STUDY ON VARIOUS CURING METHODS OF CONCRETE WITH BAGASSE ASH AS SUPPLEMENTARY CEMENTITIOUS MATERIAL

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ABSTRACT

A number of researchers today are focusing on ways of utilizing industrial and agricultural waste as a source of raw materials for production of construction products. Presence of silica in Sugarcane Bagasse Ash (SCBA) contributes to improved pozzolanic activity. The main objective of this research was to characterize the compressive strength of concrete for M30 grade by replacing cement with 15% Sugarcane Bagasse ash which is heated at 1100ºc for one hour and also subjected to varying curing methods. In this study three different types of curing methods are adopted namely conventional curing, steam curing and curing agent. In conventional curing specimens are tested after 28days of pond curing. In steam curing the strength enhancement depend on steam curing cycle; the parameters involved are Delay period, Curing temperature and Curing period. Cerapolycure is an acrylic resin based curing agent forms a seamless film and prevents the evaporation of water when applied on a concrete surface. A comparative study between three different curing methods was carried out based o their compressive strength and durability properties.

Key words: Compressive Strength, Curing, Slump, Sugarcane Bagasse ash, Super Plasticizer.

1. INTRODUCTION

Concrete is widely used in construction of buildings, bridges and other structures. Great demand for building materials like cement and fine aggregate due to high cost and scarcity has made to find the alternatives with the use of waste materials, by products and recyclables. Cement are the important constituents in concrete. Almost three quarters of the volume of concrete is composed of aggregate. In this study recent development of composites sugarcane waste raw burned products has been used known as ash. In this paper bagasse ash which is a waste product, is used has a partial replacement of cement.Different waste materials as well as by-products are used as pozzolanic materials in concrete. Utilization of different supplementary cementitious materials for the production of blended cements contributes to achieving durable and sustainable concrete. Enormous quantities of sugarcane bagasse ash (SCBA) are obtained as by-product from cogeneration combustion boilers in sugar industries; this material has been described to be a suit-able supplementary cementations material for use in concrete in previous research studies. India is the second largest producer of sugarcane and large quantity of bagasse ash (67,000 tonnes/day) is directly disposed to nearest land which causes severe environmental problems. Rapid implementation of bagasse based new cogeneration plants (that are mandated by the government) is expected to substantially increase bagasse ash generation. The utilization of bagasse ash as a supplementary cementing material through systematic processing and characterization offers a profitable and environment-friendly alternative to its disposal.

2. EXPERIMENTAL INVESTIGATION

Properties of Material

1. Cement
2. Fine aggregate (River-sand)
3. Coarse aggregate
4. Water
5. Super plasticizer
6. Bagasse Ash

2.1 Cement

Ordinary Portland Cement (OPC) is one of the most popular building materials used all across the globe. we offer the 53 Grade OPC Cement which gives even higher cement strength to match the rising demands of higher strength building material in the urban world. Property of cement details given below the table 1

Table 1 properties of cement

S.No	Test	Value
1	Specific Gravity	3.15
2	Bulk density	1330 kg/m^3
3	Normal Consistency	34%
4	Initial Setting Time	29 Min
5	Final Setting Time	580Min

2.2 River-Sand

Only some sands are suitable for the construction industry, for example for making concrete. Because of the growth of population and of cities and the consequent construction activity there is a huge demand for these special kinds of sand, and natural sources are running low. In 2012 French director Denis Delestrac made a documentary called "Sand Wars" about the impact of the lack of construction sand. Property of river sand details given below the table 2

Table 2 properties of River Sand

S.No	Test	Value
1	Specific Gravity	2.57
2	Finess Modulus	2.75
3	Bulk density	1550 kg/m^3

2.3 CoarseAggregate

It is the aggregate most of which is retained on 4.75 mm IS sieve and contains only so much finer material as is permitted by specification.

Property of coarse aggregate details given below the table 3

Table 3 properties of cement

S. No	Properties	Values
1	Maximum size	20 mm
2	Specific gravity	2.82
3	Fineness modulus	7.36

2.4. Bagasse ash:

The sugarcane mineral is extracted and fibered waste is milled makes as small fibres known as bagasse. Bagasse is burned in furnace at various temperature the final products is bagasse ash, the bagasse ash is prepared at temperature 1100^{o}c with one hour of duration.

Table 4 properties of Bagasse Ash

Types of concrete	Conventional concrete	Treatd Ash
Fineness	31.3	318
Standard consistency	28%	31%
Specific gravity	2.57	2.97
Initial setting time in minutes	65	70
Final setting time in minutes	720	720

Table 5 Chemical Composition of Bagasse Ash (%)

Chemical Compound	Untreated Ash	Treated Ash	Cement
Silica (SiO_2)	62.10	64.91	18
Lime (CaO)	10.69	15.84	65
Alumina (Al_2O_3)	5.54	6.2	5
Iron Oxide (Fe_2O_3)	5.42	7.2	4.8

2.6 Water:

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water are required to be looked into very carefully.

2.7 Super Plasticizer: Polycarboxylic ether based superplasticiser (Conplast SP430) complying with ASTM C-494 type F was used in this study.

3. MIX PROPORTION

General:
Mix design is the process of selecting suitable ingredients of the concrete and determining their relative proportion with object of producing concrete possessing certain minimum desirable properties like workability in fresh state minimum desirable and durability in hardened state.

Design Mix based on 10262-2019 method:
Target Mean Strength:

fck = fck +1.65*s
From table 2 IS:10262-2019(Page 3)Value of Standard deviation(s)for M30grade = 5 N/mm^2
Target mean strength = 30+(1.65*5)= 38.25N/mm^2

Table 6 Mix Proportion For Trial Number:

Material	Weight(kg)
Cement	455 kg/m^3
Water	182 kg/m^3
Fine Aggregate	730.08 kg/m^3
Coarse Aggregate	1088.29 kg/m^3

4. RESULT AND DISCUSSION
Test on Fresh Concrete

1. Slump cone
2. Compaction factor

1.Slump cone test
River -Sand = 85mm
2.Compaction factor test
River -Sand = 0.78

Table 7 Test Results on Fresh Concrete

Mix Notation	Slump Cone Test (mm)	Compaction Factor Test
Conventional conrete	85	0.78
Treated Bagasse Ash	100	0.95

Test on Hardened Concrete

1. Compressive strength test

1. Compressive strength test

One of the important properties of concrete is strength in compression. The strength in compression has definite relationship with all other properties of concrete. These properties are improved with the improvement in compression strength. The aim of the experiment test is to determine the maximum load carrying capacity of test specimens.The compression test specimens were tested on a compression tested on a compression testing machine (CTM) of capacity 2000KN.The specimen was placed on machine in such a way that its position is at right angle to it shown position which it had at the time of casting. Load is applied gradually as the rate 14N/mm2/min or 320KN/min. Test results given below the table 8

Table 8 Compressive Strength at 7, 14 and 28 Days

S.No	Specimen	No of Days			Average Compressive Strength(N/mm²)	
		7 Days	28 Days	56 Days	Treated Ash	Conventional Concrete
1	BGA	31.5	34.2	43.8	43.8	39.80
2	BGAC	29.2	33.1	40.3	40.3	37.36
3	T-60-2-6	28.75	33.48	45.5	45.5	39.78
4	T-60-2-8	25.43	31.99	49.2	49.2	38.75
5	T-60-4-6	22.56	28.70	46.4	46.4	41.56
6	T-60-4-8	31.52	39.7	50.1	50.1	42

Acid Attack Test Results for Conventional Concrete &Treated Bagasse ash

Table 9 Test Results on Acid Attack

S.No	Types of Concrete	Weight of Specimen		Compressive Strength N/mm²	
		Conventional Concrete	Treated Bagasse Ash	Conventional Concrete	Treated Bagasse Ash
1	Bond Curing	2.7	2.53	30.1	34.6
2	Steam Curing	2.65	2.49	34.2	39.2
3	Curing Agent	2.43	2.41	30.5	33.89

Sulphate Attack Test Results for Conventional Concrete &Treated Bagasse ash

Table 10 Test Results on Sulphate Attack

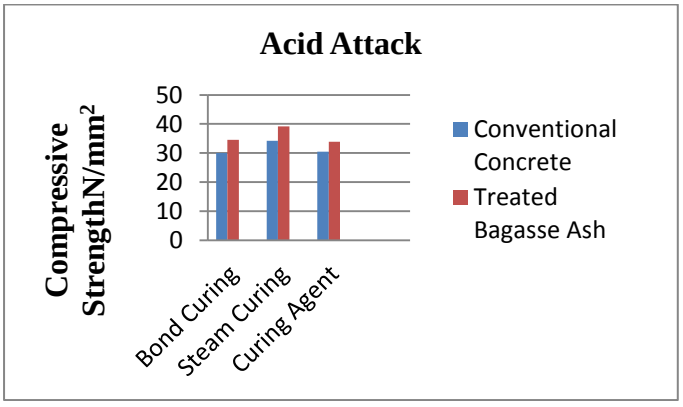
S.No	Types of Concrete	Weight of Specimen		Compressive Strength N/mm²	
		Conventional Concrete	Treated Bagasse Ash	Conventional Concrete	Treated Bagasse Ash
1	Bond Curing	2.5	2.42	31.9	34.6
2	Steam Curing	2.63	2.32	33.41	39.2
3	Curing Agent	2.74	2.29	29.8	33.89

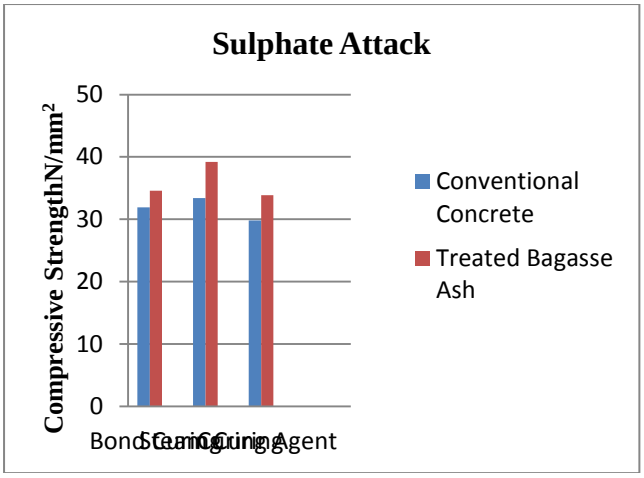
Chloride Attack Test Results for Conventional Concrete &Treated Bagasse ash

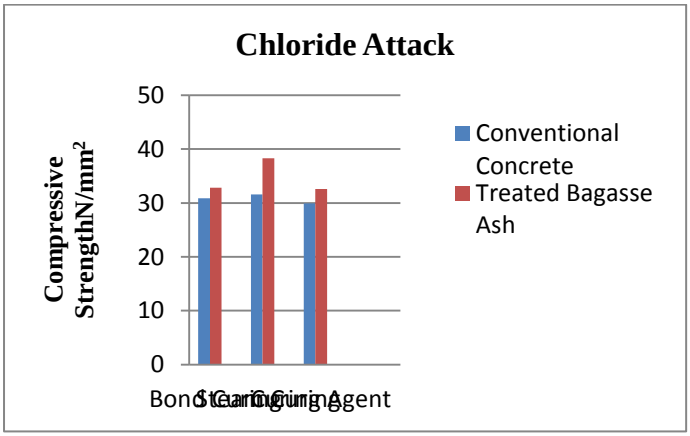
Table 11 Test Results on Acid Attack

S.No	Types of Concrete	Weight of Specimen		Compressive Strength N/mm²	
		Conventional Concrete	Treated Bagasse Ash	Conventional Concrete	Treated Bagasse Ash
1	Bond Curing	2.63	2.58	30.89	32.8
2	Steam Curing	2.51	2.52	31.55	38.3
3	Curing Agent	2.50	2.51	29.89	32.6

THE VARIOUS TEST ON CONCRETE







5. Conclusions:

- In this experimental investigation, concrete mix M30 has been designed. The concrete with bagasse ash as a partial replacement of cement for 15% are used and results have been evaluated for various curing methods.
- Incorporation of treated bagasse ash improves the compressive strength in conventional curing method.
- All concrete specimens subjected to steam curing developed higher compressive strength.
- For 60°C temperature, increasing the curing period has a beneficial effect on the initial compressive strength and also delay period of the steam curing cycle has a significant effect on initial compressive strength Increase in compressive strength was also observed in concrete treated with the water based curing agent cera polycure
- For Durability properties all types of curing with partial replacement of cement shows better results. In those types Steam curing shows better results than conventional and curing agent
- From the result it can be inferred that the strength of concrete for 28 days in all the cases was lesser when compared to conventional concrete. This is because ash contains sugar. Sugar influences the setting time of concrete hence it takes more time for the concrete to attain the targeted strength. However, the final strength is greater when compared to conventional concrete.

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