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USE OF SELF CURING AGENT POLYETHELENE GLYCOL (PEG400) IN M30 GRADE CONCRETE

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Abstract - Now days concrete is the most widely used construction material due to its high strength and durability.Concrete needs a pleasant atmosphere for the development of strength, which will be provided by curing as prescribed by IS Code. Any neglectful in curing will effect the strength of the concrete. The water demand is increasing day by day and the sources are depleting. To counter this water demand we have made a study on 'Self-Curing Concrete by the use of polyethylene glycol in M30 grade of concrete' which can drastically save the water used on the construction site.This study involves the use self curing agent-PolyEthylene Glycol (PEG400) which helps in self-curing of the concrete.

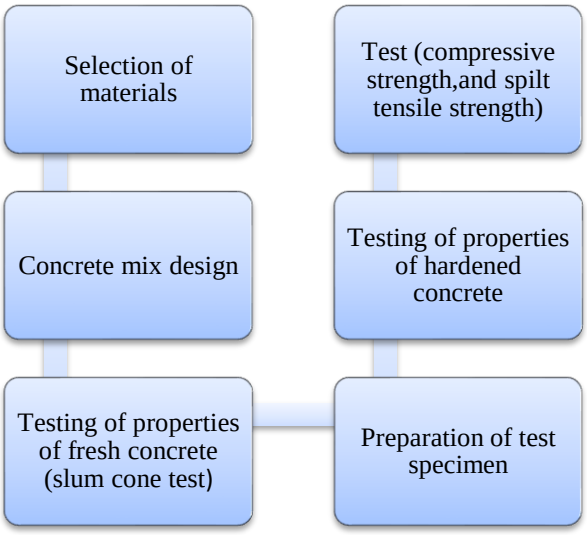
Key Words: Concrete,Glass Fibers, Aggregate,Polyethylene Glycol,Superplastisizer

1.INTRODUCTION

Curing is the process which promotes the hydration of the cement.curing allows hydration of cement which will promote to gain strength in the concrete. In conventional curing, this is achieved by external curing.while in self cured concrete it is achieved by the use of self curing agent in the concrete. The present work deal with the results of experimental investigation on Polyethelene glycol 400. Effect of these Admixture on various Strength of concrete are studied. Polyethylene glycol content varied from 1.5 to 2.5 % by weight of cement. Various Strength are considered for investigation are Compressive Strength, spilt tensile Strength. Cube size 150mm for Compressive Strength, cylinder of size 150mmx300mm for spilt tensile Strength were cast. all the specimen were Self Cured for 7 and 28 days and tested subsequently. The optimum measured quantity of PEG 400 for maximum Compressive and Spilt tensile Strength was found 2 % for M30 grade concrete . Various microstructure crack appear in a low water content specimen while Self curing process to overcome this problem of cracking Glass fibers. The Compressive and Spilt tensile Strength are increased at 2% when comparison of conventional curing of concrete. Study recommended suitable PEG 400 as an internal Self curing agent as it was completely soluble in water.

Self Cured concrete is a type of concrete with a special ability to reduce autogenous shrinkage responsible for early stage cracking. different type of internal curing agents are currently being used around the world. Using Self curing concrete will lead to an escalation in the Strength of concrete Self Curing is beneficial in low water cement ratio concrete because of the chemical shrinkage that accompanies Portland cement hydration and low permeability of these material.

2. METHODOLOGY:



2.1 SELECTION OF MATERIALS:

- **Cement (OPC53) :-**
  Conforming IS 12269-1987
  Ordinary Portland cement (OPC) 53 conforming IS 12269-1987 grade of brand birla shakti cement is a cement that contains calcareous and argillaceous materials, silica, alumina, or iron oxide. The ingredients are burned at high temperatures to create a nodular material called clinker, which is then ground into a fine powder known as cement. OPC 53 grade cement is known for its high compressive strength, which is at least 53 megapascals (MPa) after 28 days of curing.

- **Fine Aggregate:-**
  Conforming To IS : 383-1970
  For concrete using fine aggregate is zone-iii As per IS code 383:1970. Brick work and plastering purpose using fine aggregate is zone-iii. as per is code 456:2000 doing concrete water and cement and fine aggregate and course aggregate .fine aggregate is 40% out of total aggregate in concrete. fine aggregate size as per is code 383 is 4.75mm,2.36mm,1.18mm,600 micron,300 micron,150

micron. so all type of particle size in aggregate. so binding properly and no voids inside filling properly.

- **Coarse aggregate :-**
  Conforming IS 383:1970

Crushed stone aggregate with combinations of 20 mm and 10 mm in 60% and 40% respectively from a local source having the specific gravity of 2.67 conforming to IS: 383-1970 was used.the aggregate impact value for aggregates used for concrete other than wearing surfaces should not exceed 45% by weight. For concrete used for wearing surfaces, such as roads, pavements, and runways, the aggregate impact value should not exceed 30% by weight.

- **Polyethylene glycol 400 (PEG 400):**

PEG 400 (polyethylene glycol 400) is a low-molecular weight grade of self curing agent. It is a clear, colorless, viscous liquid. Due in part to its low toxicity, PEG 400 is widely used in a variety of pharmaceutical formulations. Polyethylene Glycol-400 (PEG) as a chemical agent in self-curing concrete will help to reduce self-desiccation and improve mechanical characteristics. PEG-400 retains the internal water for proper hydration of cement in concrete as compared to conventional concrete.

Table no.01: Properties Of Polyethylene Glycol

Discription	**properties**
Density	1.13kg/cm^3
pH	5-7
Color	colorless
Acidity	0.05% max
Boiling Point ^{0}C	>250
Moisture	0.25%
Molecular weight	300g/mol
Appearance	Clear viscous fluid
Ox-ethylene no	4 to 180
Specific Gravity	1.12

- **Glass fibers:-**

Glass fiber are used in concrete to improve the tensile and compressive strength of concrete. Glass fiber are strong, lightweight, and durable, and is almost indestructible. It can also resist tensile stresses, control crack development, and inhibit cracking glass fibers also provides linings and coatings provide a significant benefit to concrete surfaces and structures.

- **Super plastisizer:-**
  Conforms to ASTM C 494 Type F & IS 9103 for chemical admixture

POLYTANCRETE NGT of Sunanda industries limited is used in the concrete. it is a polymeric liquid admixture, useful for increasing the strength of concrete or mortar by reducing the water content of the mix. It is also useful for modifying and improving several properties of fresh or hardened concrete.polytancrete ngt reduces the water/ cement ratio considerably while maintaining the workability.

2.2 CONCRETE MIX DESIGN:

IS Code method of the concrete mix design from IS10262 2019 are used to calculate the concrete mix design of m30 grade of concrete.where as the w/c ratio are kept 0.45 and 1% of super plastizer are used.

MIX PROPORTION : 1:1.56:2.91

Cement = 372 kg/m^3

Water =167 kg/m^3

Fine aggregate = 583.04kg/m^3

coarse aggregate = 1083.67 kg/m^3

Admixture =5.37

Water content cement ratio = 0.45.

2.3 PREPARATION OF TEST SPECIMEN:

Table no 11 : Specimen Schedule For Tests

Sr. No.	**M30 concrete with PEG400(%)**	**Fiber**	**Super Plastisizer**	**W/C Ratio**	**Specimens for Compressive Strength No. of specimen**		**Specimens for Spilt Tensile strength No. of specimen**
					7 Days	**28 Days**	**28 Days**
1.	0%	2%	1%	0.45	3	3	3
2.	1.5%	2%	1%	0.45	3	3	3
3.	2%	2%	1%	0.45	3	3	3
4.	2.5%	2%	1%	0.45	3	3	3

2.3 Testing of properties of hardened concrete

1) spilt tensile strength:-

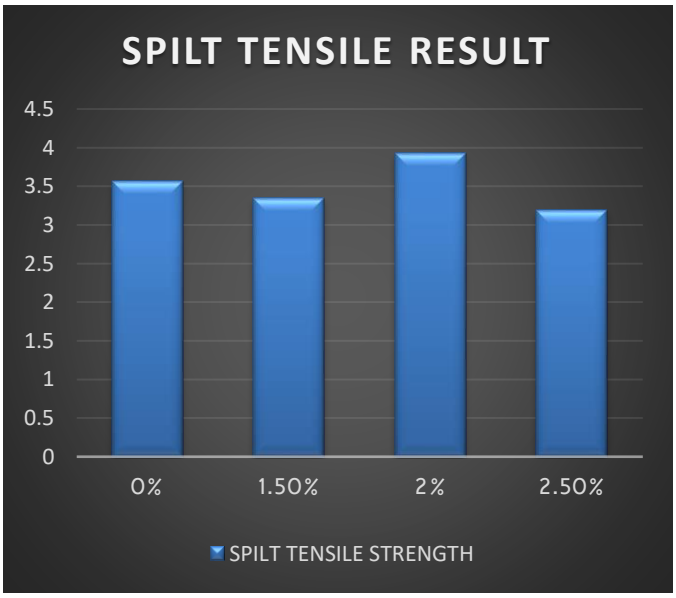
A method of determining the tensile strength of concrete using a cylinder which splits across the vertical diameter. It is an indirect method of testing tensile strength of concrete.In

direct tensile strength test it is impossible to apply true axial load. There will be always some eccentricity present.

Sr.no	Concrete mix with PEG 400	Compressive strength (n/mm^2) At 7 days	Compressive strength (n/mm^2) At 28 days
1	0%	21.12	34.51
2	1.5%	19.75	31.92
3	2%	22.87	37.76
4	2.5%	18.23	29.03

Results:

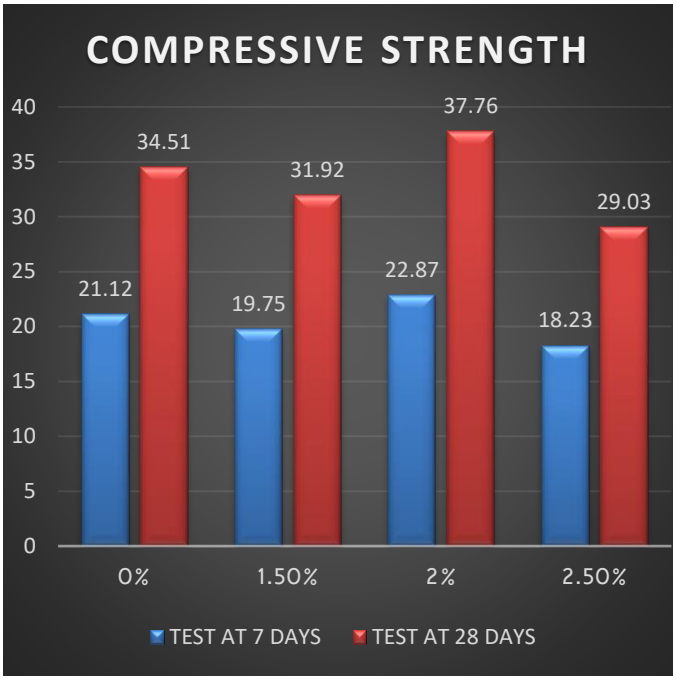
Sr.no.	CONCRETE MIX (% of PEG400)	Spilt Tensile Strength(T) (N/MM)
1	0	3.57
2	1.5	3.35
3	2	3.93
4	2.5	3.19



Spilt tensile strength result

2) Compressive strength strength :-

The compressive strength of concrete is given in terms of the characteristic compressive strength of 150 mm size cubes tested at 28 days (fck)- as per Indian Standards (ACI standards use cylinder of diameter 150 mm and height 300 mm). The characteristic strength is defined as the strength of the concrete below which not more than 5% of the test results are expected to fall. Characteristic strength of concrete is the strength of concrete specimens casted and tested as per given code of practice and cured for a period of 28 days; 95% of tested cubes should not have a value less than this value.



Compressive strength test result

3. Cost analysis

Mix	Cost Of Normal Concrete (External Curing) (A)	Cost Of Self-Curing Agent (Peg 400) Incorporated Concrete (Internal Curing) (B)	Cost Saving (A-B)
0%	11681.8 Rs	-	
1.5%	-	8382.20 RS	3299.6RS
2%	-	8717 RS	2964.8RS
2.5%	-	9051.80 RS	2630RS

For actual site conditions, the conventional concrete requires water for external curing as well as an extra labor to apply the water to the concrete for a minimum duration of 7days at 8hr/day whereas with the development of internally cured concrete the amount of water applied for external curing and its labor cost can be saved as there is no such requirement of curing in case of internal cured concrete. So an attempt was also made to find out the rates and compare the cost incurred for the normal concrete and internal cured concrete. It was found that there is significant cost saving ranging from rs. 2500 -3000 per cubic meter of concrete if concrete is internally cured.

4. Conclusion :

- Compressive strength of concrete with a dosage of PEG-400 gives higher compressive strength as compared to conventionally cured concrete. It is concluded that use of PEG-400 is increases concrete properties as well as ideal option for self curing or internal curing agent. curing water can be saved as there is no need of curing process required for self cured concrete.
- Self-curing concrete strength is relatively high as compared with conventional concrete.
- 2% is a optimum dose at which M30 concrete gives optimum compressive and spilt tensile strength.
- As the dosage of PEG400 increased at 2.5% then the strength of concrete decreased.
- The amount of water being used, rather 'Wasted' can be efficiently saved and a minimal amount of water usage can be achieved on the construction sites.
- The concrete are less expensive and cost saving over ordinary concrete as it is helping to save water.
- By the use of Self-curing concrete is the viable answer to many problems faced due to lack of proper curing.
- Cost saving can be done upto range of 2000-3000rs per cubic meter

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