

Flow time analysis of blended mixes using Marsh cone apparatus

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Abstract -Admixture-Cement interaction in concrete is a complex blend of chemical and physical mechanism that are independent. Every admixture at optimum dosage gives better results when used with cement. The proposed research is aimed to study the compatibility of super plasticizer with different types of blended cements by investigating flow time value. The present work is to study the behaviour of blended mixes (OPC+GGBS+ALCCOFINE) with the PCE (poly carboxylic ether) based admixtures at various dosages of both GGB, ALCCOFINE and chemical admixture. It was observed that most of the blended mixes were compatible with PCE based admixtures at dosages of around 3%. Increase in flow time has been observed with the addition of ALCCOFINE.

Key Words: GGBS, ALCCOFINE, PCE based admixture, Compatibility

1. INTRODUCTION

The hydration of cement involves series of reactions, which mainly depend on the cement composition, the water / cement ratio, surface area, particle size distribution, temperature and admixtures. Admixtures when added in small quantities make the hydration process much more complex. In recent times, advances in the field of cement products are related to the use of admixtures particularly organic polymeric materials. Many type of organic polymeric materials, known as superplasticizers, are being used in construction industries to alter the flow behaviour and the mechanical properties of concretes. Among various types of chemical admixtures, PCE based admixtures proved to enhance the flow fresh and hardened properties of concrete at low dosage.

2. Literature Review

The present investigation deals with the study of compatibility of chemical admixtures with different mixes. The study also deals with the fresh and hardened properties of blended concrete. The relevant literature available in this area has been critically studied and discussed.

Anshuman Dogra and Richa Bhardwaj (1) investigated the compatibility behaviour of superplasticizers with cement containing mineral admixtures like fly ash, alccofine. It was observed that Polycarboxylate Ether(PCE) based super plasticizers show greater compatibility and

economical dosage as compared to sulphonated Naphthalene Formaldehyde(SNF) based superplasticizers.

M.K.Maroliya (2) studied the change in ingredients contents of concrete like sand and cement under the influence of plasticizers and superplasticizers at various dosages level. It was also observed that plasticizers enhanced the compressive strength at reduced water-cement ratio in addition to improved workability at constant water cement ratio. Reduction in cement content was achieved with increase in sand content to overcome bleeding and segregation.

Janardhana Maganti and V.Silva Prasada Raju(3) studied compatibility of Sulphonated Naphthalene Formaldehyde and Lignosulphonates based superplasticizer with Portland slag cements. It was observed that the different brands of cements behaved differently even if the coarse and fine aggregates, water and family of chemical admixture and the method of concrete mix design were kept constant.

S.Sheela(4) studied the workability and strength behavior of superplasticized concrete and conventional concrete both in fresh and hardened states. It was also observed that the use of superplasticizer can increase the workability and strength without increasing the water cement ratio. It was also concluded that non destructive testing values were in good agreement with the strength behavior of superplasticized concrete for destructive testing.

Ravindra Gettu, Dr.Joana Roncero (5) studied some aspects related to the dosage of superplasticizer using the Marsh Cone test and the effect of the temperature in superplasticized pastes are evaluated. The study also included the loss of fluidity of cement paste with time. The study revealed that polycarboxylic acid based superplasticizers performed better than naphthalene and melamine based admixtures.

3. OBJECTIVE

- Study of characteristics of different series of cement mixes (double blended) with different types of chemical admixtures.
- Study the flow time values of blended cements for optimum dosage of chemical admixtures.
- Impart additional guidelines for the usage of ALCCOFINE in preparing flowable concrete.

4. MATERIALS USED

- **Cement:** Ordinary Portland Cement (OPC), Ground Granulated Blast furnace slag(GGBS), **ALCCOFINE**
- **Chemical Admixtures:** Polycarboxylic acid based.
- **Water:** Potable water

5. METHODOLOGY

- Study on properties of different types of blended cement and cementitious materials.
- Study on flow time using Marsh Cone Apparatus.
- Mix design of concrete using IS method.

6. EXPERIMENTAL WORK

❖ **Study on properties of ingredients**

Cement:

The following tests have been carried out for the

OPC

- Specific gravity test
- Fineness of cement

Mineral admixture(GGBS,ALCCOFINE)

Specific Gravity test has been carried out for GGBS and ALCCOFINE

Chemical Admixtures

Specific Gravity test has been carried out for Chemical Admixture

❖ **Study on flow time(Marsh Cone Test)**

The test is carried to check the flow time for 1000 ml of cement paste to completely pass through nozzle of the Marsh cone is determined for various dosages of chemical admixture and for various percentages of cement replacement by GGBS and ALCCOFINE.

Preparation of cement paste

- Cement paste of 1200 ml is prepared by keeping the w/c cement ratio of 0.5.
- Mixing is done for 4 minutes in the mortar mixer(2 minutes at high speed and 2 minutes at low speed).

7.RESULTS

TEST ON INGREDIENTS

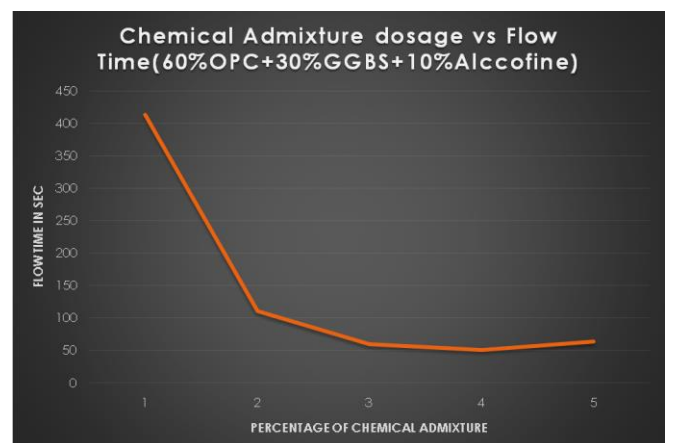
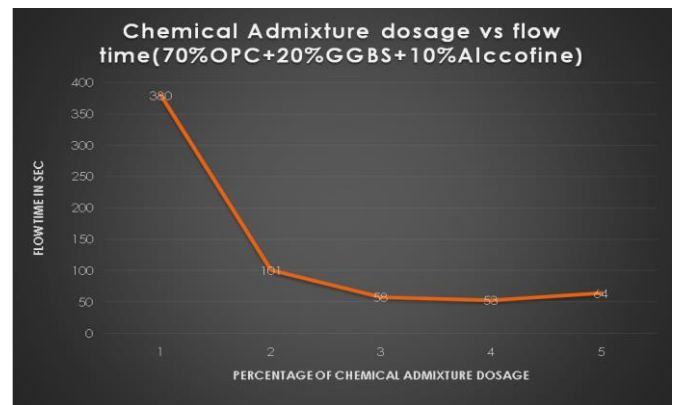
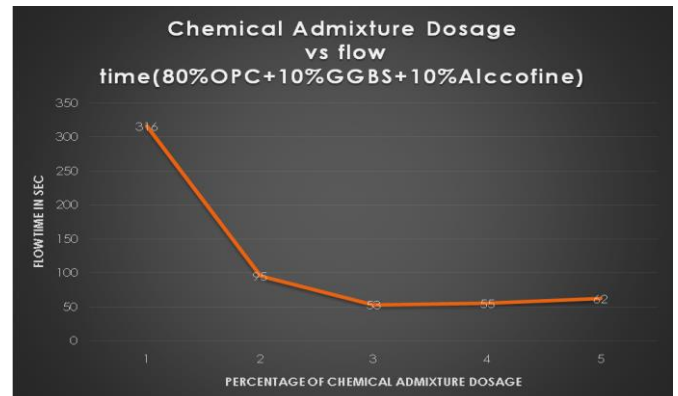
Specific Gravity

SL NO	MATERIAL	SPECIFIC GRAVITY
1	Cement (OPC)	3.05
2	GGBS	2.86
3	ALCCOFINE	3.44

Fineness

SL NO	MATERIAL	FINENESS
1	OPC	4%

GRAPHS OF FLOW TIME TEST



TESTS ON CEMENT PASTE (Flow Time Test)

Sl. No	Cement Content, grams	GGBS, grams	ALCCOFINE, grams	W/C ratio	Water Content, ml	Chemical Admixture Dosage in %	Chemical Admixture Content, ml	Flow Time , Sec
80% = OPC, 10% = GGBS, 10% = ALCCOFINE								
1	1114.2	139.27	139.27	0.4	557.1	0%	-	316
2	1102.3	137.8	137.8	0.4	551.1	1%	12.86	95
3	1086.18	135.77	135.7	0.4	543.09	2%	25.143	53
4	1072.89	134.13	134.13	0.4	536.96	3%	36.79	55
5	1059.5	132.4	132.4	0.4	529.77	4%	49.05	62
70% = OPC, 20% = GGBS, 10% = ALCCOFINE								
1	970.57	277.3	138.65	0.4	554.61	0%	-	380
2	957.88	273.	136.79	0.4	547.21	1%	12.5	101
3	946.27	270.36	135.18	0.4	540.73	2%	25.03	58
4	935.88	266.73	133.34	0.4	533.91	3%	37.1	53
5	923.17	263.76	131.88	0.4	527.52	4%	49	64
60% = OPC, 30% = GGBS, 10% = ALCCOFINE								
1	828	414	138	0.4	552	0%	-	413
2	817.75	408.95	136.45	0.4	544.8	1%	13.45	110
3	807.56	403.8	134.9	0.4	538.4	2%	26.91	59
4	797.1	398.8	133.1	0.4	531.8	3%	40.21	51
5	787.9	393.9	131.32	0.4	525.3	4%	52.53	63
50% = OPC, 40% = GGBS, 10% = ALCCOFINE								
1	687.1	549.68	137.42	0.4	549.7	0%	-	482
2	678.56	542.23	135.17	0.4	542.1	1%	13.4	123
3	669.77	535.8	133.95	0.4	535.8	2%	26.8	84
4	661.66	529.4	132.28	0.4	529.4	3%	40.1	67
5	653.56	522.9	130.71	0.4	522.9	4%	52.3	75
40% = OPC, 50% = GGBS, 10% = ALCCOFINE								
1	547.32	684.1	136.83	0.4	547.2	0%	-	520
2	540.35	675.4	135.09	0.4	540.35	1%	13.35	228
3	533.38	666.7	133.34	0.4	533.38	2%	26.7	64
4	527.06	658.55	131.67	0.4	527.06	3%	39.95	57
5	520.74	650.4	130	0.4	520.3	4%	52.03	58

CONCLUSION

- ALCCOFINE can also be utilized as a high range water reducer to improve compressive strength or as a super workability aid to improve flow.
- Due to lower hydration rate of GGBS, curing time should be prolonged than portland cement concrete.

- The addition of ALCCOFINE in cement mixes increases the self compatibility characteristic like filling ability ,passing ability and .resistance to segregation.
- The relative cost of Alccofine is cheaper than cement hence it is also economic with higher strength.
- Usage of mineral admixtures reduces the cost of concrete production.

9. REFERENCES

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