Compare Compressive Strength of Self Curing Concrete, Fiber Reinforced Concrete and Conventional Concrete

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***Abstract*— Today concrete is most widely used construction material due to its good compressive strength and durability. Any laxity in curing will badly affect the strength and durability of concrete. Self-curing concrete is one of the special concretes in mitigating insufficient curing due to human negligence paucity of water in arid areas, inaccessibility of structures in difficult terrains and in areas where the presence of fluorides in water will badly affect the characteristics of concrete. The present study involves the use of shrinkage reducing admixture polyethylene glycol (PEG 400) in concrete which helps in self curing and help better hydration and hence strength. In conventional concrete, micro-cracks develop before structure is loaded because of drying shrinkage and other causes of volume change. In the FRC, a numbers of small fibers are dispersed and distributed randomly in the concrete at the time of mixing, and thus improve concrete properties in all directions. The present study, compare compressive strength of conventional concrete, fiber reinforced concrete (polypropylene fiber) and self curing concrete using PEG400 in different % for M20 and M25 grade of concrete . It is find through this experimental study the compressive strength of self curing concrete using PEG400 is stronger than that of conventional concrete and using polypropylene fiber fibre reinforced concrete.**

***IndexTerms*— Polyethylene glycol PEG400, Polypropylene fiber, Workability, Compressive tests.**

Introduction

Concrete is the most widely used in construction material has several desirable properties like high compressive strength concrete, stiffness and durability under usual environmental factors. At the same time concrete is brittle and weak in tension. Plain concrete has two deficiencies, low tensile strength and a low strain at fracture. These shortcomings are generally overcome by reinforcing concrete. Normally reinforcement consists of continuous deformed steel bars or pre-stressing tendons. The advantage of reinforcing and pre-stressing technology utilizing steel reinforcement as high tensile steel wires have helped in overcoming the incapacity of concrete in tension but the ductility magnitude of compressive strength.

Fiber reinforced concrete (FRC) is a concrete made primarily of hydraulic cements, aggregates and discrete reinforcing fibres. FRC is a relatively new material. This is a composite material consisting of a matrix containing a random distribution or dispersion of small fibres, either natural or artificial, having a high tensile strength. Due to the presence of these uniformly dispersed fibres, the cracking strength of concrete is increased and the fibres acting as crack arresters. Fibres suitable of reinforcing concrete having been produced from steel, glass and organic polymers. Many of the current applications of FRC involve the use of fibres ranging around 1% by volume of concrete. Recent attempts made it possible to incorporate relatively large volumes of steel, glass and synthetic fibres in concrete. Results of tensile tests done on concretes with glass, polypropylene and steel fibers, indicate that with such large volume of aligned fibres in concrete, there is substantial enhancement of the tensile load carrying capacity of the matrix. This may be attributed to the fact fibre suppress the localization of micro-cracks into macro-cracks and consequently the apparent tensile strength of the matrix increases.

Concrete is the basic engineering material used in most of the civil engineering structures. Its popularity as basic building material in construction is because of its economy of use, good durability and ease with which it can be manufactured at site. Concrete like other engineering materials needs to be designed for properties like strength, durability, workability. With advent of new generation admixtures, it is possible to achieve higher grades of concrete with high workability levels economically. Curing is the maintaining of a satisfactory moisture content and temperature in concrete during its early stages so that desired properties (of concrete) may develop .The concept of self-curing agents is to reduce the water evaporation from concrete, and hence increase the water retention capacity of the concrete compared to conventional concrete. It was found that water soluble polymers can be used as self-curing agents in concrete. Polyethylene Glycol-400(PEG-400) (Used as an internal curing compound):- Polyethylene glycol is a condensation polymer of ethylene oxide and water with the general formula H(OCH2CH2)nOH, where n is the average number of repeating polyethylene groups typically from 4 to about 180. One common feature of PEG appears to be the water-soluble nature. Polyethylene glycol is non-toxic, odorless, neutral, lubricating, non-volatile and non-irritating and is used in a variety of pharmaceuticals. Thus, it is a shrinkage reducing admixture.

Conventional Concert

Concrete is prepared from a mixture of coarse and fine aggregates, Portland cement (PC), and water. Other additives such as fly ash and different types of admixtures such as air-entraining agents, accelerators, retarders, and plasticizers also may be used to improve the concrete's capabilities for workability and/or strength. Before concrete is produced, the components that make up

concrete are tested for their qualitative performances. The aggregates for concrete are usually tested for gradation, hardness, specific gravity, absorption, and organic material impurities. PC usually is tested for consistency, initial and final set, soundness, and strength (with mortar). Water is tested at the source of supply for its purity and portability. Admixtures usually are considered acceptable on certification from the supply after mixing the components, fresh concrete is produced and transported to the field to be poured into its final place for hardening. Subsequently, a test for consistency, named the "slump test", is carried out on concrete samples.

Self Curing Concrete

Excessive evaporation of water (internal or external) from fresh concrete should be avoided; otherwise, the degree of cement hydration would get lowered and thereby concrete may develop unsatisfactory properties. Curing operations should ensure that adequate amount of water is available for cement hydration to occur. This paper discusses different aspects of achieving optimum cure of concrete without the need for applying external curing methods.

Fiber-Reinforced Concrete

(FRC) is concrete containing fibrous material which increases its structural integrity. It contains short discrete fibres' that are uniformly distributed and randomly oriented. Fibres' include steel fibres, glass fibre, synthetic fibres and natural fibres – each of which lend varying properties to the concrete. In addition, the character of fibre-reinforced concrete changes with varying concretes, fibre materials, geometries, distribution, orientation, and densities. Fibre reinforced concrete (FRC) is a concrete made primarily of hydraulic cements, aggregates and discrete reinforcing fibres. FRC is a relatively new material. This is a composite material consisting of a matrix containing a random distribution or dispersion of small fibres, either natural or artificial, having a high tensile strength. Due to the presence of these uniformly dispersed fibres, the cracking strength of concrete is increased and the fibres acting as crack arresters. Fibres suitable of reinforcing concrete having been produced from steel, glass and organic polymers. Many of the current applications of FRC involve the use of fibres ranging around 1% by volume of concrete. Recent attempts made it possible to incorporate relatively large volumes of steel, glass and synthetic fibres in concrete. Results of tensile tests done on concretes with glass, polypropylene and steel fibres, indicate that with such large volume of aligned fibres in concrete, there is substantial enhancement of the tensile load carrying capacity of the matrix. This may be attributed to the fact fibres suppress the localization of micro-cracks into macro-cracks and consequently the apparent tensile strength of the matrix increases Concrete develops micro cracks with curing and these cracks propagate rapidly under applied stress resulting in low tensile strength of concrete. Hence addition of fibers improves the strength of concrete and these problems can be overcome by use of Polypropylene fibers in concrete. Application of polypropylene fibers provide strength to the concrete while the matrix protects the fibers.The primary role of fibres in a cementitious composite is to control cracks, increase the tensile strength, toughness and to improve the deformation characteristics of the composite. The performance of FRC depends on the type of the fibers used.Inclusion of polypropylene fibers reduces the water permeability, increases the flexural strength due to its high modulus of elasticity. In the post cracking stage, as the fibers are pulled out, energy is absorbed and cracking is reduced.

II OBJECTIVES

Following are the main objective of this study

1] To study the mechanical characteristics of concrete i.e compressive strength by varying the percentage of of polypropylene fiber from o.5%,1%,1.5% by weight of cement for both M20 and M25 grade on different properties and having different grade of concrete .

2] To study the effect of self curing concrete varying the percentage of PEG400 from 0% to 2% by weight of cement haviforM20 and M25 grade of concrete and compare compressive strength with different % of PEG.

3] To study the compressive strength of conventional concrete with M20 and M25 grade of concrete

4] Finally compare the compressive strength of conventional concrete ,polypropylene concrete and self curing concrete using PEG400

III EXPERIMENTAL PROGRAMME

1] **Materials**

Cement PPC- 53 grade available in local market is used in the investigation. The cement used has been tested for various proportions as per IS: 4031-1988 and found to be conforming to various specifications of IS: 12269-1987. The specific gravity was 3 and the fineness was 3200 cm2/gm

Coarse aggregate Crushed angular stone from was used as coarse aggregate.

Fine aggregate The specific gravity and fineness modulus was 2.93 .bulking of sand 20%and silt content in sand is 1%

Polypropylene fibers (PP) The fibers used were fine polypropylene monofilaments .The fibers were supplied by Reliance Industry by name RECRON 3s .It is available in 3 different sizes i.e 6mm,12mm and 24 mm .In the present investigation 12mm fiber length is used specific gravity 0.91gr/cm^3 water absorption

Polyethylene glycol (PEG 400) –Polyethylene glycol is a condensation polymer of ethylene oxide and water with the general formula H (OCH2CH2) nOH, where n is the average number of repeating ox ethylene groups typically from 4 to about 180. The abbreviation (PEG) is termed in combination with a numeric suffix which indicates the average molecular weights. It is water-soluble in nature.

Experiment work

Preparations and casting of test specimen. The experimental program was aimed to study the compressive strength and compare ***Test conducted - Compressive test*** 1. compression test result 4cubes of each percentage 7 and 28 days are cast 2.size of cube 150mm*150mm*150mm cube are tested respectively 3.Specimen surface are cleaned of dust 4.One by one the specimens are heald in position by applying 15mpa load in compression testing machine 5.That time cube berk stop automatic machine and take reding of load 6.Fainaly the graph between the cube crushing strength and representative

Workability

It is generally agreed the workability of concrete increases by using superplastizer ,the slump variation with the different % PEG and % FRC

Table 1.slump test result

Sr No	PEG400 In %	Average Slump In (Mm)		PPE In %	Average Slump In (Mm)	
		M20	*M25*		*M20*	*M25*
1	0	49.25	70.25	0	49.25	70.25
2	0.5	59.5	83.25	0.5	50	69.75
3	1	76	101.75	1	44.25	61.75
4	1.5	101	100.75	1.5	37.5	50.57

IV.THE TEST RESULT AND DISCUSSION

The results of the Slump & compressive test were represented .The graphical representation of the Compressive test are results is shown in graph . As the % of PEG 400 is increased the slump is found to increase. % PPF is increased the slump go to decreases for M20 and M25 grade of concrete

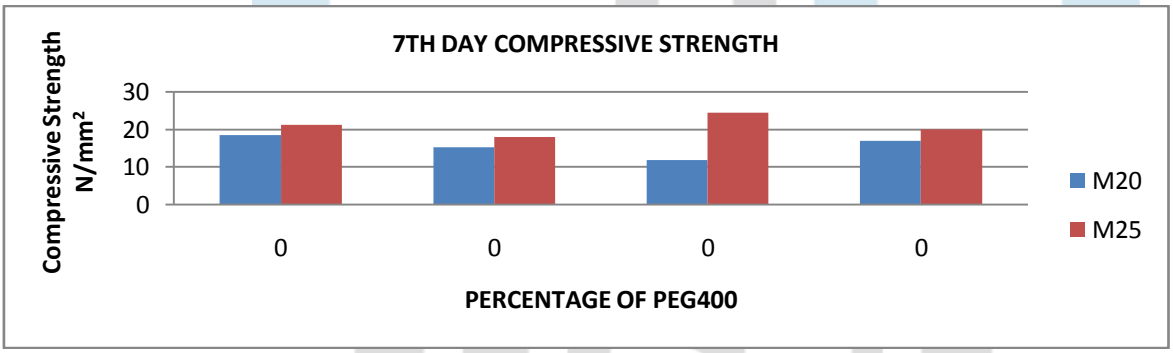
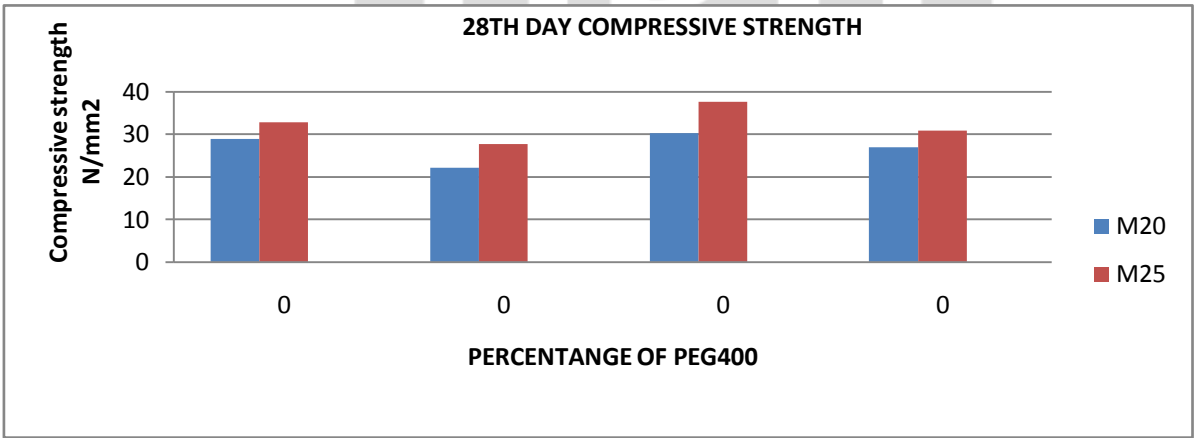


Figure1: compressive strength of cube with 0% PEG



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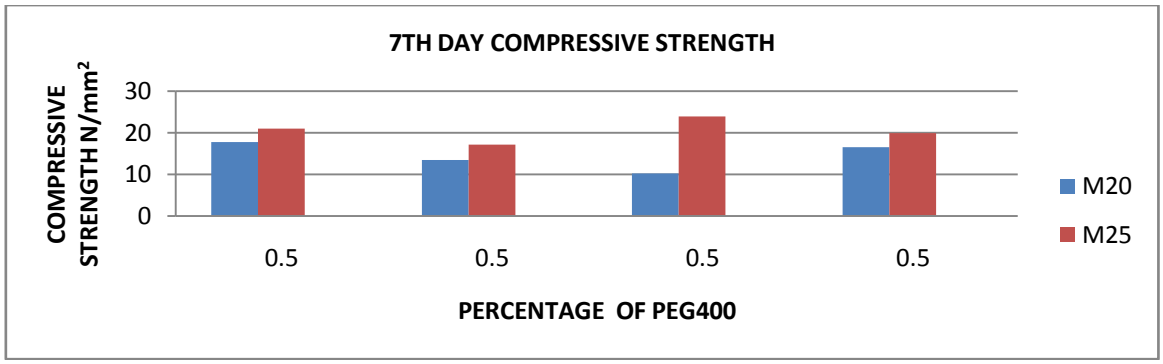

Figure1: compressive strength of cube with 0.5% PEG

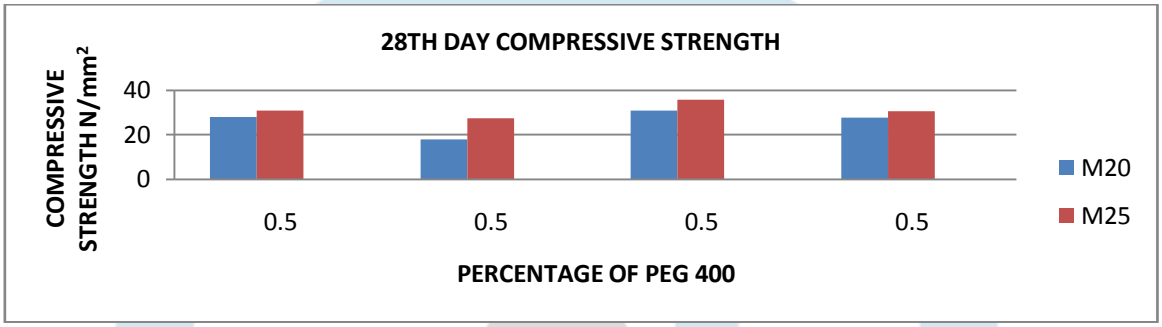

Figure3: compressive strength of cube with 0.5% PEG 400

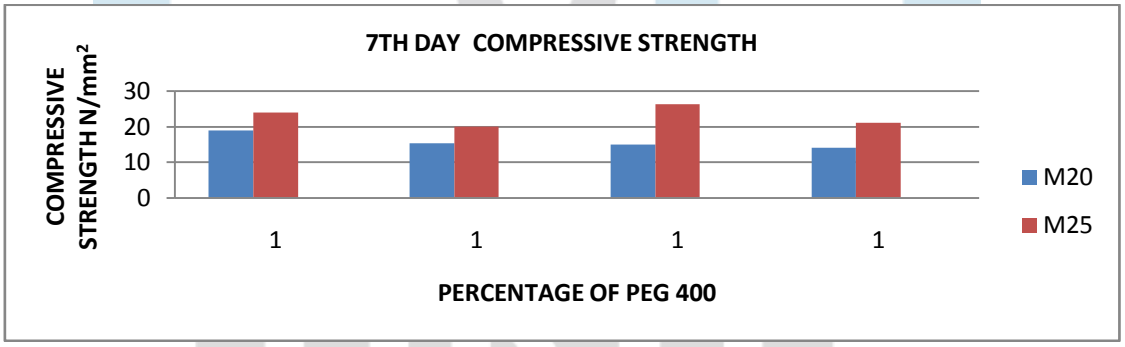

Figure4: compressive strength of cube with 1% PEG 400

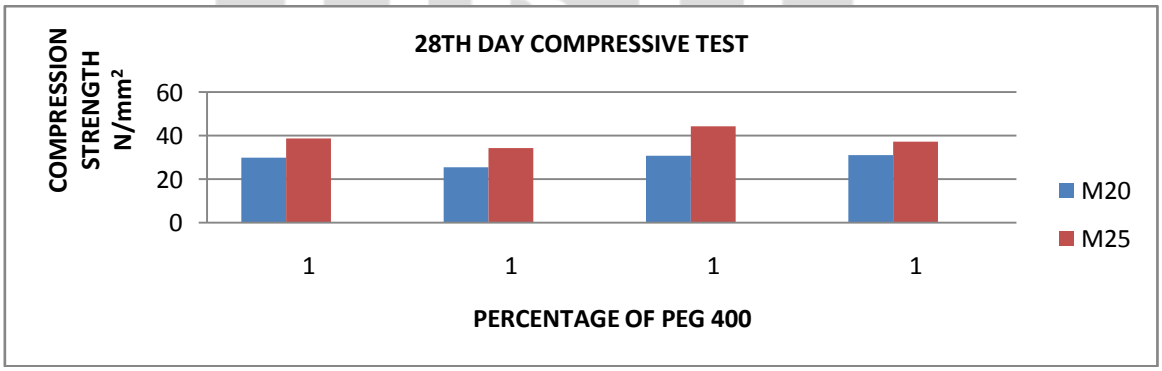

Figure5: compressive strength of cube with 1% PEG 400

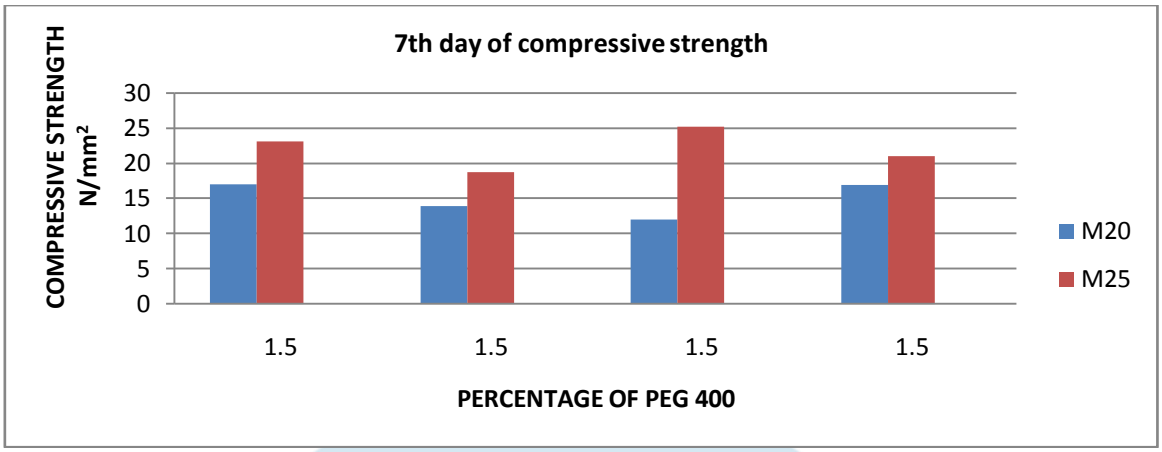

Figure6: compressive strength of cube with 1.5% PEG 400

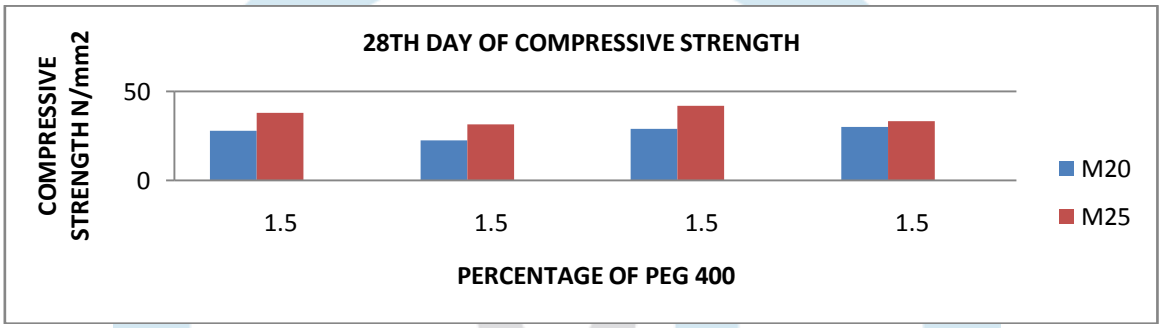

Figure6: compressive strength of cube with 1.5% PEG 400

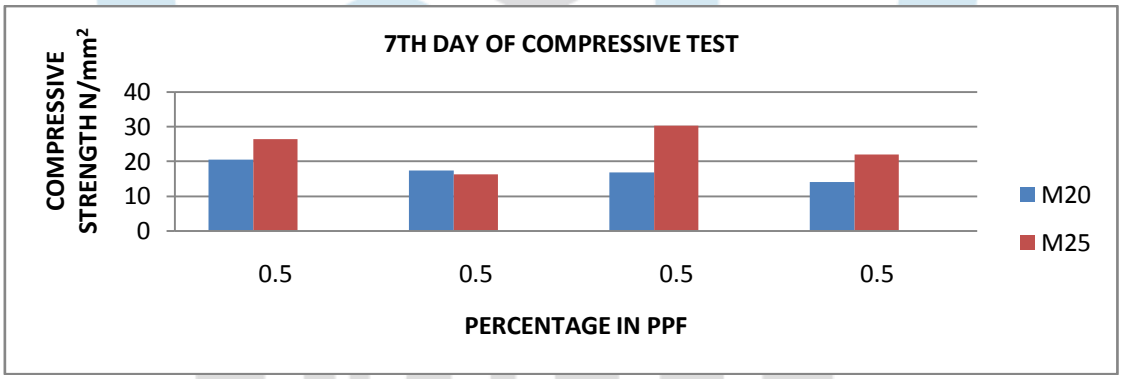

Figure7: compressive strength of cube with 0.5% polypropylene fiber (PPE)

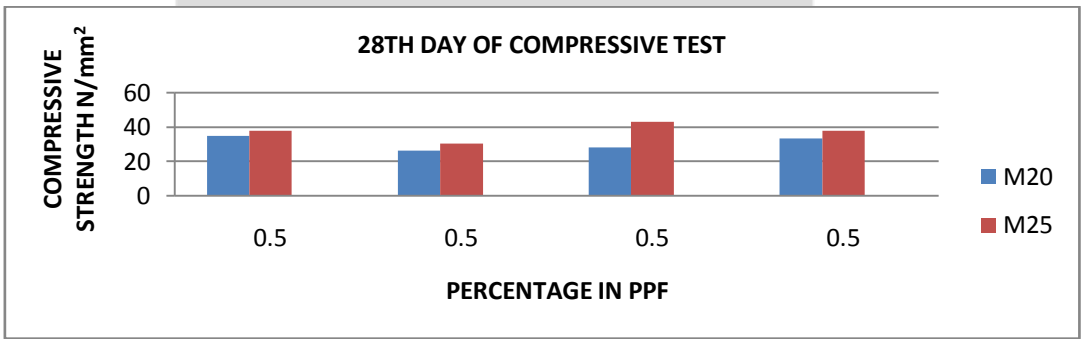

Figure7: compressive strength of cube with 0.5% polypropylene fiber(PPF)

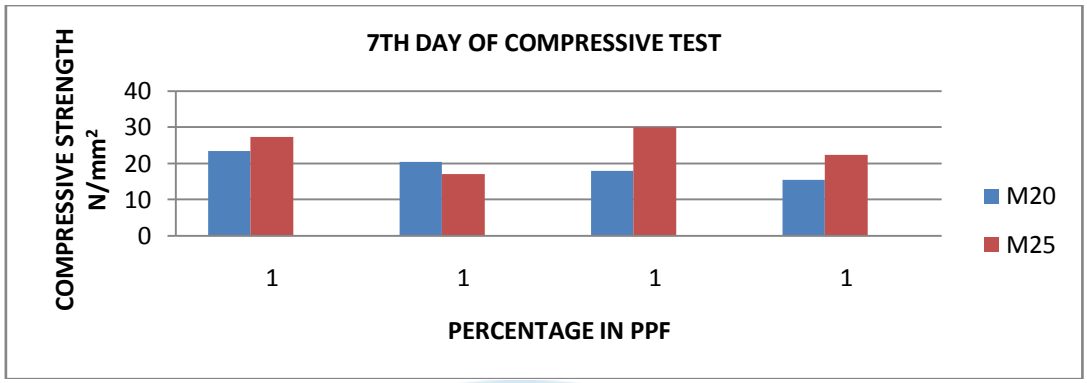

Figure7: compressive strength of cube with 1% polypropylene fiber (PPF)

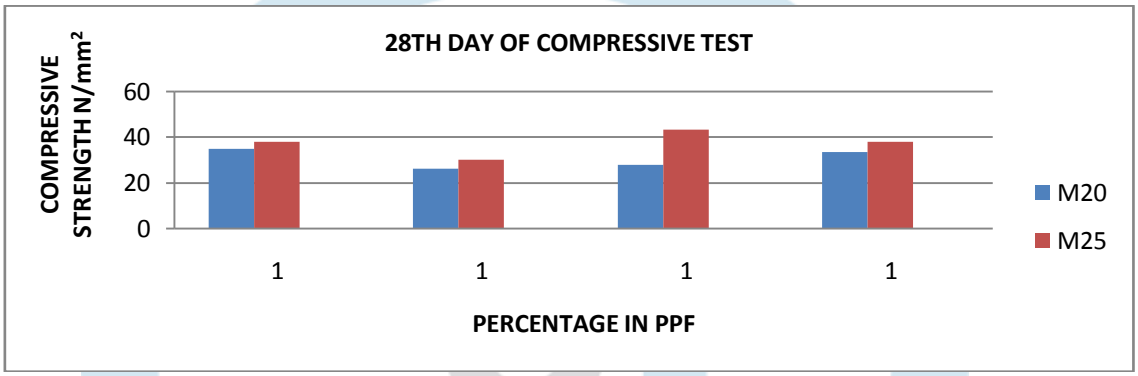

Figure8: compressive strength of cube with 1% polypropylene fiber (PPF)

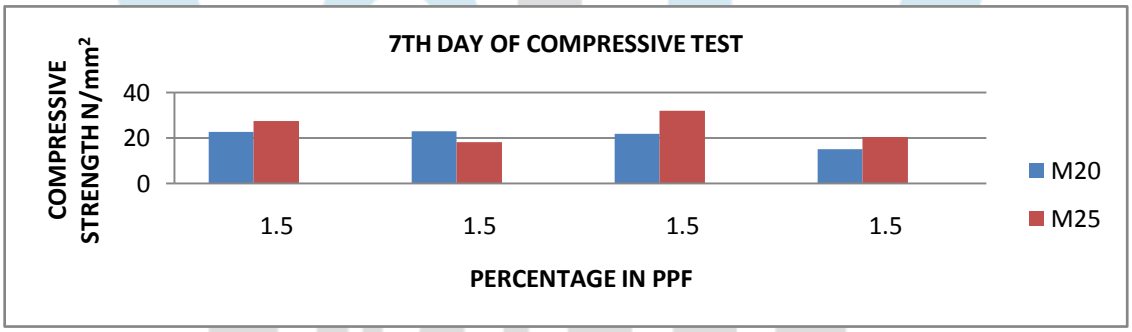

Figure9: compressive strength of cube with 1.5% polypropylene fiber (PPF)

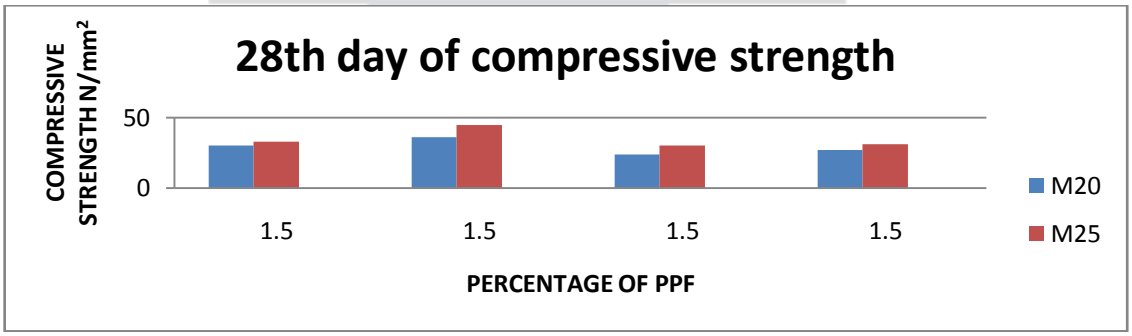

Figure10: compressive strength of cube with 1.5% polypropylene fiber (PPF)

V.CONCLUSION

1.The optimum dosage of PEG400 for maximum strengths (compressive) was found to be 1% for M20 and for M25 grades of concrete as compare to conventional concrete and fiber reinforced concrete.

2. As percentage of PEG400 increased slump increased for both M20 and M25 grades of concrete.

3. As percentage of polypropylene fiber increased slump decreases for both M20 and M25 grades of concrete.

4. Self curing concrete is the answer to many problems faced due to lack of proper curing.

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