
EFFECT OF SUPERPLASTICISERS FOR ENHANCING THE PROPERTIES OF CONCRETE

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Abstract:- The objective of this research work was to study the effects of super plasticizing admixture on concrete properties, such as workability, compressive strength and flexural strength. Therefore, in order to study those properties Acrylic Polymer Based Super plasticizers Supercrete was used. The experiments were performed on M20 concrete grade which have 0.40 and 0.45 water to cement ratio and Super plasticizers at a dosage of 0%, 0.8%, 1.2% , 1.6% and 2% admixture. To facilitate the study, the experiments have been classified into four phases, such as to study the effects of super plasticizer admixture on workability, to study the effects of way of super plasticizer admixture addition on concrete quality, to study the effects of super plasticizer admixture on concrete quality by reducing amount of mixing water and, to study the effects of super plasticizer admixture on concrete compressive and flexural strength. Finally, the addition of super plasticizer admixture was shown improvement on workability, strength (compressive and flexural) and permeability.

Keywords: - Super plasticizer, Supercrete, Workability

INTRODUCTION

Generally, admixtures are classified in to two mineral and chemical admixtures. Water reducing admixture is one type of chemical admixture which provide a wide benefit for concrete in the fresh and hardened sates. Different water reducing admixtures can be available in the market; from those admixtures high range water reducing admixture also known as super plasticizer, type F is the main type of admixture which provide a lot of improvement for concrete properties. This admixture is produced in our country as mega flow SP1 and SP4, which has a capacity to improve the workability, strength and permeability of concrete. However, in our country researches and investigation are not yet done on admixtures. The use of admixture is less recognized and the local construction parties that participate in the construction industry have little information and awareness about the uses and effects of admixtures on the production of quality concrete. According to information obtained from different sources written by experienced professionals, the qualities of being constructed infrastructures are not as such strong and durable; crack and failure is frequent and the cost incur for construction is very high this is due to less advancement of construction technology and materials usage. However, super plasticizing admixture can substantially reduce those problems, because they have a potential to reduce the water demand of a concrete mix without reducing workability, allowing to increase early and ultimate strengths without additional cement, reduce concrete permeability and thereby reduce aggressive penetration, like: chloride, carbonation, sulphate, etc and reduce crack and enhance durability. Therefore, this research has investigated some benefits which are obtained by the use of super plasticizer admixture as a construction material. This research finally helps to create awareness and shows the benefits obtained by the use of super plasticizing admixtures.

I. EXPERIMENTAL PROGRAMME

The specific objectives of this research are to compare the properties of concrete produced with and without using Acrylic Polymer Based super plasticizing admixture i.e. Supercrete, examining the effects of different dosage of Acrylic Polymer Based super plasticizing admixture on workability and strength of concrete, Investigating the effects of way of Acrylic Polymer Based super plasticizing admixture addition on the

properties of concrete, Studying the effects of Acrylic Polymer Based super plasticizing admixture on concrete properties by reducing Water content.

2.1 The materials used for this study are cement, fine and coarse aggregates. However, a chemical admixture (superplasticizer) is added in order to change the characteristics of concrete for certain applications. Since the materials are important in determining the quality of produced concrete, they should be properly selected and chosen before the beginning of the experiment.

2.1.1 Cement

Ordinary Portland cement of 53grade was used in this experimentation conforming to IS-12269-1987.

2.1.2 Sand (Fine Aggregate)

Locally available sand with specific gravity 2.69 conforming to zone II as per IS -383-1970.

2.1.3 Coarse Aggregate

Locally available aggregates of retained on sieve 16mm and 10mm aggregates were used.

2.1.4 Superplasticiser (Admixture)

The Superplasticiser used in this was “SUPERCRETE” which was Acrylic Polymer Based Superplasticiser.

The various percentages of Superplasticisers used were 0.8, 1.2, 1.6 and 2.0 by weight of Cement.

2.1.5 Water

Potable water was used for experimentation.

2.2. MATERIAL PROPORTIONS FOR EXPERIMENTATION

Concrete Grade- M20, Cement Grade- OPC 53 Conforming to IS 1126

2.2.1 Specific Gravity

For Fine Aggregates- 2.69

For Coarse Aggregates-2.91

2.2.2 Mix proportion

For w/c 0.40 = (1:1.8:3.5)

For w/c 0.45 = (1:1.86:3.5)

Tests were conducted with the 9 cubes for 1 batch and the average strength of 3 cubes are considered for 1 proportion. Therefore the table below signifies the various quantities of materials in TABLE 1 to TABLE 4.

Table 1. Materials Proportion for w/c ratio 0.4

SR. NO	CONCRETE+SP%	CEMENT	SAND	C. AGGREGATE	WATER	SP
1.	CONTROL MIX	15.518	29.98	38.07	6.90	0
2.	2%	13.794	25.73	47.39	6.21	0.276
3.	1.6%	13.794	25.73	47.39	6.21	0.221
4.	1.2%	13.794	25.73	47.39	6.21	0.166
5.	0.8%	13.794	25.73	47.39	6.21	0.110

Table 2. Materials Proportion for w/c ratio 0.45

SR NO.	CONCRETE+SP%	CEMENT	SAND	C. AGGREGATE	WATER	SP
1.	2%	13.794	25.03	48.14	5.52	0.276
2.	1.6%	13.794	25.03	48.14	5.52	0.221
3.	1.2%	13.794	25.03	48.14	5.52	0.166
4.	0.8%	13.794	25.03	48.14	5.52	0.110

Table 3 Quantities of Materials for 3 Beams

SR NO.	CONCRETE	CEMENT	SAND	C. AGGREGATE	WATER	SP
1.	CONTROL MIX	25.87	50.61	64.27	11.64	0

Table 4 Quantities of Materials for 3 Cylinders

SR NO.	CONCRETE	CEMENT	SAND	C. AGGREGATE	WATER	SP
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1.	CONTROL MIX	8.69	16.99	21.58	3.91	0
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II. RESULTS AND DISCUSSIONS

The results of various tests are tabulated below:

Table 5. Workability Obtained for various ratios during the experiment.

SR.NO	PROPORTIONS	SLUMP(mm)
1.	For Control Mix, For W/CM- 0.45	90
2.	For W/CM-0.40 & SP-0.02	95
3.	For W/CM-0.40 & SP-0.016	85
4.	For W/CM-0.40 & SP-0.012	85
5.	For W/CM-0.40 & SP-0.008	80
6.	For W/CM-0.45 & SP-0.02	110
7.	For W/CM-0.45 & SP-0.016	105
8.	For W/CM-0.45 & SP-0.012	105
9.	For W/CM-0.45 & SP-0.008	95

Table 6. Compressive strength of Control Mix Cubes

	Compressive Strength	Average Strength (MPa)
	21.33	
3 Days	18.22	19.10
	17.77	
	26.67	
7 Days	24.44	25.63
	25.77	
	37.77	
28 Days	36.88	36.73
	35.55	

Table 7. Compressive Strength on addition with SP (W/CM-0.40)

	3 Days		7 Days		28 Days	
SP		Avg. (Mpa)		Avg. (Mpa)		Avg. (Mpa)
	16		24.00		32.88	
2 %	17.33	16.58	25.78	25.48	30.22	31.40
	16.44		26.67		31.11	
	23.11		32.88		40.00	
1.6 %	24.88	22.81	31.11	32.00	44.44	42.07
	20.44		32		41.78	
	21.33		31.55		38.22	
1.2 %	20.44	21.32	29.33	30.66	37.78	38.22
	22.22		31.11		38.67	
	20.66		28.44		33.78	
0.8 %	19.55	20.11	32.44	30.07	33.33	33.48
	20.11		29.33		33.78	

The setting and hardening time of the Concrete with the Super plasticizers is higher than the Normal Concrete. From the Experimentation, when w/cm is 0.40 and SP is 1.6%, the strength of concrete is maximum. The Slump Value is maximum when SP added is 2% in w/cm-0.40 of amongst the 4 proportions. There is an increase in strength when SP added is 0.8% till the 1.6% and after that the strength of the concrete is decreased as added SP is 2%. From the above it is clear that 1.6% SP along with w/cm-0.4 is the best proportion.

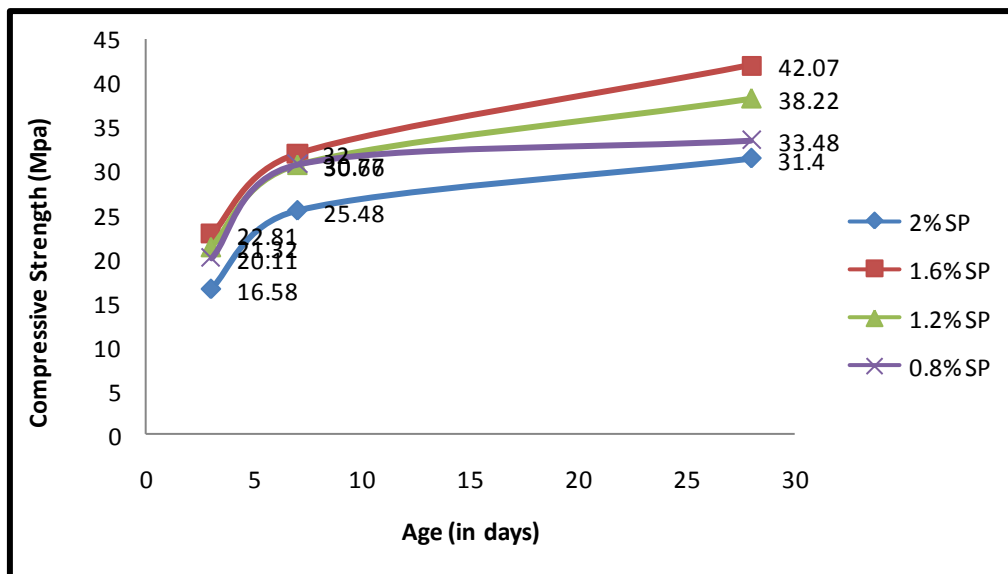


Fig. 1. Comparative Graphical Representation of compressive strength of w/c ratio 0.4

Table 8. Compressive Strength on addition with SP (W/CM-0.45)

	3 Days		7 Days		28 Days	
SP		Avg. (Mpa)		Avg. (Mpa)		Avg. (Mpa)
	4.44		5.33		16.89	
2 %	5.77	5.18	6.22	6.22	17.33	17.33
	5.33		7.11		17.78	
	10.66		23.11		31.11	
1.6 %	8.00	8.73	20.00	21.48	30.22	27.11
	7.55		21.33		31.11	
	19.56		25.78		32.89	
1.2 %	21.33	20.15	24.44	25.18	32.00	32.74
	19.56		25.33		33.33	
	18.22		24.89		28.44	
0.8 %	18.67	18.52	25.33	24.74	28.00	28.44
	18.67		24.00		28.89	

From the Experimentation, when w/cm is 0.45 and SP is 1.2%, the strength of concrete is maximum. The Slump Value is maximum when SP added is 2% in w/cm- 0.45 of amongst the 4 proportions. There is an increase in

strength when SP added is 2% till the 1.2% and after that the strength of the concrete is decreased as added SP is 0.8%. From the above it is clear that 1.2% SP along with w/cm-0.45 is the best proportion.

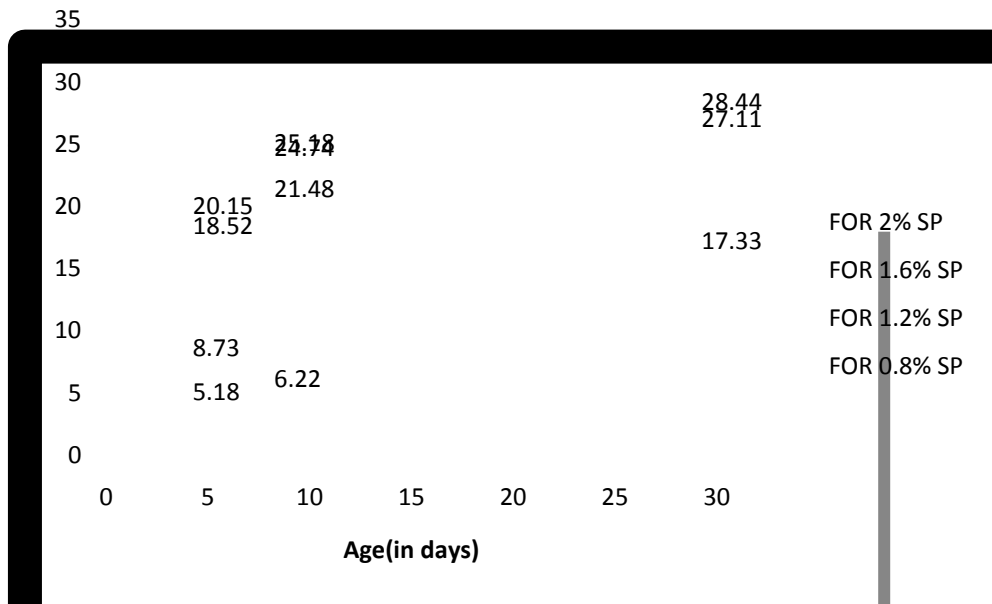


Fig. 2. Comparative Graphical Representation of compressive strength of w/c ratio 0.45

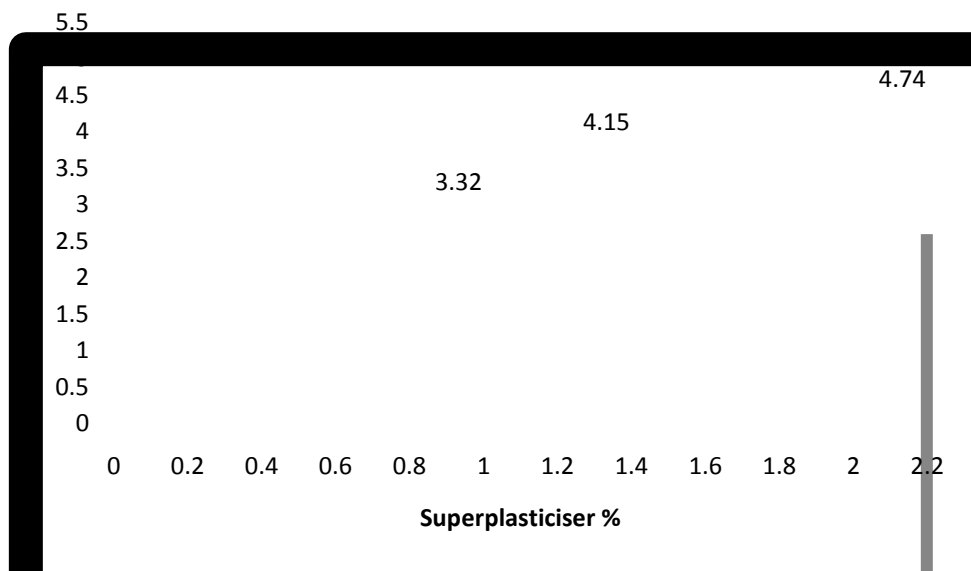


Fig. 3. Graphical Representation of flexural strength of 28 days

There is rise in the flexural strength of the concrete as the Superplasticiser percentage is reduced from 2% upto 1.2% and then the strength decreases at 0.8%. The maximum flexural strength obtained is at SP- 1.2 % and W/CM-0.45. The strength of the concrete with SP is more than the Control Mix Concrete. The workability of the Concrete with W/CM-0.45 & SP- 2% is more than other proportions.

CONCLUSION

The strength of the concrete in which the Super plasticizer is added has given better strength as comparison with normal concrete. The workability of the Concrete with the Super plasticizer is much higher than the normal concrete. i.e. the workability for Control mix is around 80mm slump value, whereas after the addition of Super plasticizer the Workability is 110mm slump value. From the graphs of comparative study it is clear that when W/CM-0.40 and SP-1.6% the compressive strength of the concrete is in higher side as comparison with other mixes. From the test results we have, it has been found that in case of W/CM-0.45 the strength for 1.2% SP is in higher side then the other mixes. The Flexural strength of the Concrete increases gradually and it has attained maximum strength at W/CM-0.45 & SP- 1.2%. Our observation during the experimentation is that the concrete having more Super plasticizer takes more for its setting and hardening. The Compressive Strength and the Flexural Strength of Concrete with the addition of Supercrete Super plasticizers is determined but the Split tensile Strength is not done and it has the scope of determining it. The variations in temperature for the curing water can be done and the tests can be performed.

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