International Journal of Advance Research in Science and Engineering
Vol. No.5, Special Issue No. (02), March 2016
www.ijarse.com
IJARSE
ISSN 2319 - 8354

USE OF SAP IN CONCRETE

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ABSTRACT

The super absorbent polymer (SAP) has ability an absorb relatively large amount of water which will be in the gel and same time in these the volume increases proportionally. These properties are found to be very useful & effective in plain concrete. The use of a super absorbent polymer in concrete is prove that have many positive effects on the properties of concrete in its both fresh & hardened state of concrete. This study focuses on effect of SAP on mechanical properties of concrete. The dosage of SAP varies from 0.1% to 0.7% at an interval of 0.2%.The results indicate that SAP addition of 0.1 to 0.3% with w/c ratio 0.45 gives good strength of concrete. It is also observed that with the addition of SAP there is no need to cure in concrete water.

Keywords*: *Concrete curing, Concrete strength, sealant, Super Absorbent Polymer.

I. INTRODUCTION

In the last few decades great advance in concrete technology have arisen to a large extent out of developmentand use of new chemical additiveswhich although mix with concrete in very small quantity can dramatically increase crucial properties of concrete in fresh and harden state. One prominent example use the plasticizers are used with the other appropriate ingredient. They unable the development of new type of concrete like self-compacting concrete or ultra-high performance concrete.The introduction to super absorbent polymer asa new component for the production of concrete materials these makes available number of new possibilities with respect to water control & result the control over the rheological properties of fresh in addition water absorption and water release in either fresh or harden concrete. Well control and take release of water can be fostered by the specific design of SAP material to particular practical need. Concrete is mixture cement, sand, aggregate, water. Throughout the life of concrete, water has central Importance. It is an importantcomponent in the mixing, curing and hardening of concrete. Its exchange with the surroundings roots hardened concrete to shrink, swell and probably crack. Its presence in hardened concrete influences strength and creep and it plays a central role in deterioration due to the frost action or alkali –silica reactions. Finally we can say that, control of water is important for the concrete.When concrete is removed from water the moisture evaporates from the concrete surface due to this crack are form are known as shrinkage crack. Following are the types shrinkage like plastic shrinkage, drying shrinkage and Autogenous shrinkage. The autogenously deformation of concrete is defined as the unrestrained, bulk deformation that occurs when concrete is kept sealed and a constant temperature. When the autogenous deformation is a contraction, it may be referred as autogenous shrinkage. Obviously, control of water is important to concrete.by the use of super absorbent polymers (SAPs) for

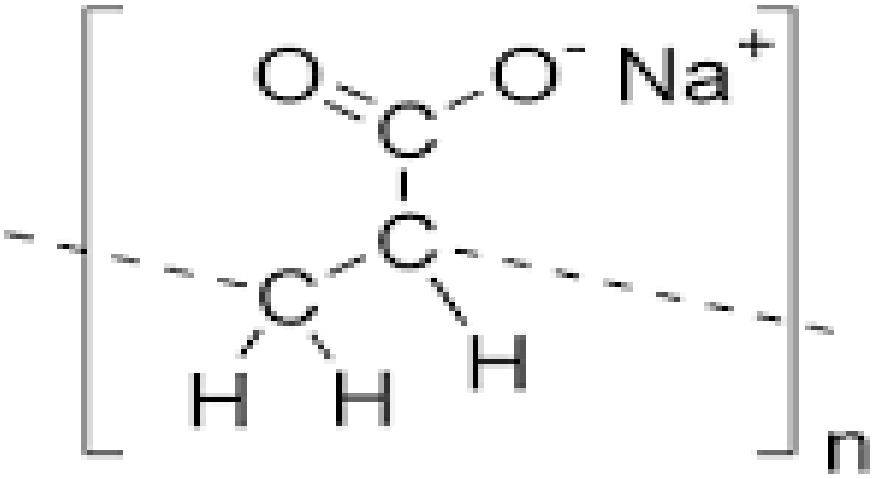
achieving that control. SAPs are polymeric materials that have the ability to absorb a large amount of liquid from the surroundings and retain it within its structure. SAPs are mainly developed for absorption of aqueous solutions and in extreme cases, they may have a water uptake of 5000 times their own weight (3).Standard, industrial – quality SAPs typically have a water absorption of 100 to 400 g/g dry and they can be produced in almost any size and shape. SAPs belong to the group of so-called "smart materials" means the materials that, in a controlled way, significantly change the properties in response to an external stimulus. When SAPs are exposed to water, they swell, and subsequently subjected to drying ,they reversibly shrink. These key properties can actively be used in relation to concrete.

1.1 Scope of Project Work

1.Further Studies could be conducted to find out the effect of SAP on shrinkage and creep of concrete.
2.Experimentation could be conducted to examine the bond strength after replacement of SAP with cement.
3.Searching of technics to the voids created after release of the water from SAP.

1.2Background SAP:-

Superabsorbent are cross-linked networks of hydrophilic polymers with a high capacity for water uptake. They have a variety of valuable applications in medicine, agriculture and industry in general. Early superabsorbent were made from chemically modified starch and cellulose and other polymers like polyvinyl alcohol, polyethylene oxide, all of which are hydrophilic and have a high affinity for water. When lightly cross-linked, chemically or physically, these polymers became water-swell able but not water soluble.



Sodium polyacrylate chemical compound.

Today's superabsorbent polymers are made from partially neutralized, lightly cross-linked acrylic acid and acrylamide and their modifications. The polymers are manufactured at low solids levels for both quality and economic reasons, and are dried and milled into granular white solids. In water they swell to a rubbery gel that up to 99 wt. % water.

II. METHODOLOGY

2.1 Test on cement

1 fineness test of cement

2 standard consistency of cement

3 initial & final setting time of cement

4 compressive strength of cement

2.2 Test on Aggregates

1 Grading Of Aggregate

2 Specific Gravity of Aggregate

2.3 Test on concrete

2.3.1 Workability of concrete

The ease with the concrete is placed in the formwork and compacted is termed as the workability of concrete. The importance of measuring the workability of concrete is to check hour to hour and day to day variation in the ingredients of concrete of concrete being fed in to the mixer.

Methods of measuring Workability of concrete:

- Slump cone test
- Compaction factor test
- Flow table test
- Vee-bee consistency test

Slump Cone Test

The internal surface of the mould is thoroughly cleaned and applied with a light coat of oil. the mould is placed on a smooth, horizontal ,rigid and non-absorbent surface. the mould is then filled in four layers with freshly mixed concrete, each approximately to one-fourth of the height of the mould. Each layer is tamped 25 times by the rounded end of the tamping rod (strokes are distributed evenly over the cross-section). After the top layer is rodded, the concrete is struck off the trowel. The mould is removed from the concrete immediately by raising it slowly in the vertical direction. The difference in level between the height of the mould and that of the highest point of the subside concrete measured. This difference in height in mm is the slump of the concrete.(Ref. from textbook Advance Concrete Technology).

2.3.2 Compressive Strength Of Concrete

Concrete is characterized by its compressive strength. It is an important property of concrete which indicates overall quality of concrete. Other properties like tensile & shear strength, durability, shrinkage etc, can be judged by it. As per IS 456-2000, strength of individual concrete cubes should not be less than 15% of the average strength.The coarse aggregate, cement, river sand & SAP in their specified proportion were initially added to the tray and then water was added. Thereafter, the entire batch of was mixed thoroughly through hand mixing. The specimens are cast in cast-iron moulds of robust construction, generally 150 mm cubes. Before

assembling the mould, its mating surface were covered with mineral oil to the inside surfaces of the mould in order to prevent any development of bond between the mould and the concrete. Each layer of concrete is compacted by not fewer than 35 strokes with a 25 mm MS rod. A total of 45 cubes were casted for different proportions of SAP in concrete. The compressive strength was tested at 7 and 28 days. Three cube of each proportion was kept without curing and compressive strength was tested at 7 day..(Ref. from textbook Advance Concrete Technology).

2.3.3Flexural Strength Of Concrete

Concrete is weak in tension and strong in compression. In this test two point loads are applied at 1/3rd span by equal load. The bending moment at failure is noted and modulus of rupture is found out. Thus we come to know the indirect tensile strength of concrete.

As per IS 456-2000, flexural strength should not be less than 0.7 $\sqrt{f_{ck}}$ N/mm2, where f_{ck} is the characteristic compressive strength of concrete.

The coarse aggregate, cement, river sand and SAP in their specified proportions i.e., 0%, 0.1%, 0.3%, 0.5% and 0.7% were initially added to the tray and then water was added. Thereafter the entire batch of was mixed thoroughly through concrete mixer. The specimens are cast in cast-iron mould of robust construction of size 500×100×100mm. Beams are filled in 2 layers and compact by tamping rod and then partially compact by vibrating machine. Cover the specimen with gunny bags. Remove the mould at end of 24 hours and immerse in water for curing.

Modulus of rupture or flexural strength is $\sigma_b = \frac{PXL}{bd^2}$

(Ref. from textbook Advance Concrete Technology *).*

III. ADVANTAGES

1) Super absorbent polymer have been successfully used as internal curing agents & it should be minimize whole curing which necessary for gaining the strength.
2) SAP aslohelps to increase the strength of concrete compare with the normal concrete.
3) Due to lack of sufficient quantity of water shrinkage is observed in concrete as a results SAP helps for reducing such problem of shrinkage.
4) Water Stored in SAP Pores is available for internal curing which may cause a denser structure of cement matrix.
5) As the Addition of SAP it results very effective in reducing the cracking in bonded mortar overlays.

IV. RESULTS AND CALCULATIONS

Compressive strength of normal concrete (curing) & SAP concrete (without curing).

Sr.no	Dosage of SAP	Compressive Strength(MPA)	% gain strength	Remark
1	Normal concrete (0.0% SAP)	13.40	67%	With curing
2	o.1%	15.60	78%	Without curing
3	o.3%	14.87	74.4%	Without curing
4	0.5%	14.87	74%	Without curing
5	0.7%	14.38	71.9%	Without curing

V. CONCLUSION

So from the experimental work, following conclusions have been concluded;

1) As we concluded optimum SAP contain is 0.1 %.
2) 7 days compressive strength increases by 11.0% as compared to the normal concrete.
3) As per 7 days results, we are hoping to have 28 days positive results as compared to the normal concrete.
4) Without curing 7 days compressive strength of M20 grade concrete is 15.60MpaWith SAP 0.1% of weight of cement.
5) We hope that flexural strength should be gave an positive results as compared to normal concrete after 28 days test.

VI. ACKNOWLEDGEMENT

We wish to justify our sincere gratitude to Prof. C. K. Patil, principal and Prof. K. U. Saraf, H.O.D of Civil Department for providing us an opportunity for presenting project on **"**Use Of Super Absorbant Polymer (Sap) In Concrete**".**We sincerely thank to our project guideProf.S.G.Upadhyayfor their guidance and encouragement for completing the project work and special thank to Mr. Samir Patkar(Project manager at RMC Ready Mix India, Nashik.) We also wish to express our gratitude to the officials and other staff members who rendered their help during the period of our project. Last but not least we wish to avail our self of this opportunity, express a sense of gratitude and love to our friends and our parents for their manual support, strength, and help and for everything.

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