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Experimental Investigation of Self Curing Concrete Incorporated with Peg and Fly Ash

Mr. Umesh R. Chaudhari[1] and Mr. Sachin U. Pagar. [2]
[1]PG student, Department of Civil Engineering, K. C. T. LT. G. N. Sapkal College of Engineering, Nashik
[2]Prof, Department of Civil Engineering, K. C. T. LT. G. N. Sapkal College of Engineering, Nashik

Abstract: *Water curing is the most effective curing method to promote continuous hydration of cement and cement supplementary material in concrete. In practice, this ideal curing condition is provided for a limited period in concrete construction. Membrane curing is used to prevent the drying of freshly place concrete surface and to minimize the risk of plastic shrinkage cracking, particularly in concrete slabs. Self-curing admixture is relatively new chemical admixture to improve the water retention in concrete. This work discusses the result of an experimental investigation into the evaluation of a concrete mix with replacement of cement by fly ash up to 30% And PEG-400 is taken 1.0% on M25 mix. The self-curing admixture was found to improve compressive strength of concrete under air stored condition. The lowest drying shrinkage for self-curing concrete indicates the effectiveness of water retention property of the self-curing admixture and it is concluded that a self-curing admixture is a useful ingredient in concrete mixes when conventional water curing procedure is difficult to perform and it also offers improved workability of concrete mix.*

Keywords: peg-400, hydration

I. INTRODUCTION

During the last two decades, concrete technology has been undergoing rapid developments. In recent years, the concept of internal curing of concrete has gained popularity and is steadily progressing from laboratory to field of practice. According to the ACI 308 committee, ‘‘internal curing refers to the process by which the hydration of cement occurs because of the availability of additional internal water that is not part of the mixing water’’. Typically, an additional internal water is supplied via the incorporation of saturated lightweight fine aggregates or polyethylene-glycol which causes reduction of the surface tension of the mixing water and reduces the water evaporation from concrete and hence increases the water retention capacity of the concrete.

Polyethylene-glycol which decreases the surface tension of the water and minimizes the water evaporation from concrete and hence increases the water retention capacity of the concrete. It has been found that water-soluble polymers (Polyethylene Glycol) can be used as self-curing agents in concrete. In the new millennium, concrete incorporating self-curing agents will represent a new trend in the concrete construction. 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. Concrete like other engineering materials needs to be designed for properties like strength, 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 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.

II. OBJECTIVES OF STUDY:

The main objective of this study is to find out the physical properties of hardened concrete with the curing agent and Fly ash also we have to find out optimum percentage of Fly ash will be used for improving the mechanical properties of concrete along with the economy.

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III. LITERATURE REVIEW:

Jagannadha (2012) investigated the strength of self curing concrete by adding polyethylene glycol PEG 400 0.5%, 1%, 1.5% and 2% by weight of cement to the concrete. To study the strength characteristics mixes M20 and M40 were considered. The optimum dosage of polyethylene glycol (PEG400) for maximum strengths (tensile, compressive and modulus of rupture) was found to be 1% for M20 and 0.5% for M40 grades of concrete. As percentage of polyethylene glycol (PEG400) increased slump increased for both M20 and M40 grades of concrete

Stella (2014) studied the effect of polyvinyl alcohol in self curing concrete. The tensile, Compressive and flexure strength of self-curing concrete for 28 days is found out and compared with conventional concrete of similar mix design. Use of Polyvinyl alcohol (0.48% by the weight of cement) as self curing agent Provides higher compressive, tensile as well as flexural strength than the Strengths of conventional mix. Increase in the Percentage of polyvinyl alcohol results in the reduction of weight loss.

Venkates warlu (2015) studied the benefits of using polyethylene glycol 600 as self curing agents for varying dosages ranging between 0.1-2 % in conventional concrete. The results show that 1.5% of PEG600 is optimum dosage for sorptivity, water retention, and compressive strength.

Kumar (2015) studied the effect of polyethylene glycol 200 on strength characteristics of Self-curing concrete by varying percentage from 0% to 2% by weight of cement for both M20 and M40 grades of concrete. The compressive strength increased for both PEG and PEA at 1% compared to conventional concrete for M25.

IV. MATERIALS

A. Cement*:* The Ordinary Portland Cement of 53 grade conforming to IS: 12269-1987 is used.

B. Fine Aggregate: The fine aggregate type used in the study was Natural sand.

C. Coarse Aggregate: Coarse aggregate are the crushed stone is used for making concrete.

D. Fly Ash: Fly ash is a fine gray powder consisting mostly of spherical glassy particles that are produce as a byproduct in coal fired power stations.fly ash has pozzolanic properties meaning that it reacts with lime to from cementitious compounds .it is commonly known as supplementary cementitious material. Fly ash chemically reacts with the byproduct calcium hydroxide released by the chemical reaction between cement and water to form additional cementitious products that improve many desirable properties of concrete.

Fig. Fly Ash

E. Polyethylena Glycol: 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 oxyethylenegroups 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. The abbreviation (PEG) is termed in combination with anumeric suffix which indicates the average

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molecular weight. One common feature of PEG appears to be the water-soluble nature. The PEG-400 use in the investigation have Molecular Weight 400, Appearance Clear liquid, pH 5-7, Specific Gravity 1.126.

Fig. PEG 400

V. CASTING

Casting programme consists of Preparation of moulds as per IS 10086:1982, preparation of materials, weighing of materials and casting of cubes. Mixing, compacting and curing of concrete done according to IS 516:1959.

Concrete mix is were prepared as per design mix and for each mix following specimens of both conventional and selfcuring concretes were casted.

Cubes of size 150mm X 150mm X150mm.

Table1: Proportion of Polyethylene Glycol and Fly ash

Specimen Designation	%Cement	%Fly ash	% PEG400
NM	100	0	1.0
FA10	90	10	1.0
FA20	80	20	1.0
FA30	70	30	1.0

VI. TESTINGS

Compressive strength test: Concrete cube specimens (150 mm x 150 mm x 150 mm) for computing compressive strength.

VII. RESULTS

Table No. 2. Compressive Strength Results

% Cement	% Fly Ash	% PEG400	Compressive strength(Mpa)	
			(7Days)	(28Days)
100	0	1	21.40	32.50
90	10%	1	20.10	31.25
80	20%	1	18.60	30.40
70	30%	1	17.40	28.50

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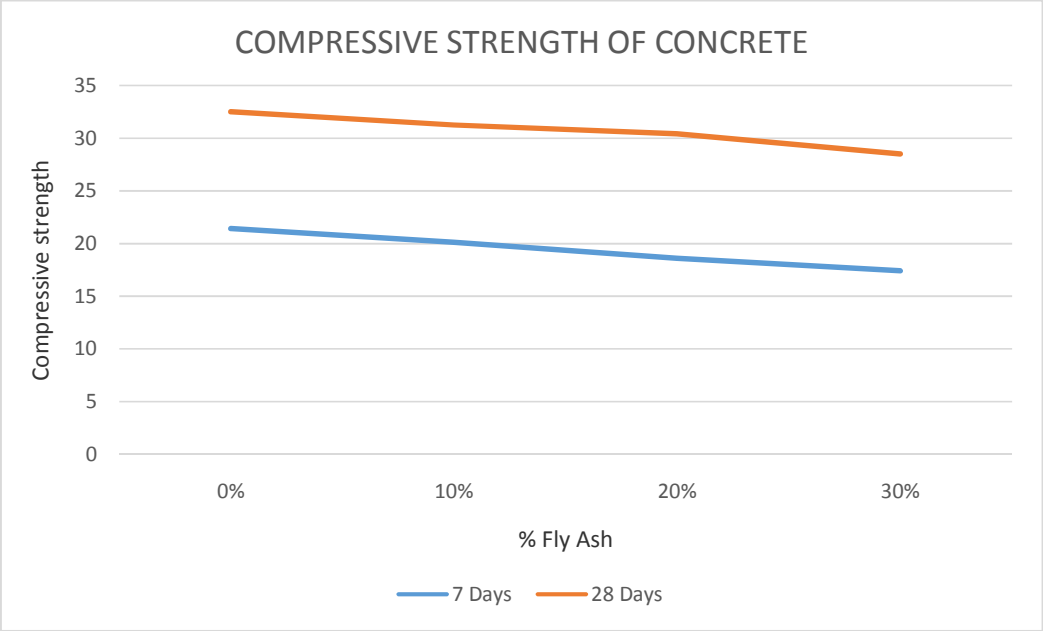

Graph 1. Compressive Strength of Concrete

VIII. CONCLUSION

1. As we increase the percentage of fly compressive strength of concrete goes on decreasing.
2. Concrete with 10% replacement of cement with Fly Ash shows good mechanical properties (Compressive Strength).
3. As the fly ash percentage increases workability increases.

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