Experimental Study on Partial Replacement of Cement with Alccofine and Sugarcane Bagasse Ash in Concrete

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Abstract Standard concrete is manufactured using a ternary blended method in which alccofine and sugarcane bagasse ash are used to partially substitute cement. Cement substitute products also to mineral admixtures have been shown to increase the strength and durability of concrete in recent days. Pozzolanic materials such as alccofine and sugarcane bagasse ash can be used to render highly durable concrete composites. The Investigated of partially replaced with Alccofine & Sugar cane bagasse ash in varying proportions from 0% to 20 % & 20% of replaced of Alccofine & Sugarcane Bagasse Ash. The results summarize that the standard concrete made with these trail mixes shows excellent fresh and hardened properties. The replacement of alccofine & sugarcane bagasse ash shows an early strength gaining property.

Keywords— Alccofine, Sugarcane Bagasse Ash, Compressive Strength Test

I. INTRODUCTION

Alccofine1203 is a highly processed product based on high glass content slag with high reactivity obtained by the control granulation process. As a result, combining Alccofine 1203 with Sugarcane Bagasse Ash produces an exciting alternative that can be defined as high-strength, high-performance concrete. Sugarcane bagasse ash is very much similar to volcanic ashes used in the production of the earliest known hydraulic cement about 2,300 years ago. A pozzolan is a siliceous or siliceous/aluminous material which when mixed with lime and water forms a cementitious compound. Sugarcane bagasse ash produced thus possesses both ceramic and pozzolanic properties. When crushed coal is burned for heat, the ash contains 80% Sugarcane bagasse ash and 20% bottom ash. Flue gas collected at the economizer, air preheater, and ESP hoppers carries the ash further. Bottom ash is clinker ash collected in a liquid hopper under the boilers. Newly developed admixtures allow for extremely low water/binder ratios without reducing workability. One of the main advantages of mineral admixtures in high strength concrete is whether the reduce cement content, which has economic and environmental benefits, but also means that temperature rise is reduced as the compressive level is higher.

A. Objective

1. To determine the performance of Alccofine and Sugarcane bagasse ash concrete by partial replacement of cement by 5%, 10%, 15%, 20%.
2. To Investigate the compressive strength of concrete for 7days, 14 days, and 28 days curing.
3. To find the optimum replacement of cement by Alccofine and Sugarcane bagasse ash.

II. LITERATURE REVIEW

Mohammed Qureshi, et.al, (2014), explores the strength gain of up to 7 days is outstanding in all mix proportions; strength gain between 7 and 28 days is comparatively less, but strength gain between 28 and 56 days is high due to ash. We find that the initial compressive strength gained by using Fly-Ash (18%) and Alccofine (12%) is 43.49 MPa after 7 days, but the strength gains after 28 days are very weak, with initial compressive strength achieved by using Fly-Ash
(18%) and Alccofine (12%) being 59.56 MPa and 61.83 MPa after 28 days and 56 days, respectively.

Ansari U.S., et.al, (2015) explores the partially replaced by alccofine and fly ash for M70 grade of concrete**.** The compressive strength of concrete increases with increase alccofine and fly ash content in HPC up to 15-20 %. The mix's density was improved, resulting in a higher packing value. The cube failure pattern was dumbbell, with aggregate crushing taking precedence. Because alccofine is less expensive than cement, it should be pushed in the Indian construction industry for better concrete strength and durability.

Vijaya Sekhar Reddy .M, et.al, (2016) experimental investigation an attempt is made to evaluate the

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compressive strength of standard concrete for 7 days and 28 days curing period. In this study, Class F fly ash was used in various proportions of 0%, 5%, 10%, 15%, and 20%, while alccofine was used in 0%, 5%, 10%, 15%, and 20%. By substituting 20% alccofine and fine fly ash for cement, the overall compressive strength of M40 grade concrete after 28 days of curing is 52.00 MPa. The addition of alccofine enhances self- compatibility characteristics such as filling, passing, and segregation resistance. Alccofine is less costly than cement in terms of relative quality. As a result, it is often cost-effective to produce greater power**.**

Kiran. K, et., (2017) Sugarcane Bagasse Ash was used to demonstrate that it can be used to partially substitute cement up to 15% by weight without causing significant strength loss. The findings showed that concrete with 5% SCBA had higher strength after 28 days of curing. Cement mechanical properties of concrete evolve later in life.

Venkatesan. B, et. at, (2020) The Study of partially replacing cement with Alccofine and fine aggregate with iron powder in concrete were studied, and conclusions were drawn. In contrast to the other mixes, the addition of admixtures to Alccofine concrete creates workability issues that can be solved by adding water or superplasticizers. If Alccofine is used as a 10% partial substitute for cement, the compressive strength of the concrete increases by20.52 percent as compared to standard concrete, which has a compressive strength of 38.14 N/mm2 after 28 days.

III. MATERIAL PROPERTIES

A. CEMENT OPC is manufactured at a much higher rate than PPC. OPC's chemical composition includes a variety of minerals, like calcium, iron, alumina, and silica, both in major and traceable proportions. Although the OPC comes in a variety of grades, the most popular of which are OPC 53 and OPC 43. The 53-grade cement is widely used when it achieves excellent results in terms of consistency and fineness. To be suitable for use in construction, the cement to be used must have a quality value of more than 90%. As per IS standards, OPC 53 grade cement is used in research.

B. FINE AGGREGATE River sand and M-sand are also the two types of fine aggregate that can be found. M-sand has been used as an alternative to river sand for the last 10-15 years due to the increased use of river sand. The main reason to use M sand is it is widely available and helps in avoiding environmental degradation. Elongation and flaky particles are missing in M sand. The concrete is much more stable and stronger due to the cubical-shaped particles. M-sand crystallite size should vary from 150 microns to 4.75 mm. M-sand prevents bleeding and segregation of concrete by reducing voids.

C. COARSE AGGREGATE In concrete, coarse aggregate improves bonding. The total should have positive attributes, such as size and form. It should be angular, flaky, or elongated in shape. And these shaped aggregates are more suitable for concrete mixes and are in low supply. The coarse aggregate material used is around 20 mm in size.

PHYSICAL PROPERTIES

A. Sieve Analysis

B. Specific Gravity

A. SIEVE ANALYSIS The fineness modulus of coarse aggregates is an index value that indicates the average particle size in the coarse aggregate. Sieve analysis with standard sieves is used to compute it. Coarse aggregate is defined as aggregate that is retained on a 4.75mm screen after being sieved through 4.75mm.

TABLE 1 Sieve Analysis of Fine Aggregates

S.No	Sieve Size	Retained On Sieve	Cumulative Mass Retained	Cumulative Percentage of Passing %	% Of Passing
1	4.75 mm	1.6	1.2	0.12	99.99
2	2.36mm	72.4	74	7.4	92.6
3	1.18mm	553	627	62.7	37.3
4	600 µ	180.8	807.8	80.78	19.22
5	300 µ	98.2	906	90.6	9.4
6	150 µ	49	955	95.5	4.5
7	Pan	45	1000	100	0

TABLE 2 Sieve Analysis of Coarse Aggregate

S.No	Sieve Size	Weight Retained	% Weight Retained %	% Weight Passing %	% Cumulative % Retained %
1	40 mm	0	0	0	100
2	20 mm	612	29.4	30.12	64.95
3	12.5 mm	1314	67.4	97.752	2.67
4	10 mm	37	1.57	99.47	0.58
5	6.3 mm	9.5	0.5	100	0

TABLE 3 Specifc Gravity

DESCRIPTION	SPECIFIC GRAVITY
Cement	**3.15**
Fine Aggregates	**2.7**
Coarse Aggregates 20 mm	**2.4**
Alccofine	**2.64**
Sugarcane Bagasse Ash	**1.96**

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IV. RESULTS AND DISCUSSION

The mechanical properties such as compression strength tests were conducted on the specimens.

A. Compressive Strength Test

TABLE 4 Compressive Strength of Conventional Concrete

Days	Compressive strength (MPa)
7	34.83
14	35.43
28	36.63

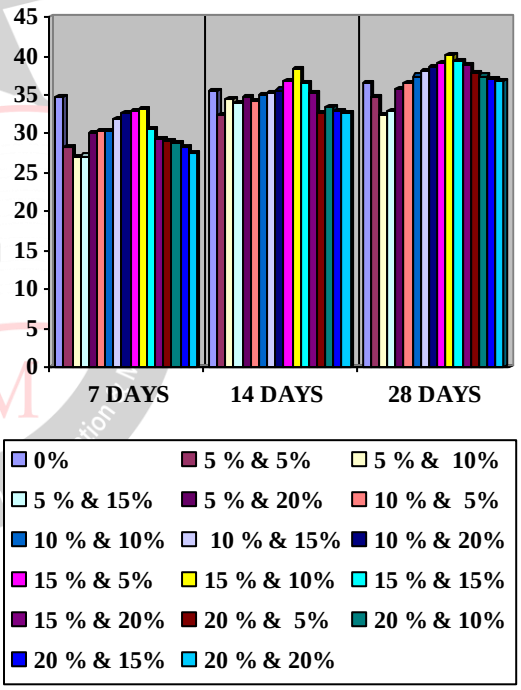
A. *Compressive Strength Test*

The tests on concrete under compression are conducted on the concrete cube of size 100 x 100 x 100mm.

TABLE 5 Compressive Strength at 7,14, and 28 Days

DESCRIPTION	@ 7 DAYS (N/mm^2)	@ 14 DAYS (N/mm^2)	@ 28 DAYS (N/mm^2)
CONVENTIONAL CONCRETE	34.83	35.43	36.63
ALCCOFINE 5 % SUGARCANE BAGASS 5%	28.40	32.5	34.67
ALCCOFINE 5 % SUGARCANE BAGASS 10%	27.06	34.43	32.46
ALCCOFINE 5 % SUGARCANE BAGASS 15%	27.13	34.03	32.96
ALCCOFINE 5 % SUGARCANE BAGASS 20%	30.06	34.66	35.83
ALCCOFINE 10 % SUGARCANE BAGASS 5%	30.43	34.2	36.6
ALCCOFINE 10 % SUGARCANE BAGASS 10%	30.4	34.9	37.43
ALCCOFINE 10 % SUGARCANE BAGASS 15%	32	35.23	38.13
ALCCOFINE 10 % SUGARCANE BAGASS 20%	32.66	35.63	38.66
ALCCOFINE 15 % SUGARCANE BAGASS 5%	32.83	36.7	39.2
ALCCOFINE 15 % SUGARCANE BAGASS 10%	35.13	38.3	40.2
ALCCOFINE 15 % SUGARCANE BAGASS 15%	30.56	36.43	39.3
ALCCOFINE 15 % SUGARCANE BAGASS 20%	29.43	35.23	38.8
ALCCOFINE 20 % SUGARCANE BAGASS 5%	29.06	32.7	37.83
ALCCOFINE 20% SUGARCANE BAGASS 10%	28.9	33.53	37.43
ALCCOFINE 20 % SUGARCANE BAGASS 15%	28.2	32.86	37
ALCCOFINE 20 % SUGARCANE BAGASS 20%	27.6	32.76	36.73

Graph 1 Compressive Strength at 7, 14, and 28 Days



V. CONCLUSION

Following conclusions have been obtained from the experimental study carried out to investigate the influence of sugarcane bagasse ash & Alccofine on strength of M25 grade concrete which is designed as per code IS10262-2009.

- The Optimum value compressive strength of M25 grade concrete for 7 days is 35.13 MPa by partial replacement of cement by 15% Alccofine and sugarcane bagasse ash.

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- The compressive strength of M25 grade concrete for 14 days is 38.3 MPa by partial replacement of cement by 15% Alccofine and sugarcane bagasse ash.
- The Optimum value compressive strength of M25 grade concrete for 28 days is 40.2 MPa by partial replacement of cement by 15% Alccofine and sugarcane bagasse ash.
- The cement replacement by 15% Alccofine and with Sugarcane bagasse ash 10% gives the gradual increase in compressive strength compared with conventional concrete.
- It is better performance when compared to the other slag materials.
- Hence concrete made with partial replacement of cement with Alccofine and Sugarcane bagasse ash can be effectively used in construction.

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