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EXPERIMENTAL STUDY ON SELF- CURING CONCRETE

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Abstract - *Today concrete is most extensively used construction material due to its good compressive strength and durability. It is expected that the present consumption of concrete in the world is of the order of 10 billion tones every year. The strength and durability of concrete will be fully industrial only if it is cured. Due to the curing of concrete large amount of water is required. To overcome the high consumption of water it is neededto study self-curing concrete. Self-curing is also referred as Internal- Curing. Self-curing concrete is one of the particular concretes in extenuating insufficient curing due to human disregard and also due to scarcity of water in arid areas, inaccessibility of structures in hard terrains and in areas where the presence of fluorides in water will badly affect the characteristics of concrete. The current study involves the use of shrinkage reducing admixtures in concrete which helps in self-curing and helps in better hydration and hence strength.*

Key Words: *Self-Curing concrete, Shrinkage Reducing Admixtures, Hydration, Mechanical properties.*

1. INTRODUCTION

Self-curing or domestic curing is a technique that can be used to supply additional moisture in concrete for added effective hydration of cement and reduced self-desiccation. It was found that water soluble alcohols can be used as self-curing agent in concrete. The use of self-curing admixtures is very important from the point of vision that water resources are receiving valuable every day. New developments in curing of concrete are on the prospect as well. In the next century, mechanization of the placement, preservation, and removal of curing mats and covers will advance as performance-based provision compute curing for receiving and payment. In addition, effective sealants and compounds that prevent the loss of water and promote moist curing conditions will be in high demand. Self-curing concrete should become existing in the not-too-distant future.

Self-curing concrete is provide to absorb water from wetness from air to realize well hydration of strengthen in concrete. It solve the problem when the quantity of cement hydration is lower due to no curing or inappropriate curing by using a self-curing agent like poly-acrylic acid which has strong ability of fascinating moisture from the thought and providing water essential for curing concrete. M.V.Jagannadha Kumar *et al*, studied that the optimum dosage of PEG400 for maximum strengths (compressive, tensile and modulus of rupture) was create to be 1% for M20 and 0.5% for M40 grades of concrete. As proportion of PEG400 enhanced slump increased for both M20 and M40 grades of concrete. Strength of self- curing concrete is on par with conventional concrete. Self-curing concrete is response to many problems faced due to lack of proper curing. A. Aielstein Rozario *et al,* said that the permeability of concrete decreases with an increase in the replacement of fly ash with cement and in addition of P.E.G dosage. So the penetration of chemicals is decreased with the adding up of PEG and the concrete is safe beside sulphates. The proportion of weight loss of the concrete specimens is also decrease for every grade of concrete. From the results, we know that the self-curing concrete has the capability to resist the sulphates at hand in the soils and in the sea waters. It can be economical, so it can be adoptable for construction. Stella Evangeline *et al,* have investigated the Strength Variations in Concrete by Using super absorbent polymer and polyvinyl alcohol as shrinkage reducing admixtures. Polyvinyl alcohol is added in various proportions are 0.03%, 0.06%, 0.12%, 0.24%, 0.48%. It was establish the compressive strength, flexural strength, tensile strength. The maximum compressive strength, flexural strength and tensile strength is establish respectively 33.7 N/mm2, 8.0 N/mm2,4.945N/mm2 for 28 days.

This paper presents the results of compressive and flexural strength on concrete containing pond ash as partial replacement of cement and then addition of super absorbent polymer and polyvinyl alcohol. For this work, M30 grade concrete was used and the tests were conducted for various proportions of pond ash of 0-30%. And adding S.A.P of 0-0.6% and PVA of 0-0.50% in concrete. The results obtained were compared with conventional concrete.

Objectives of the Study:

The objective of this study is to experimentally investigate the mechanical properties of self-curing concrete with the addition of shrinkage reducing admixtures.

- To reduce water quantity in curing periods.
- To increase the compressive strength of concrete in self-curing method.
- The scope of the paper is to study the effect of Polyvinyl alcohol on strength characteristics of Self-curing concrete.
- The Compressive and tensile strength of self-curing Concrete for 7 and 28 days is found out and compared with conventional concrete of similar mix design.

2 EXPERIMENTAL STUDY

Materials:

A. Cement- Ordinary Portland cement (grade) conforming to IS: 12269: 1987.

SI.no	Properties	Test Results
1	Specific Gravity	3.15
2	Initial Setting Time	45 min
3	Final Setting Time	185 min

Table 1: Results on test of Cement

B. Fine aggregate conforming to IS: 383-1970

SI.no	Property	Test Results
1	Specific Gravity	2.60
2	Size	4.75mm

Table 2: Results on test of fine Aggregate

C. Coarse aggregate

SI.no	Property	Test Results
1	Specific Gravity	2.60
2	Size (% by weight)	30%-20mm

Table 3: Results on test of Course Aggregate

D. Water- Water is necessary for the cement to hydrate and harden. It consists of hydrogen and oxygen. It is a significant component of concrete as it chemically participate in the reactions with cement to form hydration product C – S – H gel. The water use for concrete should be free from the unwanted salts that may react with cement and reduce their effectiveness. Silts and suspended particles are undesirable as they obstruct with setting, hardening and bond characteristics. Algae in mixingwater may reason a marked reduction in strength of concrete either by combine with cement to reduce the bond or by causing huge amount of air entrainment in concrete

E. Chemical admixtures

Super absorbent polymer:

- ✓ The common SAPs are further at rate of 0–0.6 wt of cement. The SAPs are covalently cross-linked.
- ✓ One type of SAPs are deferment polymerized, spherical particle with an normal particle size of around 200 mm;
- ✓ A different form of SAP is solution polymerized and then flattened and sieved to particle sizes in the variety of 125–250 mm.
- ✓ The size of the distended SAP particles in the cement pastes and mortars is regarding three times better due to pore fluid absorption.
- ✓ The swelling time depends particularly on the particle size allotment of the SAP.
- ✓ It is seen that more than 50% enlargement occurs within the first 5 min after water adding together.

Polyvinyl alcohol:

- ✓ Polyvinyl alcohol is formed commercially frompolyvinyl acetate, regularly by a continuous process.
- ✓ The acetate groups are hydrolyzed by ester transaction with methanol in the presence of anhydrous sodium methylate or aqueous sodium hydroxide.
- ✓ Polyvinyl alcohol is an neutral and flavorless translucent, white or cream colored granular powder.
- ✓ Polyvinyl alcohol contains two OH groups. It helps to retain water from concrete.
- ✓ It is soluble in stream, slightly soluble in ethanol, but insoluble in other natural solvents.
- ✓ Typically a 5% solution of polyvinyl alcohol exhibits a pH in the range of 5.0 to 6.5. Polyvinyl alcohol has a melting point of 180 to 190°C.

F. Mineral admixtures- Mineral admixtures are suitable more popular in current decades. The use of recycled materials as concrete ingredients has been in advance popularity because of increasingly inflexible environmental legislation, and the discovery that such materials oftenhave complementaryand expensive property the most obvious of these are pond ash, a by-product of coal-fired power plants. The use of these materials in concrete reduces the amount of Resources necessary as the pond ash act as cement alternate. This displaces energetically expensive sand and ecological harms, while reducing the amount of industrial waste that must be liable off.

Mix details of Self-Curing Concrete: MIX DESIGN FOR M30 GRADE CONCRETE Cement = 472.5Kg

Fine Aggregate = 525Kg/m^3

Coarse Aggregate = 1141.6Kg/m^3

Water = 189litre

C	F.A	C.A	W/C
1	1.11	2.42	0.40

Table 4: Final Mix Proportion

3. RESULTS AND DISCUSSIONS

Workability Tests: (Slump value):

The measured slump values of ordinary and pond ash replaced concrete with water cement ratio 0.5such as pond ash 0-30% (5,10,15,20,25,30 replacement).The variations of slump value with pond ash percentage are shown in fig.1. It is denoted that the slump value increases with increase in Percentage replacement of cement of pond ash for the same water cement ratio. Concrete does not give adequate workability with increase of pond ash.

S.No	Percentage of replacement	Slump value (mm)
1	Pond ash- 0%	2.9
2	Pond ash-5%	2.5
3	Pond ash-10%	2.2
4	Pond ash-15%	2.0
5	Pond ash-20%	1.7
6	Pond ash-25%	1.5
7	Pond ash-30%	1.2

Table 4: Replacement of pond Ash

Compressive strength

The compressive strength, as one of the most important properties of concrete. 28 days cube compressive strength is tested on cubes of size 150 x 150 x 150 mm. Three cube samples each for various percentage of SAP,PVA,POND ASH replaced by weight of cement were tested to determine the 7 days,14DAYS, and 28 days compressive strength using a 1000 KN compression testing machine.

Fig -1: Cube Specimen under Compression Test

Sl.no	% of SAP by the weigh t of ceme nt	% of PVA by the weigh t of ceme nt	% of Pond Ash by the weigh t of Ceme nt	Average compressive strength N/mm²		
				7 day s	14 day s	28 days
Contro l beam	0	0	0	22	24	30
Group-1	0.1	0.25	5	19.3	24.8	29.8
Group-2	0.2	0.30	10	20	25	31.3
Group-3	0.3	0.35	15	21.2	25.2	31.5
Group-4	0.4	0.40	20	22	25.8	33
Group-5	0.5	0.45	25	23.5	26	33.7
Group-6	0.6	0.50	30	24	26.8	34

Table 5: Compressive strength of S.A.P. and PVA, Pond ash replaced specimen at 7, 14, 28 days

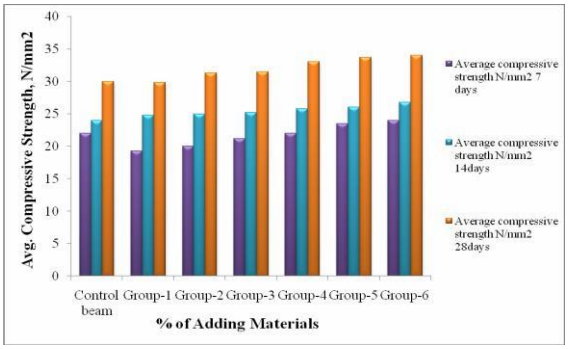

Chart -1: Avg.Compressive Strength for 7, 14 and 28days

Split tensile strength:

Tests are carried out on 150 X 300 mm cylinders confirming to ASTM-C 496 to attain the splitting tensile strength at the age of 7 days, 14 days and 28 days. In the split tensile test, the cylinder is located with its axis horizontal, between plates of the testing machine and the load is increased until the failure occurred by splitting in the plane containing the vertical diameter of the cylinder sample The experimental results, the split tensile strength of self -curing concrete was higher than conventional real.

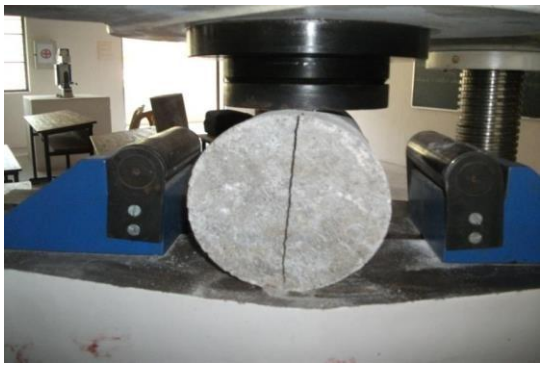

Fig -2: Cylinder Specimen under split tensile strength

S.No.	% of SAP by the weight of cement	% of PVA by the weight of cement	% of Pond Ash by the weight of Cement	Average tensile strength N/mm²		
				7 days	14 Days	28 Days
Control beam	0	0	0	3.7	3.92	4.2
Group-1	0.1	0.25	5	3.32	4.13	4.5
Group-2	0.2	0.30	10	3.5	4.32	4.47
Group-3	0.3	0.35	15	3.42	4.26	4.4
Group-4	0.4	0.40	20	3.12	4.28	4.39
Group-5	0.5	0.45	25	3.45	4.29	4.98
Group-6	0.6	0.50	30	3.8	4.50	5.0

Table 6: Split tensile strength of S.A.P. and PVA, Pond ash replaced specimen at 7,14,28 days

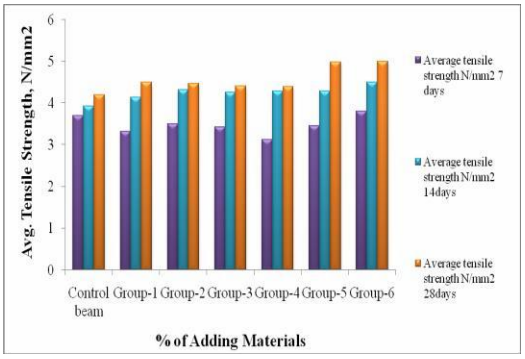

Chart -2: Avg. Tensile strength for 7, 14 and 28 Days

Flexural strength

Tests are carried out on700 X 150 X 150 mm beam to attain the flexural strength at the age of 7 days, 14 days and 28 days.

Fig -3: Prism Specimen under Flexure test

S.No.	% of SAP by the weight of cement	% of PVA by the weight of cement	% of Pond Ash by the weight of Cement	Average flexural strength N/mm²		
				7 D	14 D	28 D
Control beam	0	0	0	5.12	5.5	5.93
Group-1	0.1	0.25	5	4.94	5.4	5.69
Group-2	0.2	0.30	10	4.87	5.4	5.89
Group-3	0.3	0.35	15	4.95	5.5	5.96
Group-4	0.4	0.40	20	5.0	5.6	5.98
Group-5	0.5	0.45	25	5.12	5.78	6.34
Group-6	0.6	0.50	30	5.20	5.7	6.55

Table 7: Flexural strength of S.A.P. and PVA, Pond ash replaced specimen

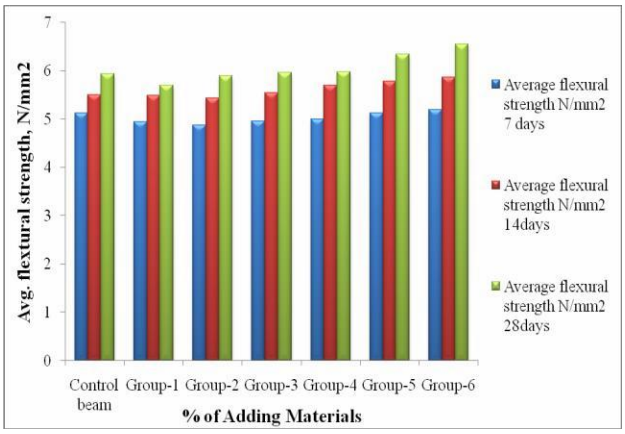

Chart -3: Avg. Flextural Strengt h for 7, 14 and 28 Days

4. CONCLUSION

Based on the experimental work reported in this study, the following conclusions are drawn:

- ✓ The optimum dosage of PVA for maximum Compressive strength was start to be 0.5% for grades of concrete.
- ✓ As percentage of PVA increased slump increased For M30 grade of concrete.
- ✓ Strength of self-curing concrete is on par with Predictable concrete.
- ✓ Self-curing concrete is the answer to many Problems faced due to lack of proper curing.
- ✓ Wrapped curing is less capable than Membrane Curing and Self-Curing it can be applied to simple as well as complex shapes.

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