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Compressive and tensile strength analysis of Polyethylene Terephthalate (PET) for 7, 28 and 56 days

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ABSTRACT: -*Incorporation of fibers into concrete matrix to enhance its mechanical properties has been around now for few decades. The study was undertaken to analyses the effect on the compressive and tensile strength of concrete matrix. The study determined the rate of gain of strength for Polyethylene terephthalate (PET) fiber reinforced concrete at 7 days and 28 days testing. The fiber content was varied at the rate of 1%, 2% 3% 4% and 5% for analyzing both compressive and tensile strength of concrete. The gain of strength was 80% of the design mixes at 7 days 5% more than the conventional concrete.*

Keywords: *Fibers, Concrete, Compressive, Tensile, PET, rate of gain of strength.*

INTRODUCTION

Plastic is so versatile that it has become an integral part of our lives. This has resulted in ever increasing amount of plastic that is consumed all over the world. This consumption of plastic is owing to its low density, fabrication capabilities, automotive and industrial applications, medical delivery systems, artificial implants, other health care applications, land soil conservation, water desalination, flood prevention, preservation and distribution of food, housing, security systems etc. The worldwide researchers are researching on materials to suitably add to concrete matrix to enhance its properties. The literature review suggests that up to 20% of plastic content was used to replace the fine aggregates. The decrease in the slump with increase in the plastic content was also reported. The fiber infusion in concrete and soil mixes is a trending practice in research to conserve waste resources by reusing and recycling them in form of structural elements.

MATERIAL USED

Cement: Ordinary Portland cement of 43 grade confirming to IS: 8112-1989 of specific gravity 3.15.

Fine Aggregate: Aggregates with specific gravity of 2.60 and fineness modulus of 2.73 is used. And the grading zone of fine aggregate is zone II as per Indian Standard specifications IS: 383-1970.

Coarse aggregate: Coarse aggregate of size less than 20mm in fractions 10mm - 40% and 20 mm - 60% with specific gravity 2.70 and fineness modulus 6.865 was used confirming to IS: 383-1970. –

Admixture: Sika Visco Crete 20-HE

Fiber: PET flakes.

Water: locally available tap water is used.

MIX DESIGN

The concrete mix is designed as per IS: 10262-2009 IS: 456-2000 for normal concrete. we have used M25 grade with water cement ratio of 0.43.On the basis of preliminary testing of normal cubes having ratio of a suitable concrete mix was established and water cement ratio of 0.43. Cubes of 150×150mm and cylinders of 150×300mm were casted and they were cured in a water tank

METHODS AND METHODOLOGY

The compressive strength and tensile strength of concrete specimen was determined. The PET fiber was used for reinforcing the concrete which were obtained from the waste bottles. A total of 54 concrete specimens were casted 27 cubes for compressive strength analysis and 27 cylinders for split tensile strength analysis. The percentage of fiber was varied from 1-5% for each set of three concrete specimens to be tested.

RESULT AND DISCUSSION

The concrete specimens were tested for 7 days, 28-day and 56-day strength analysis. The graph was plotted together to serve the comparison between the two duration of testing.

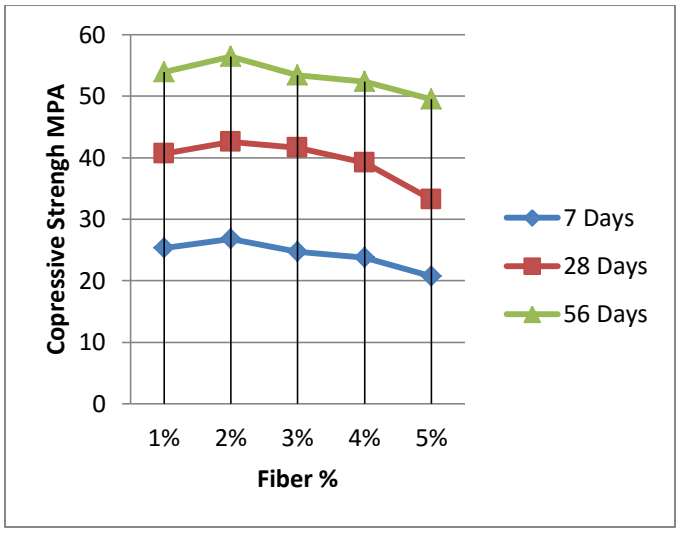

Figure 1 Compressive Strength of Concrete vs. % fiber

The figure one represents the Compressive strength gain analysis of PET fiber reinforced concrete specimens at 7-days, 28-day and 56- days compressive strength testing. The addition of PET fiber in concrete matrix resulted in gain of 94-100 % of the design strength of concrete mix at 7 days testing. While the 28 days testing result showed the

Strength gain of about 150%-170%.And for 56 days testing result showed the strength gain of about 200 %.

The maximum strength gain was at 1% and 2% for 7 days, 28-days and 56 days which is (25.33MPa and 26.75MPa) and (40.6MPa and 42.58MPa) and (53.97Mpa and 56.41Mpa) respectively.

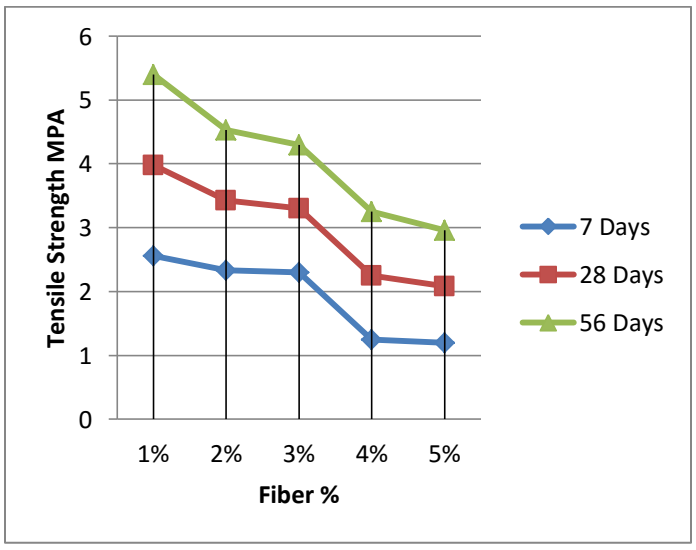

Figure 2 Tensile Strength vs. Fiber content

The figure two represents the strength gain analysis of PET fiber reinforced concrete specimens at 7 days 28-day and 56days Split tensile strength testing. The addition of PET fiber in concrete matrix resulted in gain of 82%-75% of the design strength of concrete mix at 7 days testing. While the 28 days testing result showed the strength gain of about 110%-128%. And for 56 days testing result showed the strength gain of about 150 %.The maximum strength gain was at 1% and 2% for 7 days 28-days and 56 days which is (2.56MPa and 2.33MPa), (3.98MPa and 3.43MPa) and (5.40MPa and 4.53MPa) respectively.

CONCLUSION

The reinforcement of concrete specimen with PET fibers enhances the mechanical properties of concrete. The rate of gain of strength for concrete matrix is accelerated on addition of PET fibers. The optimum PET fiber content for compressive strength of concrete is 1-2%. However, the variation at 3%, 4% and 5% still resulted in more gain of strength in concrete specimen than the original design mix. The compressive strength starts to decrease after the 2% of fiber content. The optimum fiber content for Split tensile strength of concrete specimen lies in range of 1-2% of fiber Content. While the other variation in fiber content resulted in reduction of split tensile strength. The study will conclude that any increment in split tensile strength of concrete specimen will result only at the dosage of 1-2% of fiber content; the other higher dosages of 3%, 4% and 5% will result in reduction of tensile strength up to 89%, 71% and 54% respectively. The PET fiber reinforced concrete can be used at places which are not subjected to high temperatures. The PET fiber reinforced concrete is a sustainable reuse of waste plastic to deal with the environmental hazards of plastic disposal. The study will conclude that the PET fiber concrete is economical feasible and sustainable form of concrete.

REFERENCES

1. J.M. Irwan, R.M. Asyraf, N. Othman, H.B. Koh, M.M.K. Annas, and Faisal S.K.,"The Mechanical Properties of PET Fiber Reinforced Concrete from Recycled Bottle wastes," Advanced Materials Research, Vol 795, 2013 pp 346 351. Available Online at: https://core.ac.uk/download/files/434/18264203.pdf

2. R, N. Nibudey, P.B. Nagarnaik, D.K. Parbat and A.M. Pande," A model for compressive strength of PET fiber reinforced concrete," American Journal of Engineering Research e-ISSN: 2320-0847, p-

ISSN: 2320-0936, Volume-02, Issue12,pp-367-372.
Available Online at:
http://www.ajer.org/papers/v2(12)/ZO212367372.pdf

3. SaverioSpadea, Ilenia Farina, Anna Carrafiello and Fernando Fraternali," An experimental study on the cement mortar reinforcement through recycled nylon fibers," University of Saleno, Available Online at:
https://arxiv.org/ftp/arxiv/papers/1409/14097258.pdf

4. Margareth da Silva, Matheus Soares Viana Fernandes," Bending Behavior of Recycled PET Fiber Reinforced Cement based Composite," International Journal of Engineering and Technology, Vol 7, No. 4 August2013.