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INCREASE IN COMPRESSIVE STRENGTH OF CONCRETE BY ADDITION OF SUPER PLASTICIZER

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Abstract

Super plasticizers are commonly known as High Range Water Reducers because it permits low water cement ratio as well as the workability also affected. In very recent decades, super plasticizers creates milestone in the advancement of chemical admixtures The dramatic effect of super plasticizer (SP) on properties of fresh and hardened concrete has studied and the properties of concrete inspected are compressive strength and slump test. To determine the optimum dosage for the admixture, an experimental investigation conducted and the effect of over dosage of the SP admixture experimented, together with one control mixed.

1. Introduction

Concrete is a composite material obtained by mixing cement mixture, aggregates and water. Besides these basic components, concrete contains additions and/or additives. The concrete performances depend on the quality of component materials, their proportions, the place and the exposure conditions. The quality of raw materials used in clinker manufacture, conditions of calcinations fineness and particle size of cement, the relative proportions of cement and the water amount, all influence the physicochemical behaviour of cement grout. Furthermore, the type of cement, aggregates nature, water, mixing temperature, additives and the environment will determine the physical, chemical behavior and durability of concrete. Super plasticizer is the fourth generation of super plasticizer for concrete. It meets the requirements for high range water reducing super plasticizers. It is also called as Conflux Guard. Super plasticizer admixture has special chemicals which helps in water reduction of concrete and also gives the better workability. It aids in making a cohesive concrete mix. They are chemically different from normal plasticizers. The use of plasticizers permits reduction of water to an extent up to 30% without reducing the workability in contrast to the possible reduction up to 15% in case of plasticizers

Concrete is a composite man-made material mostly used as building binding material in construction era. Now-a-days concrete is used with advanced and improved technologies such as R.C.C. structures or F.R.C. structures to give extra ordinary strength and durability to the structures against sliding, cracking, buckling, overturning etc. Now-a-days in the field of Civil Engineering era a lot of work has been done related to the experimental study of compressive strength of concrete cubes in which only cement, sand, aggregates and water are used in the form of water-cement ratios with different grade of concrete with steel fiber concrete and silica fume and without Admixture [1-2]. But they did not use Super plasticizers as an Admixture. Admixture are the materials other than the three basic ingredients of cement-concrete-cement, aggregate and water added to the concrete mix before or during mixing to improve certain properties like setting time, workability, dispersion etc. To modify the mechanical properties Super plasticizer in the form of Admixture is used in this study.

Construction industry is one of the fastest growing sectors in India. Rapid construction activity and growing demand of houses has lead to the short fall of traditional building materials like bricks, cement, sand and wood. Demand of good quality of building materials to replace the traditional materials and the need for cost effective and durable materials for low cost housing has necessitated the researchers to develop variety of new and innovative building materials. Rice milling generates a byproduct known as husk and this husk is converted in to ash is known as rice husk ash. This RHA in turn contains around 85-90% silica. Silica is the basic component of sand which is used with cement for plastering and concreting. Few researchers have been studied the use of rice husk ash [3-4]. According to johan plank *et al.* gives a scientific paper on super plasticizer which is received 23 October 2008, accepted 14 January 2009.

2. Experimental set up

The tests and comparative study done on the mixture are for the following:

- Slump flow test
- Workability retention test
- Compressive strength of concrete

A study on the behavior of a specific concrete mix with different super plasticizer can show the comparative view on the behavior of the different super plasticizer used. Table 1 gives the properties of the super plasticizers used in

this research.

TABLE 1 PROPERTIES OF SUPERPLASTICIZER USED

Sl. No	Name of the admixture	Relative density	Colour	Dosage*
1.	SNF	1.24 at 25ºC	Dark Brown	0.5-2%
2.	PCE	1.08 at 25ºC	Honey Brown	0.4-1.2%
3.	MPCE	1.08 at 25ºC	Golden Brown	0.6-1.2%

Additional material for proposed concrete: Sulphonated Naphthalene Formaldehyde (SNF):

Sulphonated Naphthalene Polymers and supplied as a brown liquid instantly dispersible in water. Conplast SP430 G8 has been specially formulated to give high water reductions up to 25 percentages without loss of workability or to produce high quality concrete of reduced permeability. Sulphonated naphthalene formaldehyde polymer is a major ingredient of super-plasticizers. It takes a role neutralizing the surface charges on the cement particles and enhancing water tied up in the cement concrete agglomerations and thereafter reducing the viscosity of the paste and concrete. It promotes dispersing the cement particles and reduces water requirements without affecting the workability thus resulting high-strength concrete and lower permeability.

Slump Test Procedures

FIGURE1 SULPHONATED NAPTHALENE FORMALDEHYDE

Table 5.1.1 slump value for fresh concrete with different percentage of admixture

- The internal surface of the mould is thoroughly cleaned and freed from superfluous moisture and adherence of any oldest concrete before commencing the test.
- The mould is placed on a smooth, horizontal, rigid and non-absorbent surface.
- The mould is then filled in four layers, each approximately ¼ of the height of the mould.
- Each layer is tamped 25 times by the tamping rod taking care to distribute the strokes evenly over the cross section.
- After the top layer has been rodded, the concrete is stuck off level with a trowel and tamping rod.
- The mould is removed from the concrete immediately by raising it slowly and carefully in a vertical direction. This allows the concrete to subside. The subsidence is referred to as SLUMP of concrete.
- The difference in level between the height of the mould and that of the highest point of the subsided concrete is measured. This difference in height is noted in mm and is taken as Slump of concrete.
- Higher the slump value, higher is the workability.

The mix we prepared for testing was of M40

Workability test Procedures

Workability of concrete is one of the most important criteria that should be always be kept in check for long duration depending upon the retention time which is calculated keeping the distance between the site and the Ready Mixed Concrete (RMC) plant. When concrete is to be designed for more than M40, naturally admixture(s) of preferred choice is to be used. The main types of admixtures that must be used are water reducing agents and super plasticizer When water reducing agents are used, the total quantity free water used reducing agents and super plasticizer. When water reducing agents are used, the total quantity free water used will be kept will be kept under control as increasing free water affects the strength of concrete

Compressive strength test Procedures

For the preparation of the specimens the following procedure is adopted and this module includes the curing of the Cubes and is illustrated as follows.

- Weight the quantities of cement, fine Aggregates, Coarse Aggregates and water for one batch of concrete to an accuracy of 0.1percentage of the total weight of batch.
- Mix the concrete by hand (or) preferably in a laboratory batch mixer.
- For mixing the Concrete we have adopted the mix ratio 1:2.11:3.5.
- First of all mix the equal amounts of Cement and sand with hand followed by the trowel.
- Now add the coarse aggregates to the cement and sand and mix it thoroughly. Mixing should be in such a way that all the constituents in the concrete should mix uniformly so that we can obtain a uniform mix.
- Now add require amount of water by the weight of cement to the Mix. Care should be taken water should not go out of the mixing plate or batch mixer.
- Mix the concrete after adding the water thoroughly.
- Now take the moulds of size 15 × 15 × 15 cm, apply grease or oil to the sides of the mould. Make sure that the screws are fixed tightly so that bleeding does not take place.
- Now transfer the required quantity of the concrete into the moulds. Transfer of concrete should be in such a way that we should lay nearly u3 layers and compacting each layer for 25 times.
- After filling the mould level it on the top side of the cube and leave it aside for 24 Hours.
- After 24 hours unfasten the screws and take out the cube and proceed for curing.
- We have adopted the method of Immersion for curing. The cubes are to be placed in the water for 7 days, 21 days, 28 days and compression test is to be done with respect to the age.

- Care should be taken that the specimens are deeply immersed in the water and the water should be free from the organic matter, salinity, and alkalinity of higher order as it affect the durability of the concrete.

3 RESULTS AND DISCUSSION

As increase in the values of admixture the slump values are increased from the graph it is shown that SNF has least and MPCE are the highest slump values. The higher the flow value, the greater will be the ability to fill the formwork under its own weight. So MPCE is better for

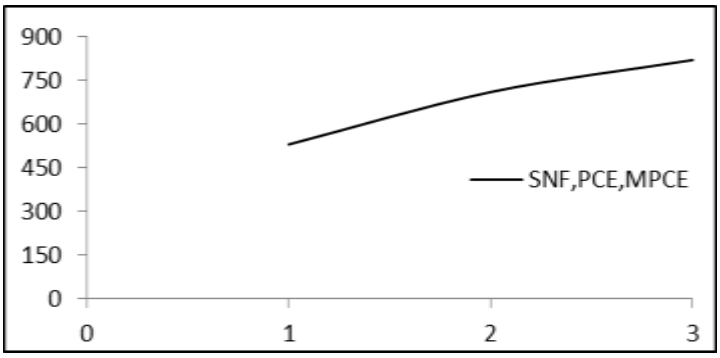

Figure 2. Variation in slump flow test value for different type of super plasticizer

TABLE 2 SLUMP VALUE FOR FRESH CONCRETE WITH DIFFERENT PERCENTAGE OF ADMIXTURE

PERCENTAGE of ADMIXTURE	WATER CEMENT RATIO	SLUMP (mm)	DEGREE OF WORKABILITY
0	0.40	108	High
0.5	0.40	100	High
0.9	0.40	96	Medium
1.5	0.40	73	Low
3.0	0.40	82	Medium

In the above graph we have seen that for a normal concrete slump value is higher and as we increase the dosage of super plasticizer with a constant w/c ratio it decrease the slump value.

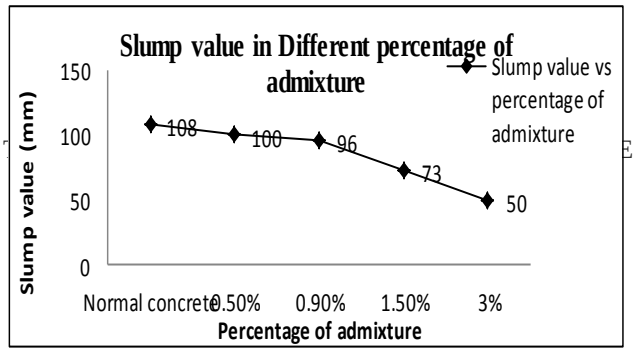

Figure3 Slump values in different percentages of admixtures

As increase in super plasticizer the strength of concrete is increased from 0.5% to 3% but as per results the maximum strength reached at 0.9% and beyond increase in % of admixture there will not any significant changes

Table3 COMPRESSIVE STRENGTH OF CONCRETE

percentage of admixture	7 days N/mm2	21 days N/mm2	28 days N/mm2
No admixture	25.33	28.88	42.44
0.5 percentage	9.78	22.22	26.22
0.9 percentage	25.55	35.55	44.44
1.5 percentage	26.66	33.55	44.44
3 percentage	21	33.33	36.44

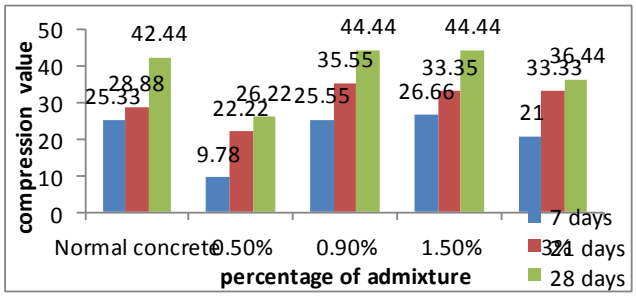

Figure 4 combined graph of compressive strength vs different percentage of admixture

Super plasticizer effects are

- Water reduction reduces for getting high slump in concrete which gives high strength concrete with reduced permeability.
- Workability improves compaction leading to denser concrete and superior finish
- Durability increases cohesiveness of concrete
- Superior plasticizing effect, resulting in improved flow, placing and compaction. Chloride free does not attack reinforcement

4. CONCLUSIONS

- In this project we have added super plasticizer as per code IS 10262-2009 up to the maximum i.e 0.5 percentage to 3 percentage without changing the water cement ratio.
- We found that the compressive strength for normal concrete gives good strength but when we increase the dosages or percentage of super plasticizer from 0.5 percentages to 3 percentages the compressive strength increased from the normal concrete which gives a very good result in compared with normal concrete.
- But the increase in strength by adding super plasticizer is limited for certain percentage. There is a limit to add super plasticizer if we increase the dosage it affect the strength of concrete.
- So in this project in 0.9 percentage of admixture it gives good compressive strength but in 3 percentages it decreases the compressive strength.
- The mix was becoming harsh with increase in percentage i.e 3 percentages and it favorable at 0.9 percentages.

Acknowledgments

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