"SELF CURING CONCRETE"
AND COMPARISION WITH M20 AND M30

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Abstract : The aim is to study about preparation of self curing concrete .It was recommended that it dissolved in water (poly-ethylene glycol & poly carboxylate ether) can be used as self curing agent in concrete. Self curing agent is to reduce the water evaporation and water of curing from the surface of concrete & hence they increase water retention capacity of concrete and reduced water of curing to the conventional concrete. The use of self curing agent is very important for saving of water is a necessity in day to day life (As $1M^3$ of concrete requires $3M^3$ of water for curing).In this paper, the chemical agent PEG600 is used with different percentages i.e 1% ,2%, 3%, 4%by weight of cement & PCE is used with 0.1% ,0.2% ,0.3% ,0.4 by the weight of cement which is a super plasticizer & was used to gain the workability of concrete. The properties as well as compressive strength were examined with conventional & self curing concrete at 7 days & 28 days for M20 & M30 mixes. From the result it was seen that maximum strength was found to be in 1% of PEG600 for M20 & M30 grade of concrete. At normal condition the self curing concrete can be use where as in extreme hot weather condition the used of self curing concrete gives a huge impact on the economy in our concrete works.

IndexTerms –CONCRETE,SELF CURED,M20 & M30,PCE & PEG

I. INTRODUCTION

The imagination of a world without concrete is impossible with curing. Concrete is a soul of infrastructures project. Curing (hydration process) is necessary to gain strength in concrete structures. Conventional concrete is a mixture of cement, sand, aggregate and water needs curing to achieve strength. It is require to cure for a minimum duration of 28 days for good hydration & to gain the target mean strength. Lack of water curing can badly affect the strength & hydration process. Self-curing concrete is one type of advance concrete, which cures itself by retaining water in it making film around it. For the same admixture Poly-Ethylene Glycol(PEG600), used as a self-curing admixture. Many researchers used PEG by preparation analysis of self-curing concrete is done. The effect of admixture on compressive strength of M20 & M30 mix for 7& 28 days is analyses. This paper presents the result which is conducted on the concrete by preparing using PEG-600. The results are encouraging and satisfactory.

1.1 Concrete

Concrete is made up of three basic components: water, aggregate (sand and gravel) and Portland pozzolana cement. Cement is acts as a binding agent who is usually in powder form when mixed with water and aggregates. Construction industry needs a lot of water in the curing process. The days are now that all the construction industry has to switch over to an alternative curing systemizes, not only to save water for the sustainable development of the environment but also to promote the construction activities even in remote areas where there is scarcity of water. Curing is the done to control the rate of moisture loss from concrete during cement hydration.

1.2 Curing

Curing is the necessary operation done for maintaining satisfactory moisture content and temperature in freshly cast concrete for 28 days, in simple language it is the procedure of pouring water on concrete after initial setting time of concrete.

Curing has a major impact for developing the strength in concrete, which ultimately leads to its upgradation in performance and durability. Proper and genuine curing in concrete structures is prime requirement to satisfy the performance and durability. The conventional curing involves periodic external curing applied after mixing is done, concrete is placing and finishing of the surface is achieved. Self-curing also called as internal curing is a method and is done so that additional moisture is provided in concrete for attaining hydration process more effectively in cement.

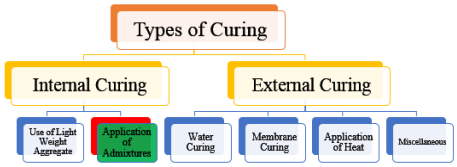

Fig 1 Classification of curing

Self-Curing Concrete: The phenomenon of self curing involves that is curing is taken to happen from inside to outside in which the availability of additional internal water which is not a part of mixing water leads to the occurrence of hydration of cement. Internal curing provides extra water throughout the overall micro-structure, thus maintaining water of mix during hydration in the cement paste. Internal curing of concrete consists of two major methods. The first method uses saturated porous lightweight aggregate for supplying a source of water internally that can replace the water consumed by shrinkage during hydration process. These saturated porous lightweight aggregate act as a source of water by storing water in them and are able to release the water whenever required by concrete. The second method is the use poly-ethylene glycol that plays the role of reducing the evaporation of water from the surface of concrete and also helps in retaining water. Self-curing can also be known as Internal- Curing. Self-curing concrete is a specialized concrete that helps in covering up the insufficient curing done because of negligence by human beings and also in desert areas because of water scarcity, in areas where the characteristic strength of concrete is badly affected due to the presence of fluorides in water. Polyethylene glycol (propylene glycol type) is a material which can provide internal water reservoirs and assists in maintaining water/cement ratio in concrete.

1.2 Poly Ethylene Glycol (Peg-600)

Polyethylene glycol is a condensation polymer of ethylene oxide and water and has the general formula H(OCH2CH2) n OH, where n stands for the average number of repeating ox ethylene groups and ranges from 4 to 180. Polyethylene glycols (PEGs) are formed by the additional reaction of Ethylene oxide (EO) with Mono ethylene glycol (MEG) or Di-ethylene glycol and are family of water-soluble linear polymers. Polyethylene glycols are available in average molecular weight ranging from 200 to 8000. For this experimental programme PEG 600 was chosen as self curing agent. PEG 600 has a specific gravity of 1.13 and it includes a distribution of polymers having varying molecular weights in certain distribution with an average of 600. PEG 600 appears as a clear liquid. One property of PEG is that it has water-soluble nature.

1.3 Plasticizer

Plasticizers or water reducers, and super plasticizers or water reducers that are very high ranged and are chemical admixtures that are added to concrete mixtures to improve workability. The strength of concrete is inversely proportional to the amount of water added or water-cement (w/c) ratio, unless the mix is 'starved' of water. For the production of high strength concrete, water added has to be less (without "starving" the mix), by which the workability of the concrete mixture will be reduced and will make the mixing difficult thus necessitating the use of plasticizers, water reducers, super plasticizers or dispersants. It has none of the disadvantages except all the advantages of lime. This liquid admixture plays the role of using less gauging water than usually required and plasticizing the cement/sand mix and gives a 'fatty' mortar with strong adhesion which is easily workable. Though a reasonably fast initial setting period is provided but ample time is being left for the bricks to be adjusted.

METHODLOGY

MIX DESIGN

Concrete Mix Design is a method by which the relative quantities and proportions of different ingredients of the concrete i.e. Cement, Water, Fine Aggregate, Coarse Aggregate are determined with the purpose of producing a concrete that is homogeneous ,fully compactable that displays necessary Strength and Properties with economy. The Mix Design is done as per **IS 10262:2009 Guidelines for Concrete Mix Design Proportioning.** With the following materials and details, a concrete mix of M-20 Grade was designed:-

Thus, the ratio of cement, sand and aggregate for mix design of **M20** Grade concrete is **1:2.41:3.26**

Thus, the ratio of cement, sand and aggregate for mix design of **M30** Grade concrete is **1:1.67:2.519**

RESULTS AND DISCUSSION

This chapter deals with the result and discussion of the preparation of self-curing concrete by using Poly Ethylene Glycol admixture (PEG-600) with plasticizer poly carboxyl ate ether (PCE). In this chapter it has been witnessed that the testing results of ingredients that are used in preparation of self curing concrete.

Compressive strength of conventional concrete

CONCRETE MIX	DAYS	AREA (mm^2)	LOAD (KN)	COMPRESSIVE STRENGTH (N/mm^2) {average}
M20	7	150x150	280	13
	28	150x150	460	21
M30	7	150x150	540	24
	28	150x150	695	31

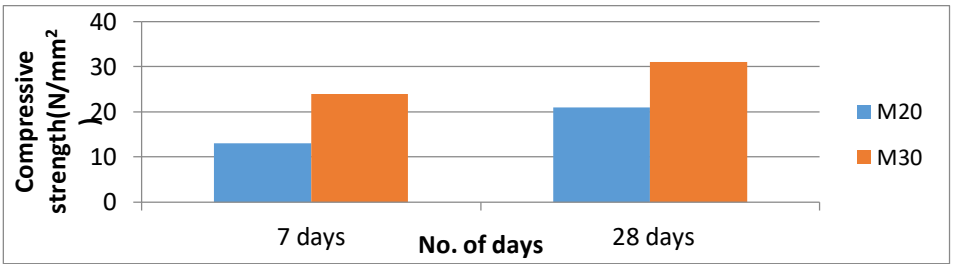

Fig 2: Graphical representation of comp. strength of conventional concrete

The compressive strength of conventional concrete from the table it has been observed that the compressive strength of M20 and M30 mix concrete has been calculated for 7 and 28 days. The average compressive strength of M20 concrete mix for 7 days is around 13 N/mm^2 and that of 28 days is 21 N/mm^2 which meets the value of IS code i.e. 65% of grade of concrete for 7 days and the compressive strength for the mix of actual grade of mix. Similarly, the satisfactory result has been also found for M30 mix concrete which meets the desired compressive strength mentioned in IS code. From the above results it can be concluded that our process for preparing concrete is up to the mark and can be adopted for further work related to it.

Compressive strength of non-conventional concrete (PEG-600)

CONCRETE MIX	PEG 600	AREA (mm^2)	LOAD (KN)		COMPRESSIVE STRENGTH (N/mm^2) {average}	
			7 days	28 days	7 days	28 days
M20	1%	150X150	140	300	6.3	13.33
	2%	150X150	148	200	6.6	10
	3%	150X150	140	225	6.3	10
	4%	150X150	101	215	4.48	9.56
	5%	150X150	103	175	4.57	7.78

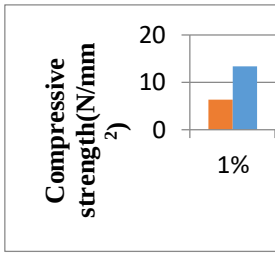

Fig. 4 Graphical representation of comp. strength of non-conventional concrete on addition of PEG-600 only.

The casting of M20 concrete mix with added admixture PEG-600. PEG is added to the concrete mix in different proportions like 1%, 2%, 3%, 4% and 5% by the weight of cement. Separate cubes were casted of different containing percentage of admixture. This table shows the load experienced by the cubes and their respective compressive strength. The highest compressive strength for 7 days obtained from testing is 6.3 N/mm^2 and that for 28 days is 13.33 N/mm^2. The result obtained from this experiment is not desired therefore this experiment needs to experience some modification for obtaining the desired results.

Compressive strength of non-conventional M20 concrete mix (PEG-600+PCE)

CONCRETE MIX	PEG 600	PCE	AREA (mm^2)	LOAD (KN)		COMPRESSIVE STRENGTH (N/mm^2){average}	
				7 days	28 days	7 days	28 days
M20	1%	0.1%	150X150	300	450	13.33	20
	2%	0.2%	150X150	220	425	9.78	18.89
	3%	0.3%	150X150	170	250	7.5	11.11
	4%	0.4%	150X150	170	300	7.5	13.33

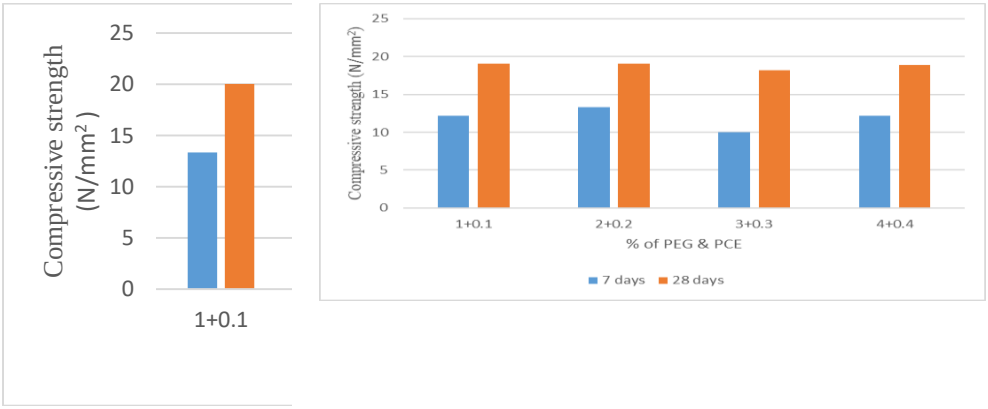

Fig 5 Graphical representation of compressive strength of non-conventional M20 concrete mix on adding (PEG+PCE)

The casting of non-conventional M20 concrete mix (PEG+PCE). PEG & PCE is added to the concrete mix in proportion like 1+0.1, 2+0.2, 3+HE 0.3, 4+0.4 percentages by the weight of cement. This table shows the load experienced by the cubes and their respective compressive strength. The highest compressive strength obtained from the testing for 7 days is 13.33 N/mm^2 and that of 28days is 20 N/mm^2 for the mix of adding PEG and PCE of 1% and 0.1% respectively. However, it has been seen that the further increment of PCE does not shows the valuable result because it quickly absorbs the water present in the mix and get hard. Therefore, it has been concluded from this section that addition of PCE requires keen observation and detail mix design so that it does not affect the strength of the concrete. Compressive strength of non-conventional M30 concrete mix (PEG-600+PCE)

CONCRETE MIX	PEG 600	PCE	AREA (mm^2)	LOAD (KN)		COMPRESSIVE STRENGTH (N/mm^2){average}	
				7 days	28 days	7 days	28 days
M30	1%	0.1%	150X150	275	430	12.22	19.11
	2%	0.1%	150X150	300	430	13.33	19.11
	3%	0.2%	150X150	225	410	10	18.22
	4%	0.2%	150X150	275	425	12.22	18.88

Graphical representation of compressive strength of non-conventional M30 concrete mix on adding (PEG+PCE)

The casting of non-conventional M30 concrete mix (PEG+PCE). PEG & PCE is added to the concrete mix in proportion like 1+0.1, 2+0.1, 3+0.2, 4+0.2 percentages by the weight of cement. This table shows the load experienced by the cubes and their respective compressive strength. The highest compressive strength obtained from the testing for 7 days is 13.33 N/mm^2 and that of 28days is N/mm^2.

CONCLUSION

1.Optimum dosage of PEG600 for maximum compressive strength was found to be 1% for both M20 &M30 grade of concrete.

2. Strength of self curing concrete was found to be equal with conventional concrete.

3. The optimum value of adding plasticizer PCE 0.1% by weight of cement. Further addition will lead to rapid hardening concrete.

4. The strength from self curing concrete was found to be equivalent to conventional concrete without any amount of water used for curing.

FUTURE SCOPE

1. The self cured concrete can be further tested for M30 mix by the combination of adding admixture like PEG and PCE.
2. The combination of PEG-600 and PCE should be determined by trial and error method for M30 mix to obtained maximum result.
3. The dampness (if any) in concrete due to internal curing could be check in future.

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