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HARDENED PROPERTIES OF POLYETHYLENE TEREPHTHALATE BASED CONCRETE

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***Abstract*:** This experiment is done by various tests to check and analyze compressive strength of the concrete after adding the optimal amount of PET fiber, as an constituent to obtain appropriate results for the research. This research shows the increased mechanical properties, at certain PET fiber fraction. In this research, we have taken a proportionate amount of PET fiber to the weight of cement to improve the mechanical property of concrete.

In our research, we have mixed PET fiber concrete of M25 grade, by the fractional volume of cement in different ratios, as 0.5%, 1.0 %, 1.5% and 2%.Then , the mechanical properties of concrete namely compressive strength were compared to the standard concrete, to analyze the effective amount of PET fiber to be used in construction sites.

Keywords : Concrete, Polyethylene Terephthalate (PET fiber), compressive strength, flexural strength.

Introduction: Concrete is vastly used as a construction material undoubtedly. Fresh concrete is made of aggregate, cement, sand, water and admixtures where it is required. Concrete having a homogeneous structure, good plasticity and the ability of distortion by form, sound and thermal insolation and the capability of quality development by admixtures, is increasing and more popular in structural industries day by day. Polyethylene terephthalate (PET) is widely used thermoplastic polyester .It is also called as "polyester," which sometimes causes confusion, because of polyester fibers are thermosetting material. It was widely used application in the form of bottles, thermally stabilized films, and electric component because it is a visible polymer, with fine mechanical property and desirable geometrical stability under different loads. PET contains the quality of good gas cover properties and good chemical resistivity. PET also contains wide applicability in textile industry for fiber production. PET is a thermoplastic having best physical characteristics. It is inclusive of 18 % polymers manufactured worldwide and above 60% of which is used for artificial fibers and bottles, which consumes approximately 30 percent of global PET requirement.

Past Studies: Different Researchers has conducted various experiments to improve the mechanical properties of the concrete material. A well known researcher, Mark Adom-Asamoah et al. discussed about flexural an shear behavior of concrete beam mae from recycled material. A researcher Brahim Safi proposed. The use of plastic waste as fine aggregate in the self-compacting mortars: Effect on physical and mechanical properties. M. Sulyman, J. Haponiuk, and K. Formela, "Utilization of Recycled Polyethylene Terephthalate (PET) in Engineering Materials." International Journal of Environmental Science and Development, Vol. 7, No. 2, February 2016.

Experimental Study:

Cement- In our investigation we have used Ordinary Portland cement (OPC) — 43 grade. Cement has been checked its physical property, accordingly Indian Standard specifications of IS: 8112-1989.

Fine Aggregate - Fine aggregates are classified in four zones, that is zone1, zone 2, zone 3 and zone 4 as per IS: 383-1970.

Coarse Aggregate - The coarse aggregates of size 20mm having specific gravity 2.70 and fineness modulus 6.865 was use as IS: 383-1970.

Water- Water, which fits for drinking is generally considered fitted for producing concrete. Water has to be free from acid, oils, alkalis, vegetables and other organic Impurity. Soft water also produces weak concretes. Water has 2 function in a concretes mixture. Firstly, its reaction with, chemical with cement to make a cement paste in which, the inner aggregate is held in suspension till cement paste has harden. Secondly, it is serving as vehicle or lubricants in the mixture of fine aggregate and cements.

PET Bottles Fiber- The post consumes PET mineral bottle of single brands was collected from surroundings. The fiber was cut after removing, neck and the bottom of the bottles. The dimension of fiber used is 50mm x 3mm with aspect ratio 17 for replacement of 0.5%, 1.0% ,1.5% and 2.0 % waste PET bottle fiber as specified in **Table 1**

Table 1: Specimen Properties

Aspect Ratio	Dimension (mm)	Quantity (%)			
17	50 x 3	0.5	1.0	1.5	2.0

Fig. PET Fiber

Methodology: -

Quantities of Materials:

1) Cement = 435.409 Kg/m^3

2) Fine Aggregate = 653.384 Kg/m^3

3) Coarse Aggregate = 1173.782 Kg/m^3

4) Water = 203.430 Kg/m^3

5) Water Cement Ratio = 0.467

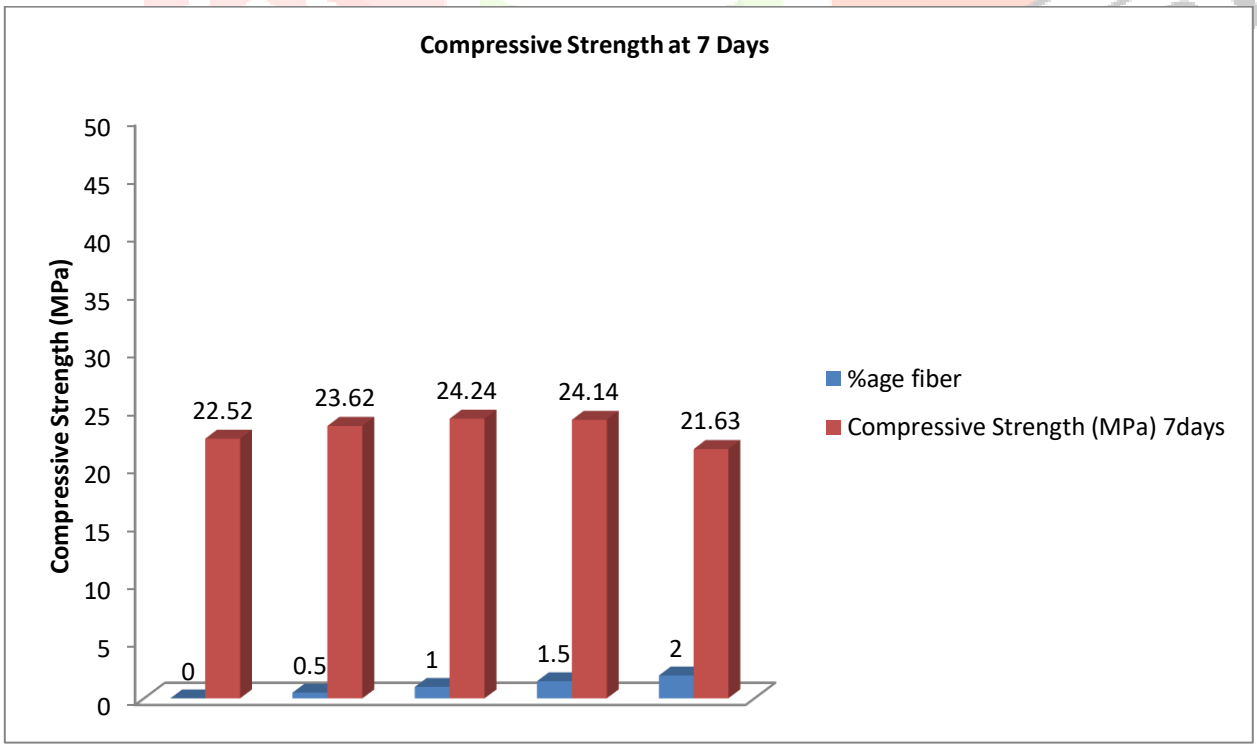
Table No.2

To express proportion in usual way

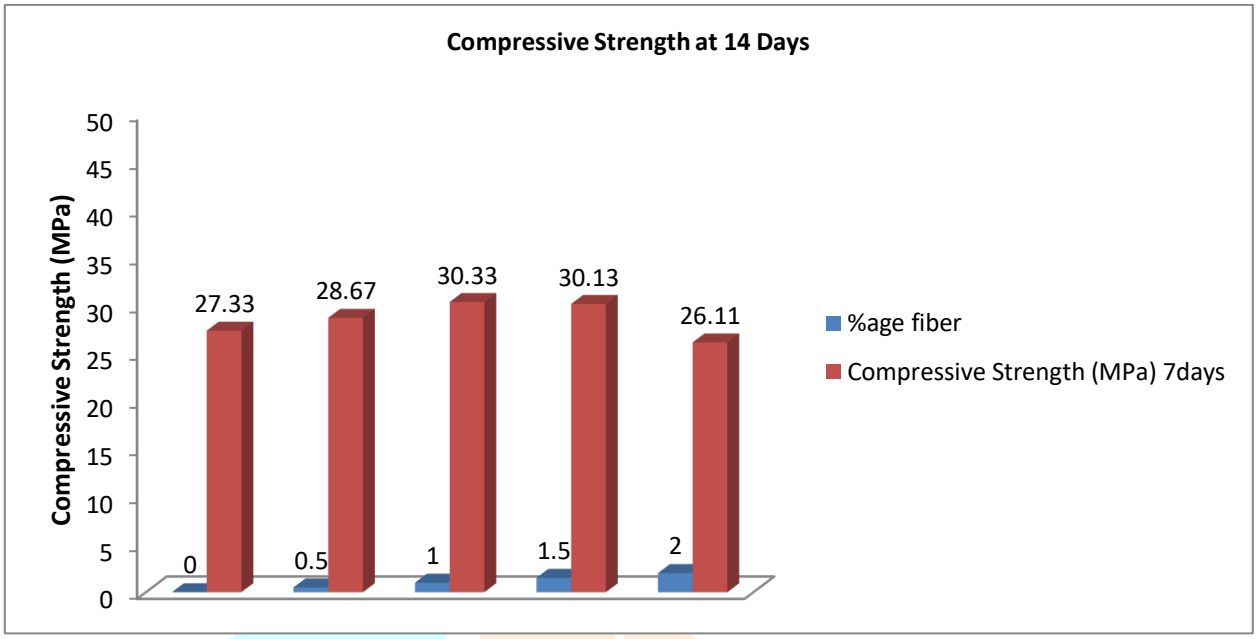
Cement	F.A.	C.A.	Water
435.409	653.384	1173.782	203.430
1	1.5	2.696	0.467

Result : -

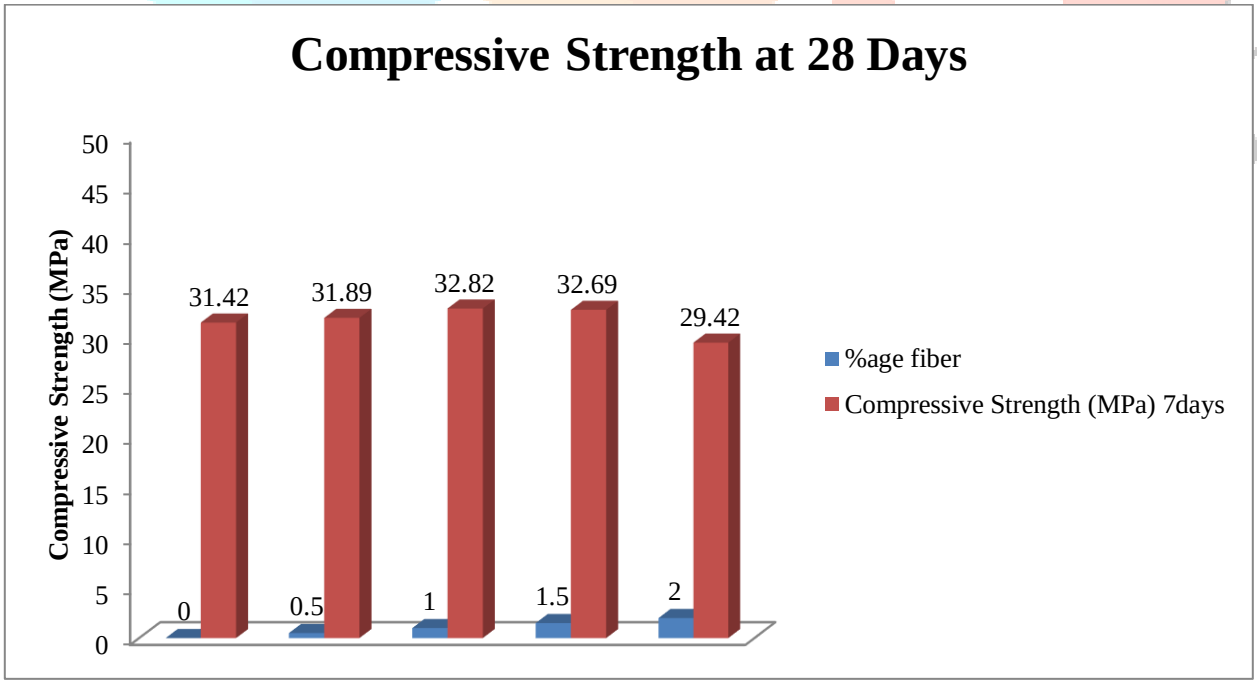
1- Compressive Strength at 7 days-



2- Compressive Strength at 14 days-



3- Compressive strength at 28 days-



CONCLUSION:-

1. For compressive strength, the optimum dosage was 1.0 % by the weight of cement with compressive strength 24.24, 30.33 and 32.82 of 7, 14 and 28 days respectively.

2. Studies based on experimental works and scientific reports prove that waste PET increases the toughness of concrete. The use of PET fiber concrete is a promising technique for developing sustainable materials to be applied in civil construction industries, and hence concrete with waste PET bottle fiber can be used not only as an effective plastic waste management practice but also as a strategy to produce more economic and sustainable building material in the future .

3. From environmental point of view, the dumping issue of PET bottles could be solved, as these are non-biodegradable in nature.

4. PET bottles can be used in local construction or under developed regions in modifying compression and tension properties of concrete at cheaper cost and energy, as it is easily available and chopped manually. Also, its lightweight results in light weight concrete.

5. The shredded plastic flakes help in reduction of crack formation because of their holding capacity and ductile nature.

FUTURE SCOPE:-

1. Further research work is needed to enhance the bonding between plastic fibers and concrete matrix.
2. If the alignment of fibers can be oriented, much higher strength can be obtained which is not possible with current lab instruments.
3. Proper cutting of fibers will result in uniform strength distribution in concrete, which will make it more efficient.
4. More research work is needed to evaluate the carbon footprint offset by incorporating PET Waste fibers to make more green and sustainable concrete.

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