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OPTIMIZATION OF BAGASSE ASH TO CEMENT MIX PROPORTION FOR M30 GRADE CONCRETE

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Abstract - With increasing demand and consumption of cement, researchers and scientists are in search of developing alternate binders that are eco-friendly and contribute towards waste management. The utilization of industrial and agricultural waste produced by industrial processes has been the focus of waste reduction research for economical, environmental and technical reasons. Cement industry creates environmental problems by emission of CO2 during the manufacturing of cement. Sugar-cane bagasse is a fibrous waste-product of the sugar refining industry, along with ethanol vapor. This waste product (Sugar-cane Bagasse ash) is already causing serious environmental pollution, which calls for urgent ways of handling the waste. Bagasse ash mainly contains aluminum ions and silica. This experimental and analytical study investigates the strength performance of concrete using Ordinary Portland cement and Sugarcane Bagasse Ash. India produces around 24-25 MEGATON of sugar these days and also approximately the estimated sugar cane bagasse ash (SCBA) produce of India. Therefore it is essential that a useful method of utilization of this sugar factory waste should be found and gainfully used. As the demand and consumption of cement rises, researchers and scientists are in search of developing alternative binders that are eco-friendly and contribute towards waste management .The utilization of industrial and agricultural waste produced by industrial processes has been the focus of waste reduction research for economic, environmental and technical reasons. Sugar cane bagasse ash is a fibrous waste product of the sugar industry, along with ethanol vapor. This waste product is already causing serious environmental pollution, which calls for urgent ways of handling the waste. It has a limited life span and after use it is either stock piled or sent to landfills. In these project bagasse ash has been chemically and physically characterized and partially replaced in the ratio of 0%,7%,14% and 21% by weight of cement fresh concrete that is slump cone test were undertaken as well as hardened concrete test is compressive strength and Flexural Strength at the age of 7 and 28 days was obtained.

Key Words: Sugarcane Bagasse Ash, compressive strength, Flexural strength, Workability

1. INTRODUCTION

It used the waste of material to forming the environmental pollution and the material are reused by the waste at include

the concrete. The control of the environmental pollution, land waste to the controlled, the reusing mater many studies were carried out on the utilization of sugarcane bagasse ash obtained from the controlled burning of raw husk as per the procedure laid down in the literature and most of the studies are focused on the improvement of physical and chemical properties of sugarcane bagasse ash in concrete. Only a few studies have been reported on the use of sugarcane bagasse ash partial replacement in cement. Very little information is available on the chloride impermeability and corrosion resistant properties of concrete blended with these ash. In this research work, an experimental investigation for the evaluation of sugarcane bagasse ash prepared from the mill residues as cement replacement materials and assessment of optimal level of replacement to the blended cement concrete system for the strength and resistance against chloride penetration and corrosion of steel are considered. . Ordinary Portland cement is recognized as a major construction material throughout the world. Researchers all over the world today are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry. This waste utilization would not only be economical, but may also result in foreign exchange earnings and environmental pollution control. Industrial wastes, such as blast furnace slag, fly ash and silica fumes are being used as Supplementary cement replacement materials. A few studies have been carried out on the ashes obtained directly from the industries to study pozzolanic activity and their stability as binders, partially replacing cement. The main composition of bagasse ash is siliceous oxide (sio2), which reacts with free lime from

cement hydration. The pozzolanic property of sugarcane bagasse ash (SCBA) came from the silicate content of the ash. The silicate undergoes a pozzolanic reaction with the hydration products of the cement and results in a reduction of the free lime in the concrete. Therefore, study attempts to make use of the sugarcane bagasse ash in India as a pozzolanic material to replace cement. Thus it is possible to use sugarcane bagasse ash as cement replacement material to improve quality and reduce the cost of construction such as mortar, concrete pavers, concrete roof tiles and soil cement interlocking block

Sugarcane Bagasse Ash (SCBA)

The sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicellulose and 25% of lignin. Each ton of sugarcane generates approximately 26% of bagasse (at a moisture content of 50%) and 0.62% of residual ash. The residue after combustion presents a chemical composition dominated by silicon dioxide (SiO2). In spite of being a material of hard degradation and that presents few nutrients, the ash is used on the farms as a fertilizer in the sugarcane harvests. Table - 1: Chemical Composition of SCBA

Components	Mass in Percentage
Silica (sio2)	66.89 %
Alumina (Al2O3)	29.18 %
Ferric Oxide(Fe2 O3)	
Calcium oxide (Cao)	1.92 %
Magnesium oxide (Mgo)	0.83 %
Sulphur trioxide (SO3)	0.56 %
Loss of Ignition	0.72 %

1.1 Objectives of the project

- Investigate the strength of concrete by using Sugarcane Bagasse Ash as partial replacement of cement by using V.S.I. sand.
- Study the influence of partial replacement to cement with sugarcane bagasse ash by using V.S.I. sand.
- Find the percentage of Sugarcane Bagasse Ash replaced to cement that makes the strength of concrete maximum using V.S.I. sand.
- Determine the suitability of Sugarcane Ash as partial replacement of cement in concrete.
- To determine the effectiveness of sugar cane bagasse ash (SCBA) as a cement replacement material in concrete.

1.2 Scope of Work

- The use of Sugarcane Bagasse Ash in concrete is relatively a new development in the world of concrete technology and lot of research must go in before this material is actively used in concrete construction.
- Utilization of sugarcane bagasse ash in concrete in various proportion as partial replacement for cement to improve the strength.

2. Material Used

A. Cement:

Cement is a well-known building material and has occupied an indispensable place in construction work. There is a variety of cement available in the market and each type is used under certain conditions due to its special properties such as color and composition of cement. The function of cement is first to bind the sand and coarse aggregates together and second to fill the voids. Although cement constitutes only about 10 percent of the volume of the concrete mix, it is the active portion of the binding medium and the only scientifically controlled ingredient of concrete. Locally available cement is used. Like OPC (PARASAKTI- Cement).

B. AGGREGATE:

Vertical Shaft Impactor (V.S.I.) Sand is also known as Artificial Sand or Crushed Sand. Only sand manufactured by V.S.I. Crusher is cubical and angular in shape. There is a standard specification for Fine Aggregates (Sand). It is divided in four gradations Zone-I, Zone-II, Zone-III & Zone-IV. Generally the size of the aggregate lesser than 4.75 mm is considered as Fine Aggregate.

The broken stone is generally used as a coarse aggregate. Aggregate occupies most of the volume of the concrete. The aggregates were washed to remove dust and dirt and were dried to surface dry condition. Locally available Coarse Aggregate used of 20 mm and down size. Testing is done as per Indian Standard Specification IS: 383-1970. The size of the aggregate bigger than 4.75 mm is considered as Coarse Aggregate. The coarse aggregate passed through 20 mm sieve and retained on 4.75 mm sieve & specific gravity 2.68.

C. WATER

Water fit for drinking is generally considered fit for making concrete. Water should be free from acids, oils, alkalies, vegetable or other organic impurities. Water is used for mixing, curing purposes should be clean and portable, fresh and free from any bacteria and desired matter confirming to IS 3025-1964 is used for mixing. Soft water also produces weaker concrete. Water has two functions in concrete mix. Firstly, it reacts with the cement to form a cement paste; secondly it serves as a vehicle or lubricant in the mixture of fine aggregate and cement. Water is a key ingredient in the manufacturer of concrete. Ordinary tap water is used for concrete mix.

D. SUGARCANE BAGASSE ASH:

The Sugarcane Bagasse Ash consists of approximately 50% of cellulose, 25% of hemicellulose and 25% of lignin. Each ton of sugarcane generates approximately 26% of bagasse 0.620% of residual ash. The residue after incineration presents a chemical composition dominated by Silicon Dioxide (SiO2). In spite of being a material of hard degradation and that presents few nutrients, the ash is used on the farms as a fertilizer in the Sugarcane Baggage Ash harvests.

2.2 CASTING SPECIMEN:

Test specimens of Cubes of size 150mm x 150mm x 150mm, beam with 700mm x 150mm x 150mm will be prepared using the standard molds. The samples are cast. The samples are remolded after 24hrs of casting and kept in a water tank for 7 and 28 days curing. A total of 36 specimens were cast for testing the properties such as compressive strength, and flexural strength. 24 cube samples of size 150mmx150mmx150mm for different percentages of sugarcane bagasse ash in partial replacement of cement will casted. The concrete mixes are 0%,7%,14% & 21% sugarcane bagasse ash with partial replacement of cement. All cubes will casted in one lift and consolidated using a machine vibrator. After final setting of cubes, the cube molds will be removed and cubes will be kept in a water tank for curing for up to 7 and 28 days.

3 .EXPERIMENTAL METHODOLOGY

a) COMPRESSIVE STRENGTH

Compressive strength test is the most common test conducted on concrete because it is easy to perform and most of the desirable characteristics properties of concrete are quantitatively related to its compressive strength. Compressive strength is determined by using a compression testing machine (CTM) of capacity 2000 KN. The load is applied at uniform rate. The cube specimens of the size 150 x 150 x 150 mm were tested after curing for a period of 7 and 28 days for different combinations and results were compared with control specimens.

b) FLEXURAL STRENGTH

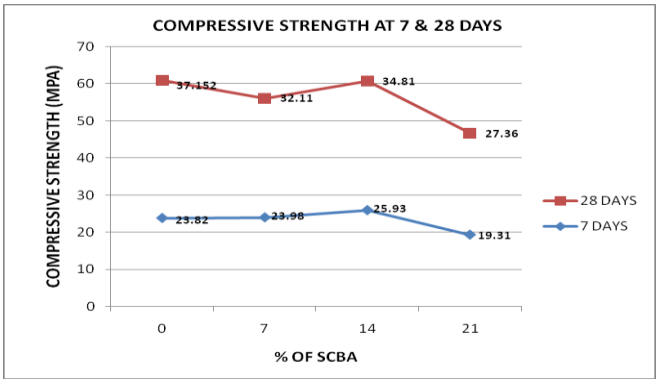
Flexural tests on beams were carried out in a universal testing machine of capacity 1000kN. Deflect meters were fixed to measure the deflection at salient points. The load acting at two points was applied without shock and increased until failure occurred. The load-deformation pattern was plotted and maximum load applied to the specimens were recorded.

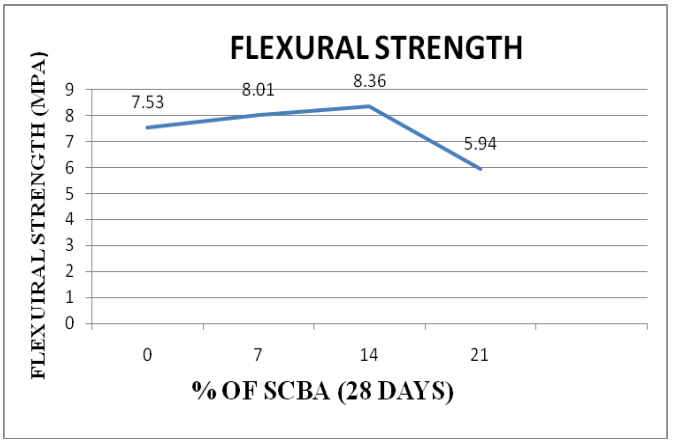
The flexural strength test was determined according to B.S. 1881: part 118, 150 x 150 x 700 mm specimens were tested. The flexural strength of the specimens was calculated by the following equation.

$$F_r = \frac{P \times L}{b \times d^2}$$

4. RESULTS:

Results are obtained as follows:





5. CONCLUSIONS:

Based on results and observations made in experimental research.The following conclusions are drawn.

- The results from above tests show that Sugarcane Bagasse Ash can be utilized for partial replacement of cement up to 14% by weight of cement without any major loss of strength.
- The results showed that the concrete with 5% of SCBA after 28 days of curing had higher strength when compared to concrete with other replacement percentages.
- Greenhouse gasses emissions can be reduced by replacement of cement with PPC.
- Mechanical properties of concrete are developed in later ages due to slow pozzolanic reactions.

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