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"Effect of SAP on Mechanical Properties of Hardened Concrete as Partial Replacement of Cement for M-30 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 (SAP) on split tensile strength, flexural strength test by varying the percentage of SAP by weight of cement from 0% ,0.8%,1.6%,2.4% & 3.2% are studied for M30 mixes*

Keywords: SAP, water cement ratio, compressive strength, flexural strength, tensile strength

1. INTRODUCTION

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.

2. MATERIAL USED

2.1 Cement: Portland Pozzolana cement (PPC) is used in this research work.

2.2 Sand: Sand is available near Narmada River. This sand is used for the above research work.

2.3 Natural aggregate: 20 mm natural coarse aggregate is used having a specific gravity of 2.72..

2.4 Super Absorbent polymer (SAP): The common SAPs are added at rate of 0.2, 0.3 and 0.4 wt % of cement. The SAPs are covalently cross-linked. They are Acryl amide/acrylic acid copolymers. One type of SAPs are suspension polymerized, spherical particles with an average particle size of approximately 1.00 mm; another type of SAP is solution polymerized and then crushed and sieved to particle sizes in the range of 0.50–2.00 mm. The size of the swollen SAP particles in the cement pastes and mortars is about three times larger due to pore fluid absorption. The swelling time depends especially on the particle size distribution of the SAP. It is seen that more than 50% swelling occurs within the first 5 min after water addition

Table 1: Properties of Super Absorbent Polymer

Particle size	1 mm(Average)
Water absorption with distilled water	150 g for 1 g of SAP
pH of absorbed water	Neutral
Density	1.08
Bulk density	0.85
Hydration / Dehydration	Reversible
Decomposition in sun light	6 months
Available water	95% approx.
Particle size	1 mm(Average)

3. EXPERIMENTAL WORK AND TEST

3.1 Mix Design for M-30 Grade: The proportion of M-30 grade concrete is calculated as per IS 10262-2009 & IS 456-2000 is 1:1.87:3.37. Water binder ratio is taken as 0.42.

3.2 Flexural Strength Test: The mould is prepared for beams used in the bending test having a size of 0.10mX0.10mX0.50m. After preparing beams rest on the flexural testing machine and load is applied. After applying load the value noted from the dial gauge. Bending strength determine at 7 & 28 days

3.3 Split Tensile Strength: The mould is prepared for cylinder used in the tensile test having a size of 0.15m diameter and 0.30m height. After preparing cylinder rest on the compression testing machine and load is applied. After applying load the value noted from the dial gauge. Tensile strength determine at 7 & 28 days

4. TEST RESULTS

4.1 Flexural Strength The below table shows the Bending strength for different percentage of SAP which is vary from 0%-3.2%.

Table 2: Flexural Strength Result

Mix Design	% SAP	7 days Flexural Strength	28 days Flexural Strength
Mix-01	0	3.8	5.34
Mix-02	0.8	4.56	6.54
Mix-03	1.6	4.38	5.96
Mix-04	2.4	4.28	5.90
Mix-05	3.2	4.21	5.56

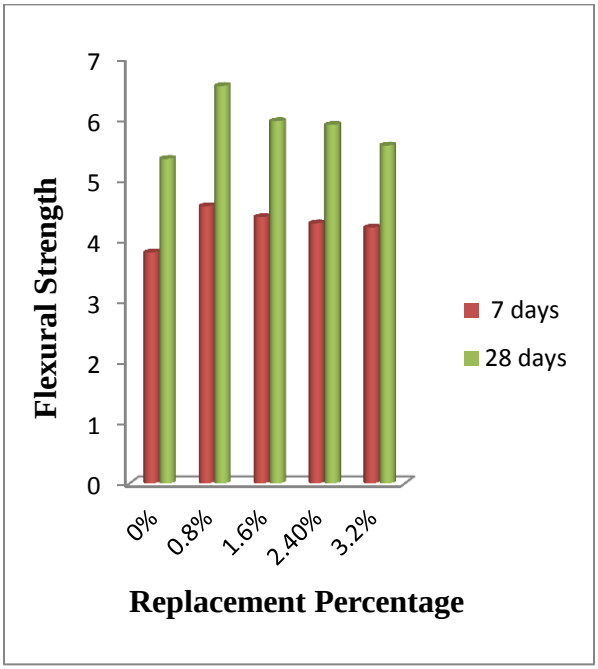
4.2 Split Tensile Strength The below table shows the tensile strength for different percentage of SAP which is vary from 0%-3.2%.

Table 3: Tensile Strength Result

Mix Design	% SAP	7 days Split Tensile Strength	28 days Split Tensile Strength
Mix-01	0	3.39	4.95
Mix-02	0.8	4.88	6.64
Mix-03	1.6	4.38	6.01
Mix-04	2.4	4.17	5.65
Mix-05	3.2	3.74	5.51

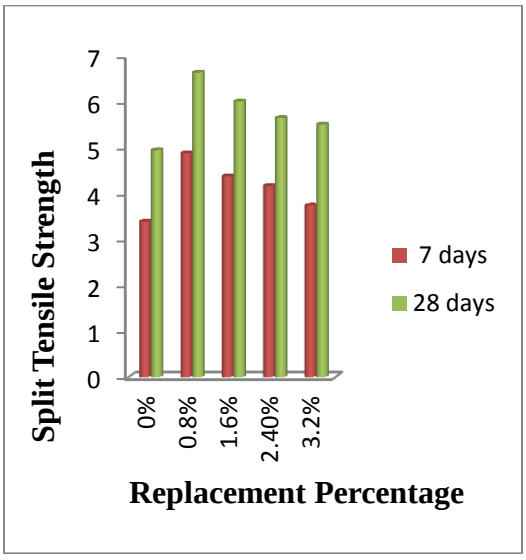
5. DISCUSSION ON TEST RESULTS

5.1 Flexural Strength: It is conclude that 7 & 28 days bending strength 20% & 22.47% increases when percentage upto 0.8%. After that strength decreases when percentage of SAP increases.



Graph:1 Flexural Strength in N/mm2

5.2 Split Tensile Strength: It is conclude that 7 & 28 days tensile strength 43.95% & 34.19% increases when percentage upto 0.8%. After that strength decreases when percentage of SAP increases.



Graph 2: Split Tensile Strength in N/mm2

6. CONCLUSIONS:

Based on the various tests conducted on concrete with varying proportion of SAP the results were obtained and discussed in previous chapter from which the following conclusions are drawn.

1. Flexural strength of concrete with 0.8% replacement of cement with SAP is 2.47% greater than Flexural strength of normal concrete

2. Split tensile strength of concrete with 0.8% replacement of cement with SAP is 3.4% greater than split tensile strength of normal concrete.
3. From the result of this study it is recommended that 0.8 % SAP is adequate for partial replacement of Cement in concrete for self curing concrete

References

1. B.Saleem basha1, C. Sashidhar2, D. Pavan Kumar3**:** An Experimental Investigation on Fresh and Hardened Properties of Self Compacting Concrete with Various Fineness Modulus of Robo Sand International Journal of Chem Tech Research CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555 Vol.10 No.4, pp 345-351, 2017

2. Abhishek Singh Deshmukh*1 and Dr. Rajiv Chandak2:COMPRESSIVE STRENGTH STUDY OF SELF-CURING CONCRETE AND CONVENTIONAL CONCRETE ISSN 2348 – 8034 Impact Factor- 3.155

3. M. Manoj Kumar 1 and D. Maruthachalam 2 Experimental Investigation on Self-curing Concrete International Journal of Advanced Scientific and Technical Research Issue 3 volume 2, March-April 2013 ISSN 2249-9954

4. 4.Surekha Shaka Experimental Investigation on Self-Curing Self-Compacting Concrete International Journal on Emerging Technologies (Special Issue on NCRIET-2015) 6(2): 306-310(2015) ISSN No. (Print) : 0975-8364 ISSN No. (Online): 2249-3255

5. Amal Francis k#1, Jino John#2 EXPERIMENTAL INVESTIGATION ON MECHANICAL PROPERTIES OF SELF CURING CONCRETE International Journal of Emerging Trends in Engineering and Development Issue 3, Vol.2 (March 2013) ISSN 2249-6149

6. Rampradheep G S 1*, M.Sivaraja 2. Experimental Investigation on Self-Compacting Self-Curing Concrete Incorporated with the Light Weight Aggregates

7. S. HASSENA SULTHANA1, M. MUJAHID AHMED2 Experimental Investigation of Self Curing Concrete and Self Compacting Concrete ISSN 2319-8885Vol.05,Issue.31 October-2016,Pages:6548-6553

8. Akshara O.S, DivyaSasi An Experimental Study on Mechanical Proper-ties of Self Curing Concrete International Journal of Scientific & Engineering Research, Volume 7, Issue 10, October-2016 ISSN 2229-5518

9. Snehal Bhosale1, V.S.Shingade2, S.K.Patil EXPERIMENTAL CHARCTERIZATION OF STRENGTH OF SELF CURING CONCRETE Vol-2 Issue-4 2016 IJARIIE-ISSN(O)-2395-4396
10. 10.Siddharth Jain: Investigation of Strength Characteristics of Concrete by Replacing Curing Water with Self Curing Compounds International Journal of Engineering Technology, Management and Applied Sciences www.ijetmas.com July 2017, Volume 5, Issue 7, ISSN 2349-4476

11. S. Azhagarsamy1, Dr. S. Sundararaman2: A Study on Strength and Durability of Self Curing Concrete Using Polyethylene Glycol-400 International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 6, Issue 1, January 2016)

12. Shreyash Shah1, Ashutosh Patil2: An Experimental Investigation of Effect of Variation of Curing Time on Compressive Strength of Concrete International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 5, Issue 3, March 2015)

13. 13.Sachin Julian Francis#1, B.Karthik*2, H.Gokulram#3 Flexural Behaviour of Self-curing Concrete with Lightweight Aggregate and Polyethylene Glycol International Journal of Engineering Trends and Technology (IJETT) – Volume 47 Number 2 May 2017

14. 14.Vishnu T Beena B R An Experimental Investigation of Self-Curing Concrete Incorporated with Light Weight Fine Aggregate and Polyethylene Glycol IJIRST –International Journal for Innovative Research in

Science & Technology| Volume 3 | Issue 04 | September 2016 ISSN (online): 2349-6010

15. Mohammad Suhail AN EXPERIMENTAL INVESTIGATION ON SELF-CURED CONCRETE: A REVIEW INTERNATIONAL JOURNAL OF RESEARCH IN TECHNOLOGY AND MANAGEMENT (IJRTM) ISSN 2454-6240

16. 16.Mr. Sanjay raj A *, Yogananda N Experimental investigation on Self-Curing Self-Compacting Concrete by Replacing Natural Sand by M-sand and Coarse aggregates By Light Weight Aggregate for M-40 Grade Concrete International Journal of Scientific and Research Publications, Volume 4, Issue 8, August 2014 1 ISSN 2250-3153

17. K.S. Johnsirani*, Dr. A. Jagannathan**, R. Dinesh Kumar*** Experimental Investigation on Self Compacting Concrete using Quarry Dust International Journal of Scientific and Research Publications, Volume 3, Issue 6, June 2013 1 ISSN 2250-3153

18. Shikha Tyagi "AN EXPERIMENTAL INVESTIGATION OF SELF CURING CONCRETE INCORPORATED WITH POLYETHYLENE GLYCOL AS SELF CURING AGENT" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 02 Issue: 06 | Sep-2015 www.irjet.net p-ISSN: 2395-0072

19. M. POOVIZHISELVI1, D.KARTHIK2 EXPERIMENTAL INVESTIGATION OF SELF CURING CONCRETE International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 01 | Jan -2017 www.irjet.net p-ISSN: 2395-0072