

Effect of Different Chemical Admixture on Fresh and Harden Concrete

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Abstract: In recent decades, huge success has been achieved by using the Chemical and Mineral admixtures for concrete construction. A lot of different types of admixtures for concrete are used now adays in construction industry. The aim of this paper is to compare different type of admixture dosage for optimal use. Tests of cement's initial setting time, consistency and compressive strength of concrete were made. Tests of cements and fresh concrete were conducted at temperature 25°C. Compressive strength was tested after 3, 7 & 28 days of curing. Specimens for those tests were cured in curing vat. Examined admixtures were based on Polycarboxylate Ether (PCE) & Napthalene Formaldehyde

(SNF). All of them are described as both set and hardening retarder for concrete. Admixtures +were added in maximum dosage allowed by producer. All of admixtures caused increase of initial setting time and increase of early compressive strength. The addition of super plasticizers to concrete imparts a high strength and workability to it, even at very small water cement ratios. But to get the maximum benefit from this amalgamation of concrete and admixtures, the incompatibility issues between these two need to be studied. In the present work, the aim is to find the optimum dosage for different super plasticizers, for a particular grade of concrete, using test on fresh and harden concrete. The results of these rheological tests conducted on the concrete are analyzed graphically to find the optimum dosage of a super plasticizer and its compatibility with the concrete mix. It has been found that Polycarboxylate Ether (PCE) based super plasticizers show greater compatibility and economical dosage as compared to Sulphonated Napthalene Formaldehyde (SNF) based super plasticizers. An analysis is further done to assess the overall practical utility of the admixtures.

Keywords: Admixtures, Concrete, Durability, Superplasticizers, Strength Slump cone test compression test, Polycarboxylate, Ether (PCE), Sulphonated Napthalene Formaldehyde (SNF), Optimum Dosage Of Super plasticizers, Workability

1. Introduction

Over the course of time, the concrete industry has to cope with the day to day challenges and the use of mineral and chemical admixtures has been a magic wand for the same. Admixture is defined as a material other than cement, water and aggregate that is used as an ingredient of concrete and is added to the batch immediately before or during mixing. It is used to modify properties of concrete according to our required need.

To achieve the desired properties in a high quality concrete, these admixtures, particularly super plasticizers, are added to

the cement. Super plasticizers are the high range water reducers used for the proper dispersion of the cement particles in a concrete suspension. The addition of the super plasticizers can reduce the water-cement ratio of the concrete to the range of 0.25 – 0.30, without affecting its strength and workability.

This also increases the durability of the concrete. Thus, we get a homogeneous workable concrete at low water cement ratios, which is less susceptible to bleeding and segregation. The addition of super plasticizers not only improves the rheological properties of the concrete but imparts it more compactness and strength in the hardened state. The properties commonly modified using admixtures are setting time, workability, air –entrainment, dispersion etc. The admixture is generally added in relatively small quantity ranging from 0.2% to 2% by weight of cement. Over use of admixtures have detrimental effects on the properties of concrete. These days, due to the availability of different types of admixtures and cement in the market, there is flexibility in choosing the right composition of the concrete according to the desired parameters, keeping in mind the overall economy and environmental safety. Admixtures, especially new super plasticizers are being developed regularly, which dramatically change the properties of the concrete. But if there is incompatibility between the cement and the admixture, it may cause rapid loss of workability, excessive quickening/retardation of setting and low rates of strength gain, in addition to the economic loss.

2. Mix design: M25 grade

Material Used:

- Cement: PPC Shree cement
- Fine Aggregates: Sand Zone- I (Confirm to IS 383)
- Coarse Aggregates: 10 mm & 20 mm

Table 1
Quantity of 1 cubic meter material

Material	Quantity in Kg
Cement	360
Water	173
Sand	731
10 mm	439
20mm	673

A. Types of super plasticizers used

1) Polycarboxylate derivatives (PCE based)

Sika A/ sikaplast 5108 PCE

SikaPlast 5108 is a powerful superplasticizer based on advanced technology which gives the following advantages:

- Strong water reduction, resulting in high density, high strength and reduced Permeability
- Less sensitive against variations in aggregates and /or different cement types
- High efficiency even at low dosage rates
- Extended workability in conjunction with subsequent strength development
- Superior plasticizing effect, resulting in improved flow, placing and compaction Characteristics

B. Sulfonated naphthalene-formaldehyde (SNF)

1) Fosroc auramix 350(SNF)

Auramix 350 is a unique combination of new generation super plasticizer based on polycarboxylic ether polymer with long lateral chain. Electrostatic dispersion mechanism considerably reduces the water demand in flowable concrete. It is supplied as a light brown liquid, instantly dispersible in water. Auramix 350 disperses the cement particles effectively in the concrete mix and hence exposes a larger surface area to the hydration process. This effect is used either to increase the strength or to produce high workability concrete or reduce cement content of concrete or to retard the setting time of concrete.

2) Fosroc conplast sp430 G8(SNF)

Conplast SP430G8 is based on Sulphonated Naphthalene Polymers and is supplied as a brown liquid instantly dispersible in water. Conplast SP430G8 has been specially formulated to give high water reductions upto 25% without loss of workability or to produce high quality concrete of reduced permeability. It Can be used to produce flowing concrete that requires no compaction. Some minor adjustments may be required to produce high workable mix without segregation. The correct quantity of Conplast SP430G8 should be used by means of a dispenser. The measured quantity of Conplast SP430G8 should be added along with a part of gauging water in case of batching plants. Alternatively, correct dosage should be used with about 20% of the total water in the last phase after the mix has been prewetted.



Fig. 1. Fosroc auramix 350(SNF)

Table 2
Result on fresh concrete

S No.	Particular of admixture	Dosage as per producer in % by weight of cement		Optimum Dosage % Of weight of cement	SLUMP in mm	
		Min.	Max.		INITIAL	After 1 hour
1	SIKA A/ SIKAPLAST 5108 PCE	0.2	1.2	0.7%	180	130
2	FOSROC AURAMIX 350(SNF)	0.3	1.3	0.6%	160	110
3	FOSROC CONPLAST SP430 G8(SNF)	0.6	2	1.4%	160	105

Table 3
Result on harden concrete

S. No.	Particular of admixture	3Days Strength N/mm ²	7Days Strength N/mm ²	28 Days Strength N/mm ²
1	SIKA A/ SIKAPLAST 5108 (PCE BASED)	12.30	29.5	37.27
2	FOSROC AURAMIX 350(SNF BASED)	10.28	24.60	36.94
3	FOSROC CONPLAST SP430 G8(SNF)	11.60	25.01	37.01

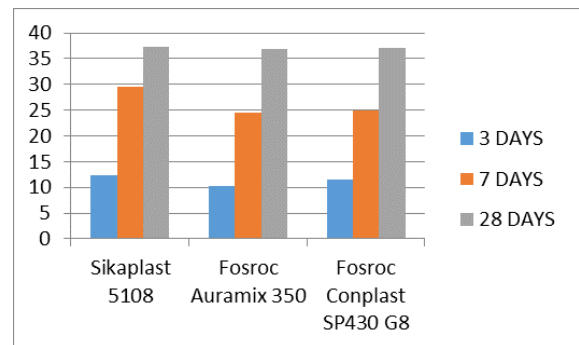


Fig. 2. Comparison of Concrete cubes results using different types of admixture type showing 3 days, 7 Days and 28 Days result

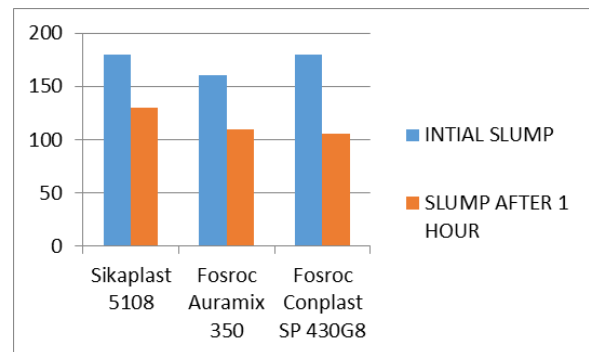


Fig. 2. Comparison of slump value of different types of admixture type at initial level and after 1 hour

C. Outcome

From this experimental analysis we come to know that optimum dosage of Sikaplast 5108, FOSROC Auramix 350 & FOSROC Conplast SP430 G8 are 0.7%, 0.6% & 1.4% of cement content by weight respectively. Earlier strength gain is more in sikaplast as compare to other two i. e. 5 % to 15%. The final strength (28 Days) is coming near to each other. For more retention we can use sikaplast 5108 out of 3 type mention above.

3. Conclusion

This paper presented the effect of different chemical admixture on fresh & harden concrete

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