will help to reduce the cost of production of concrete. The experimental analysis of plastic reinforced concrete needs an urgent attention for the use in construction industry. It is evident that the post consumed poly ethylene terephthalate (PET) bottles in fiber form can be used to improve and to get better mechanical properties of concrete. Plastic fibers developed from waste plastics thorough recycling process are costly. That's why in this study the fibers were obtained by cutting PET mineral water bottles into fibers of desired shape and size. Fibers made up of recycled materials stands as a low cost strengthening technique which is able to enhance tensile strength, structural ductility and thermo-electrical insulation of concrete matrix.

2.EXPERIMENTAL PROGRAM

The trail mixes for different proportion of ingredinets were performed and hence the final design mix was prepared for M 25 grade of concrete as per IS 10262;2009.The concrete mix proportions 1:1.56:3.12 (1 of cement,1.56 part of fine aggregate and 3.12 parts of corse aggregate) with water cement ratio of 0.5.

2.1 MATERIALS

2.1.1 .Cement

Ordinary Portland cement of grade 53 conforming to IS 12269:2013 was used for the preparation of test specimens. Properties of cement obtained are Fineness 1%, Initial setting time 18 min.

2.1.2.Fine aggregate

River sand was used as fine aggregate .Properties of fine aggregate are Fineness modulus 2.79, Specific gravity 2.56, Bulk density 1.61 kg/l and Void ratio 0.811

2.1.3.Coarse aggregate

Coarse aggregate used in the study were 12.5 mm and 20 mm .Physical properties are Fineness modulus 2.34, Specific gravity 2.67.

2.1.4.Poly Ethylene Terephthalate Fibers

PET is thermoplastic polyester, highly stable and absorbs less amount of water. It has relatively higher chemical resistance. The PET is usually crystalline and the colour varies between opaque and off-white. PET belongs to thermoplastics with high acid and salt resistance and mechanical bond strength of 3.9 Mpa. It has a low electrical conductivity The fibres were cut after removing the neck and bottom of the bottle.The length of fibres was kept 5 mm,15 mm ,20 mm and the breadth was 2mm.The aspect ratio(AR) hand 7.5(AR 7.5)and 10(AR 10).The different fractions for three aspect ratios were used in this experimentation.Figure shows the PET fibers

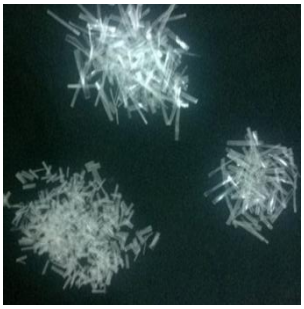

Figure 2.1: PET fibers of AR 10, AR 7.5, and AR2.5

3.RESULTS AND DISCUSSIONS

Compressive strength,Split tensile strength Flexural strength and Impact tests were conducted on the cast specimens in order to determinethe strength parameters of the concrete. Testing was carried out after 28 days of curing.

3.1 COMPRESSIVE STRENGTH TEST OF SPECIMENS

This test is usually performed for the determination of the compressive strength of concrete. The cube specimen used for compressive strength is of size 150 mm x 150 mm x 150 mm. The test is performed on a compression strength testing machine after 28 days of curing. The results are shown in the below graph.

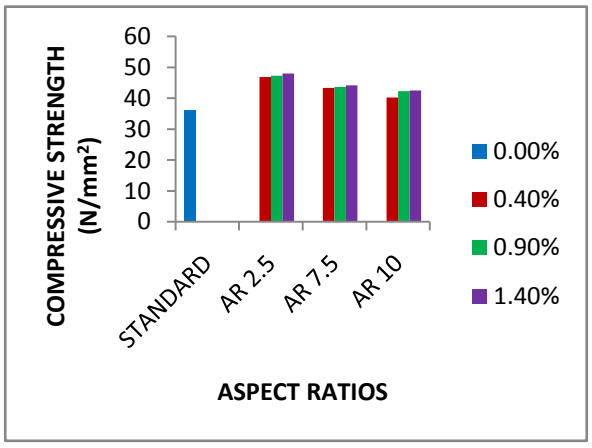

fig 3.1 Compressive strength of different aspect ratio of PET fiber with concrete

3.2 SPLIT TENSILE STRENGTH

The split tensile strength test determination is done for the determination of tensile strength of concrete. The specimens used for the split tensile strength are of size 150 mm diameter and 300 mm height. These specimens are tested on the CTM after 28 days of curing. The results are shown in the below graph.

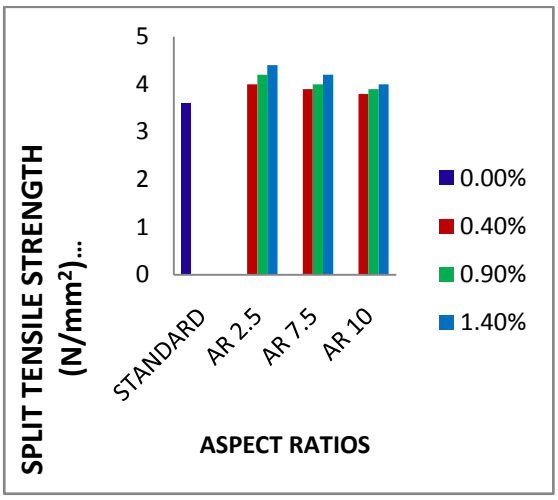

Fig 3.2 split tensile strength of different aspect ratios of PET fiber with concrete

3.3 FLEXURAL STRENGTH TEST

The flexural strength test determination is done for the determination of flexural strength of concrete. The specimens used for the flexural strength are of size 70 mm x 150 mm x150 mm. These specimens are tested on the UTM after 28

days of curing. The results are shown in the below graph

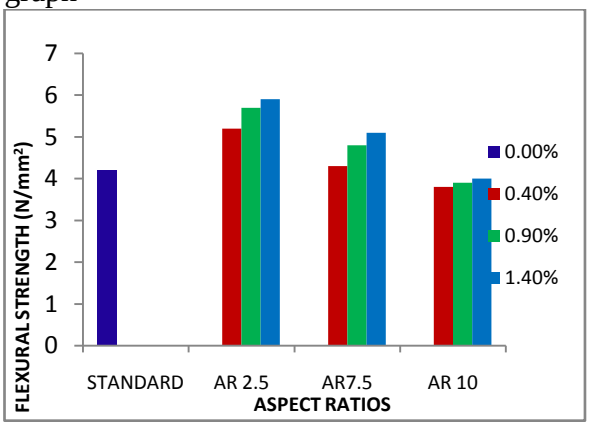

Fig 3.3 flextural strength of different aspect ratiosPET fiber with concrete

3.4 IMPACT TEST

Impact strength test is performed to determine the impact resistance of concrete. The test was carried out on a cylinder having x mm size. The test is conducted on drop weight impact testing machine after 28 days of curing. The results are shown inthe graph.

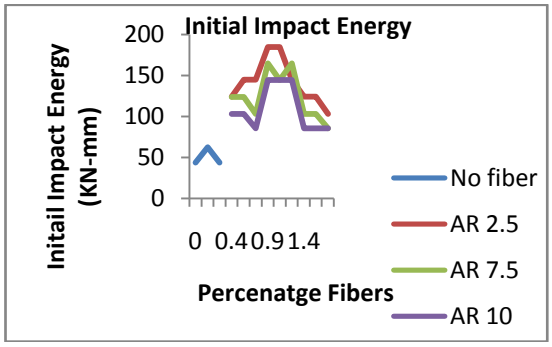

Fig 3.4 Initial Impact energy of different aspect ratios PET fiber with concrete

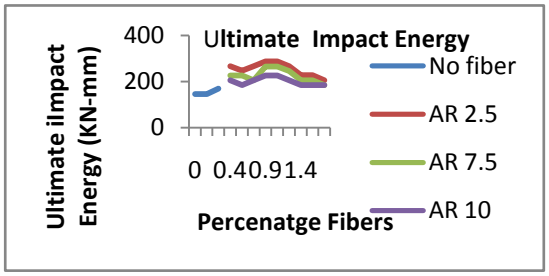

Fig 3.5Ultimate Impact energy of different aspect ratios PET fiber with concrete

4 .CONCLUSION

The significant improvements in strengths were observed with introduction of plastic fibres in concrete. It can be observed that test results that development in strength was higher for aspect ratio 2.5, which had superior mechanical bond strength, conferred the best resistance to strength parameters. The maximum percentage increase in compressive strength at 1.4% of fiber content at aspect ratio 2.5 was 32.59 % Of concrete was observed. From the test result it is observed that the tensile strength was increased with increase in fibres with the concrete. For maximum 1.4% volume fractions of PET fibers at aspect ratio 2.5, tensile strength increased by 22.22% .Flexural strength of concrete beam was increased by 40.47% due to the addition of crimped fiber at aspect ratio 2.5 and volume of 1.4%, compared to that of plain concrete specimen. The addition of crimped PET fiber to concrete improved the impact resistance of concrete.

From the results it is clear that, addition of PET crimped fiber results in a significant increase in the compressive strength, gradually. It is observed that for a lower aspect ratio, the compressive strength obtained is larger With the increase in the aspect ratio the compressive strength decreases gradually

REFERENCES

1. Soroushian,P.,Plasencia, JandRavanbakhsh, S., "*Assessment of reinforcing effects of recycled plastic and paper in concrete*" ACI Material Journal. 100 (3). 203-207. 2003.
2. European Commission DG ENV "*Plastic waste in the environment*" Institute European Environmental Policy, France. 2011.
3. N. Shamskia, "*The Influence of Pet Fibers on the Properties of Fresh and Hardened Concrete*", Journal of Structural Engineering and Geotechnics, 2 (1), 13-17, summer 2012.
4. Córdoba, L. et al," *Effects on Mechanical Properties of Recycled PET in Cement-Based Composites*". International Journal of Polymer Science. 1-6. May 2013.
5. Nibudey,R., Nagarnaik,P. ,Parbat, D., and Pande, A.," *Strength and fracture properties of post consumed waste plastic fiber reinforced concrete*" International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD),3(2).9-16.June. 2013.
6. Afroz, M., Jobaer, M., and Hasan, M., "*Performance of plain PET fibers to enhance the mechanical behaviour of*

concrete under tension and shear" International Journal of Science, Engineering and Technology Research (IJSETR).2(9). 1668-1672. September. 2013

7. P. Ganesh Prabhu, C. Arun Kumar, R. Pandiyaraj, P. Rajsh and L. Sasikumar, "*Study on utilization of waste PET bottles fiber in concrete*". International Journal of Research in Engineering & Technology. 2(5). 233-240. May 2014.
8. ACI Committee 544, 1986. *State-of-the art report on fiber reinforced concrete.* Report No. 544. IR-82.
9. R. N. Nibudey, P. B. Nagarnaik, D. K. Parbat, A. M. Pande, " *Compressive strength and sorptivity properties pf PET fiber reinforced concrete*", International Journal of Advances in Engineering & Technology, Sept., 2014.

Code books:

Indian Standard (IS)

1. *IS 456:2000, Plain and Reinforced Concrete*
2. *IS 10262:2009, Guidelines for concrete mix design proportioning*.