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"Experimental Investigation on PEG Fume as Partial Replacement of Cement for M-25 & M-20 Concrete"

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ABSTRACT: Concrete is most widely used construction material due to its good compressive strength and durability. Concrete can be cured by water curing and by self curing agent. Conventional concrete require water curing for a minimum of 28 days to complete its target strength. Therefore water curing is very much necessary to prevent unsatisfactory properties of cement concrete. In order to have good quality curing, surplus of evaporation from the surface need to be prevented. Self-curing concrete is one of the extraordinary concrete which is gaining importance in recent days as it avoid errors which were caused by human, structures which are not available, terrains where curing becomes complicated and in places where the fluoride content badly influences the property of concrete Plain concrete needs pleasant atmosphere by providing moisture for a minimum period of 28 days for good hydration and to attain desired strength. Self curing concrete is the one which can cure itself by retaining its moisture content. In the this research, the affect of admixture (PEG 400) on compressive strength, split tensile strength, flexural strength and durability test by varying the percentage of Polyethylene Glycol **(**PEG) by weight of cement from 0% ,0.8%,1.6%,2.4% & 3.2% are studied for M20 and M25 mixes. It was also found that 2.4% of PEG 400 by weight of cement was optimum for M20, while 1.6 % was optimum for M25 grade concretes for achieving maximum strength without compromising Workability

1. INTRODUCTION This chapter deals with the introduction to totally different ways of curing and therefore the difficulties in typical curing. It also deals with the introduction of self-compacting concrete with its benefits and drawbacks. The chapter focuses on the necessity of self-curing together with self compacting together with its mechanism, materials and benefits

1.1.1 Self curing

Proper curing of concrete structures is very important to fulfill performance and durability necessities. In typical curing this can be achieved by external curing applied when combination, putting and finishing. Self-curing or internal curing could be a technique that may be wont to give extra wetness in concrete for simpler hydration of cement and reduced self-desiccation. The ACI-308 Code states that "internal curing refers to the method by that the association of cement happens due to the supply of extra internal water that's not a part of the blending water". the extra internal water is usually provided by using comparatively little amounts of saturated, lightweight weight, polythene Glycol, super absorbent chemical compound particles within the concrete.

1.1.2 Need for self–curing

When the mineral admixtures react utterly in a very blending cement system, their demand for natural action water (external or internal) will be much larger than that in a very typical standard hydraulic cement concrete. once this water isn't pronto offered, as a result of depercolation of the capillary body, for instance, vital autogenic deformation and

(early-age) cracking might result. as a result of the chemical shrinkage occurring throughout cement hydration, empty pores area unit created among the cement paste, resulting in a discount in its internal ratio and conjointly to shrinkage which can cause early-age cracking. this case is intense in HPC (compared to traditional concrete) as a result of its typically higher cement content, reduced water/cement (w/ c) magnitude relation and therefore the pozzolanic mineral admixtures (fly ash, silicon dioxide fume). The empty pores created throughout self-desiccation induce shrinkage stresses and also influence the mechanics of cement association method, limiting the ultimate degree of association. The strength achieved by IC might be quite that doable below saturated curing conditions. usually specially in HPC, it's not simply doable to supply curing water from the highest surface at the speed needed to satiPEGy the continuing chemical shrinkage, as a result of the very low permeabilities usually achieved.

1.1.3 Mechanism of internal curing

Continuous evaporation of wetness takes place from AN exposed surface as a result of the distinction in chemical potentials (free energy) between the vapour and liquid phases. The polymers added in the mix mainly form hydrogen bonds with water molecules and cut back the chemical potential of the molecules that successively reduces the pressure, therefore reducing the rate of evaporation from the surface.

1.2 PROJECT OBJECTIVE:

1) To improve the effectiveness of the water content of a concrete mix by using PEG-400

2) To determine the characteristics of self-curing concrete such as slump, compressive strength, split tensile strength, modulus of rupture & durability by adding self-curing agent in varying percentage.

3) To compare the strength between conventional and self curing concrete.

2. Experimental methodology and Investigations

2.1 Cement: Ordinary Portland cement is used to prepare the mix design of M-25 grade. The cement used was fresh and \without any lumps Water – cement ratio is 0.42 for this mix design using IS 456:2007. Cement is an extremely ground material having adhesive and cohesive properties which provide a binding medium for the discrete ingredients. Chemically cement constitutes 60-67% Lime (CaO), 17-25% Silica (SiO_2), 3-8% Alumina (Al_2O_3), 0.5-6% Iron Oxide (Fe_2O_3), 0.1-6% Magnesia (MgO), 1-3% Sulphur Trioxide (SO_3), 0.5-3% Soda And Potash (Na_2O+K_2O).

2.2 Sand: Natural sand which is easily available and low in price was used in the work. It has cubical or rounded shape with smooth surface texture. Being cubical, rounded and smooth texture it give good workability. Sand which is used here is taken from Girna River. Particles of this sand have smooth texture and are blackish. Sieve analysis was done to find out fineness modulus which comes out to be 3.14% which is under limit as per IS 383-1970.

2.3 Coarse aggregate: The aggregate used in this project mainly of basalt rock which comes under normal weight category. The aggregates are locally available. 50% of the aggregate used are of 10-12 mm size and remaining 50% are of 20mm size.

2.4 Polyethene glycol- 400

Polythene glycol could be a condensation chemical compound of ethene chemical compound and water with the overall formula H (OCH2 CH2) n American state, wherever n is that the average variety of continuation of ethylene teams usually from four to concerning one hundred eighty. It seems to be water soluble. It's nontoxic and inodorous. The particular gravity is one.13. The polyethylene-glycol is employed to scale back water evaporation from concrete, and

thus increase the water retention capability of concrete that results in improved compressive strength. the utilization of polyethylene-glycol in concrete mixes improves the mechanical properties of concretes which can be attributed to a stronger water retention and causes continuation of the association method of cement past leading to less voids and pores, and larger bond force between the cement paste and aggregates. The PEG-400 used for this research.

3.Results & Discussion

3.1 Compressive Strength Test: A minimum of three cubes are casted in each batch mix for determining compressive strength. Tests are performed at the age of 28 days of the specimens. Specimens are placed in the test machine as per IS: 516-1959 clause no 5.5.1 page no 11, also loading is applied on the specimen as per the same IS code.

Table 4 Result of Cubes

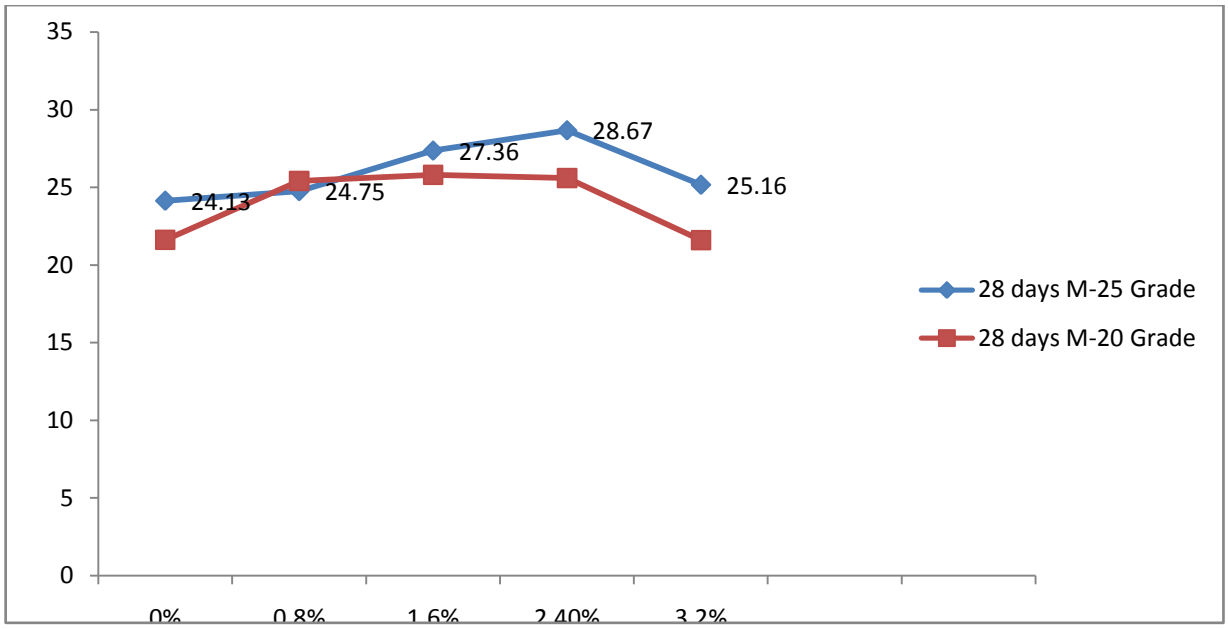
Mix	% Replacement	Compressive Strength (N/mm^2) for M-25 Grade	Compressive Strength (N/mm^2) for M-20 Grade	
		28 Days	28 days	
M-1	**0**	24.13	21.62	
M-2	0.8	24.75	25.41	
M-3	1.6	27.36	25.8	
M-4	2.4	28.67	25.6	
M-5	3.2	25.16	21.6	

3.1. Flexural strength

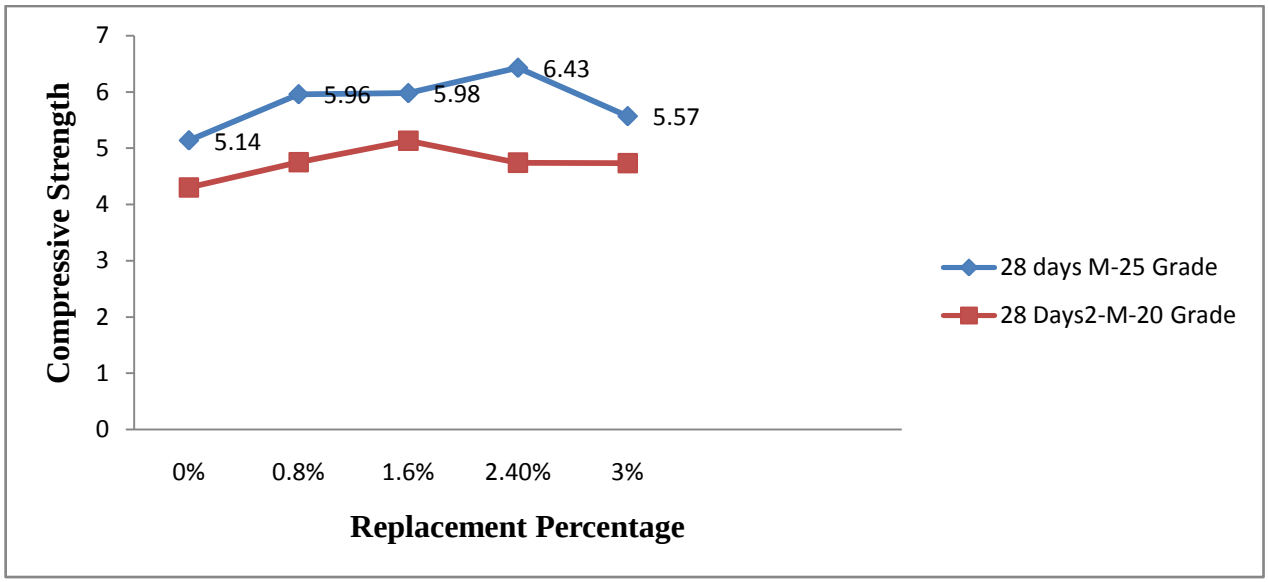
Beams of size 10cm*10cm*50cm are casted for determining flexural strength. Test on beams are performed at the age of 28 days of the specimen. Placement of specimen in machine is done as per IS: 516-1959 in the clause no 8.3.1 page no 17. Load is applied at increasing rate of 108KN/min. Load is applied until specimen fails and load at which specimen fails is recorded. As specified in the IS code flexural strength is calculated and tabulated below:-

Table 5 Result of Beams

Mix	% Replacement	Flexural Strength N/mm^2 M-25 Grade	Flexural Strength N/mm^2 M-20 Grade
		28 Days	28 Days
M-1	**0**	5.14	4.30
M-2	0.8	5.96	4.75
M-3	1.6	5.98	5.13
M-4	2.4	6.43	4.74
M-5	3.2	5.57	4.73



Graph: Compressive Strength in N/mm^2 28 Days



Graph: Flexural Strength in N/mm^2 at 28 Days

Conclusion: 1. As per the results compiled in tables compressive strength of various mixes for M25 and M20 Grade of concrete we conclude that the compressive strength of mixes using self curing compounds (PEG-400) are at par with that of the concrete with conventional curing.

2. The optimum dosage of PEG400 for maximum strength was found to be 1.6% for M25 and 2.4 %for M20 grade.

3. As percentage of PEG400 increased slump increased forM25 and M20 grades of concrete.

4. From the workability test results, it was found that the self-curing agent improved workability

5. It can be seen that the minimum strength as per the codal provisions has been achieved by the specimens cured through curing compounds. The strength achieved by the PEG400 is comparable for both types of mix i.e. M25 and M20.

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