UTILIZATION OF BAGASSE ASH IN CONVENTIONAL CONCRETE BY PARTIALLY REPLACEMENT WITH CEMENT

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ABSTRACT

India is the second largest in major sugar producing countries after Brazil. Due to that there is increase in bagasse as a by product from the sugar mill. Bagasse is the fibrous residue of sugar cane after crushing and extraction of juice. Sugar cane bagasse ash is the waste product of the combustion of bagasse for energy in sugar factories. Sugar cane bagasse ash is disposed of in landfills and is now becoming an environmental burden. In this experimental research work concrete cubes, beams and cylinders of M25 grade were casted and tested to examine various properties of concrete like workability, compressive strength, split tensile strength, modulus of elasticity and flexural strength. Sugar cane bagasse ash was partially replaced with cement at 10, 18 and 24% by weight of cement in concrete. From the results we can conclude that optimum amount of sugar cane bagasse ash that can be replaced with cement is 18% by weight with admixture.

Keyword:- *OPC cement, bagasse ash, steel fiber, compressive strength.*

INTRODUCTION:

1.1: General:

Ordinary Portland cement is recognized as a major construction material throughout the world .Industrial wastes, such as blast furnace slag, fly ash and silica fume are being used as supplementary cement replacement materials. Currently, there has been an attempt to utilize the large amount of bagasse ash, the residue from an in-line sugar industry and the bagasse-biomass fuel in electric generation industry. When this waste is burned under controlled conditions, it also gives ash having amorphous silica, which has pozzolanic properties. A few studies have been carried out on the ashes obtained directly from the industries to study pozzolanic activity and their suitability as binders, partially replacing cement5. Therefore it is possible to use bagasse ash (SCBA) as cement replacement material to improve quality and reduce the cost of construction materials. The present study was carried out on SCBA obtained by controlled combustion of bagasse, which was procured from the Tamilnadu province in India.This paper analyzes the effect of SCBA inconcrete by partial replacement of sand at the ratio of 10%, 20%, 30% . The experimental study examines the compressive strength, split tensile strength, flexural strength concrete. The main ingredients consist of Portland cement, SCBA, river sand, coarse aggregate and water. After mixing, concrete specimens were casted and subsequently all test specimens were cured in water at 7,14 and 28 Days. Sugarcane is an important food crop for tropics and subtropics. It is the major raw materials used for sugar production. Sugarcane bagasse (SCB) is the waste produced after juice extraction from sugarcane. The Sugarcane bagasse ash (SCBA) is obtained as by product of control burning of sugarcane bagasse. SCBA constitutes an environmental nuisance as they form refuse heaps in areas they are disposed. It is cultivated in about seventy four countries between 400N and 32.50S, approximately encompassing half of the globe (Agboire et al., 2002). Brazil and India are the world’s major sugarcane producing countries with Brazil having over of 719 million tons in 2010 and recorded one-third of the world's total sugarcane. Nigeria produced over15 million tons of sugarcane last year. Some states where sugarcane is mostly produced in Nigeria are Sokoto, Taraba, Niger, Kogi and generally most Northern part. SCBA from sugar producing companies is not readily available since most developing countries relied on imported sugar import. In the past, SCB was burnt as a means of solid waste disposal. But with the increasing cost of the natural gas, electricity and fuel, and with the calorific properties of these wastes, bagasse has been used as the principal fuel in cogeneration plants to produce electric power. SCBA is usually obtained under controlled burning conditions in the bailers of the cogeneration processes. Thus, the ash may contain black particles due to the presence of carbon and crystalline silica when burning occurs under high temperature (above800oc) or for a prolonged time. The nature of ash can be altered by controlling the parameters such as temperature and rate of heating. Search for alternative binders or cement replacement materials has become a challenge for national development and forward planning. Since last few years, tremendous efforts have been made to increase the use of

materials to partially replacement cement in concrete works. In this study, the bagasse ash was collected in the wet condition from a disposal area. It was air-dried completely before characterization and use. The sample of raw bagasse ash consists of three different types of particles, namely, fine burnt particles, coarse fibrous unburnt (CFU) particles and fine fibrous unburnt (FFU) particles. Most of the particles of raw bagasse ash are completely burnt fine particles. The presence of fibrous unburnt particles (CFU and FFU) was visually observed in the raw bagasse ash. Incomplete burning of plant cellular structured fibers leads to presence of more amounts of fibrous particles in the raw bagasse ash. The structure and size of these fibrous particles are entirely different from the burnt fine particles.

1.2: Scope of project:

Laboratory test on cement, fine aggregate, coarse aggregate, bagasse ash, water. Whatever may be the types of concrete being used, it is important to mix design of the concrete. The same is the case with the industrial waste based concrete or bagasse ash replacement. The major work involved is getting the appropriate mix proportion. In present work, the concrete mix with partial replacement of cement with bagasse ash were developed using OPC 53 grade cement. A simple mix design procedure is adopted to arrive at the mix proportion.

2. MATERIALS:

2.1 Cement:

The most common cement is used is Ordinary Portland Cement. Out of the total production, Ordinary Portland Cement accounts for about 80-90%. Many tests were conducted to cement some of them are Consistency tests, Se Time tests, Soundness tests, etc.

2.2 Fine Aggregate:

Fine aggregate is locally available, free from debris & soil & nearly riverbed sand is used. The sand particles should also pack to give minimum void ratio, higher voids content leads to requirement of more mixing water. In the present study the sand conforms to zone II as per the Indian standards (IS). The specific gravity of sand is 2.680. Those passing from 4.750 mm to 150 micron are known as fine aggregate, and the bulk density of fine aggregate (loose state) is 1393.17 kg/m3 and rodded state is 1606.85 kg/m3.

2.3 Course Aggregate:

The crushed aggregates used were 20 mm nominal maximum size and are tested as per Indian standards and results are within the permissible limit. The specific gravity of coarse aggregate is 2.830; the bulk density of coarse aggregate is 1692.32 kg/m3 and rodded state is 1940.18kg/m3.

2.4 Water:

The requirements of water for concreting & curing as per IS: 456-2000, after available in college campus.

2.5 Sugarcane Bagasse Ash (SCBA):

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 dominates by Silicon Dioxide (SiO_2). 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.

3. MIXING AND CASTING:

The fresh concrete was mixed using flow pan mixer of 150.00Kg capacity till uniform through consistency was achieved, prior to the mixing; the materials were spread in layers in the bottom of the pan, coarse aggregate first, followed by cement and finally the fine aggregate. The constituents of the mixes were mixed dry for 1.00 minute in order to homogenize the batched mix; subsequently water was added and mixed for a further

3.00 minutes. The concrete was cast into the moulds in three layers, and 36.00 blows were given to each layer, using 16. 00 mm diameter bar, to remove any entrapped air. For each mix the required numbers of cubes, cylinder and beam were casted. The moulds were covered by sacking for 24.00 hours at room temperature. The specimens were de-molded after at least 24.00 hrs. & poured into the curing tank. Before the molding of the samples specimens workability tests were done to observe the effect of Sugarcane Bagasse Ash on fresh concrete properties. The workability tests adopted for this investigation were the Slump Cone test. The process of selecting suitable ingredients of concrete such as cement, sand, aggregate, water and determining their relative amounts with the objective of producing a concrete of the required, strength, durability, and workability as economically as possible, is known as the concrete mix design. The proportioning of ingredients of concrete such as cement, sand, aggregate & water is governed by the required performance of concrete in two states, namely the plastic and the hardened states. If the plastic concrete is not workable, it cannot be properly placed and compacted. The property of workability, therefore, becomes of vital importance. The compressive strength of hardened concrete which is generally considered to be an index of its other properties, depending upon many factors, for ex. Water Cement ratio quality and quantity of cement, water, aggregate, batching, placing, compaction and curing. The cost of concrete is made up of the cost of material, plant and labour. The variation in the cost of material arise from the fact that the cement is several times costly than the aggregates, thus the aim is to produce as lean a mix as possible. The actual cost of concrete is related to the cost of materials required for producing a minimum mean strength known as characteristic strength that is specified by the designer of the structure. This depends on the quality control measures, but there is no doubt that the quality control adds to the cost of concrete. On the workability of mix the cost of labour is depend.

4. RESULT:

The results obtained from the experimental investigations are showed in tables. All the values are the average of the three readings in each case in the testing work of this study. To determine the compressive strength, Split tensile test, flexural strength of concrete is very important, because this strength shows concrete quality. This strength will help us to arrive the optimal proportion for replacement. The compressive strength was performed according to IS: 516-1959.The compressive strength for 7 day and 28 day of various mixes were determined and given in tables below. The results are discussed as follows.

Table no:1 Compressive strength 7 and 28 Days.

Mix	% of SCBA	Age of cube	Compressive strength	Split tensile strength	Flexural strength
M25					
A	10	7	20.62	1.365	2.86
	18	7	14.04	1.19	3.25
	24	7	11.80	0.71	2.78
B	10	28	34.84	2.29	3.84
	18	28	27.34	2.1	4.25
	24	28	20.88	1.63	3.96

5. CONCLUSIONS:

Based on the conducted experiment and according to the result obtained it can be concluded that, the strength of the concrete is increase with the help of sugar cane Bagasse ash (SCBA). Therefore, with the use of SCBA in partially replacement of cement in concrete we can increase the strength of concrete with reducing the consumption of cement. Also it is the best use of sugarcane bagasse ash (SCBA) instead of land filling and make environment clean.

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