An Experimental Study on Concrete By Partial Replacement of Cement With Marble Dust and Fine Aggregate with Sugarcane Bagasse Ash

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Abstract - In the present investigation an attempt has been made to study strength characteristics of M30 Grade concrete mixes with the replacement of cement by industrial by products such as Marble Powder (MP) and Fine aggregate replaced by Bagasse ash (SCBA).Further the replacement of MP 25% ranging from 5-25% by weight of cement and the replacement of BA Various from 5-25% by weight of Fine aggregate. The use of pozzolanic materials in concrete has demonstrated the significant influence in improving the properties viz: Fresh properties, setting time and compressive strength .The best approach is to develop a performance based specification of conventional and concrete mixes with different combinations with suitable water powder ratio. Further the fresh properties are Slump test and strength characteristics of concrete mixes developed in the laboratory with or without replacement with varying percentages of industrial by-products have been compared and behavior is studied with different curing ages.

Keywords: Concrete, Sugar cane bagasse ash, Marble dust.

I. INTRODUCTION

Concrete is the most commonly used construction material in the world. It is basically composed of two components: paste and aggregate. The paste contains cement and water and sometimes other Cementitious and chemical admixtures, whereas the aggregate contains sand and gravel or crushed stone. The paste binds the aggregates together. The aggregates are relatively inert filler materials which occupy 70% to 80% of the concrete and can therefore be expected to have influence on its properties. The proportion of these components, the paste and the aggregate is controlled by; the strength and durability of the desired concrete, the workability of the fresh concrete and the cost of the concrete.

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 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 cement. Therefore it is possible to use sugarcane bagasse ash (SCBA) as cement replacement material to improve quality and reduce the cost of construction materials such as mortar, concrete pavers, concrete roof tiles and soil cement interlocking block.

The present study was carried out on SCBA obtained by controlled combustion of sugarcane bagasse, which was procured from sugar factory in SRIRANGAPATNA NEAR MANDYA. Sugarcane production in India is over 300 million tons/year leaving about 10 million tons of as unutilized and, hence, wastes material. This report analyzes the effect of SCBA in concrete by partial replacement of cement at the ratio of 0%, 5%, 10%, 15%, 20% and 25%by weight. The experimental study examines the compressive strength. The main ingredients consist of Portland cement, marble dust, SCBA, fine aggregate, 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.

II. METHODOLOGY

1. Tests on Cement

- Fineness
- Setting Time
- Specific Gravity Test
- Standard Consistency of Cement Paste

2. Sugarcane Bagasse Ash

The sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemi-cellulose 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 dominates 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.

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Fig. 1 Baggase ash

TABLE 1. Composition of Bagasse

Oxides	**SBA**
SiO_2	67.81%
Al_2O_3	19.41%
Fe_2O_3	3.85%
CaO	4.03%
MgO	1.11%
Na_2	0.35%
K_2O	1.69%
SO_3	0.66%
Loss of ignition	1.09%

3. Tests on Bagasse Ash

- Fineness
- Standard consistency of a cement paste with bagasse ash
- Specific Gravity Of Bagasse Ash

4. Marble dust as a cement replacing material

Marble has been commonly used as a building material since the ancient times. The industry's disposal of the marble powder material, consisting of very fine powder, today constitutes one of the environmental problems around the world (Corinaldesi et al., 2010). Marble blocks are cut into smaller blocks in order to give them the desired smooth shape. During the cutting process about 25% the original marble mass is lost in the form of dust. The finest marble dust for making brilliant white grounds. Our whiting is dry ground from marble deposits in Georgia. Dry grinding reduces it to a powder without destroying its particle structure, which is important in making strong grounds and providing tooth on the surface of the grounds. The low surface area of our marble (when compared to precipitated chalk) keeps oil absorption low, which is ideal when adding it to oil paint and mediums. In painting grounds it makes a durable surface with tooth for egg and casein tempera, distemper, encaustic and oil paint.

Fig. 2 Marble Dust

TABLE 2. Properties of Marble Dust

Calcium Carbonate	95%
Brightness (Hunter Y)	92
Retained On 325 Mesh Screen	0.03%
Moisture	0.12%
Oil Absorption	19 G OIL / 100 G PIGMENT

Solid Density	22.7 LBS./GAL
Bulk Density, Packed	90 LBS./FT^3
Bulk Density, Loose	60 LBS./FT^3
Specific Gravity	2.7
Refractive Index, Mean	1.6
Mean Particle Size	11 MICRONS
Hegman	3

5. Tests on Marble Dust

- Fineness
- Standard consistency of a cement paste with Marble Dust
- Specific Gravity Of Marble Dust

6. Tests on Fresh Concrete

TABLE 3. Slump Test results

W/C Ratio	Initial reading (mm)	Final Reading (mm)	Type of slump	Slump value
0.42	300	300	True slump	0
0.43	300	270	-	30
0.44	300	232	Shear slump	68
0.45	300	225	Collapse	75

III. PREVIOUS WORK

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The present study is to investigate experimentally the fresh and hardened properties of lightweight concrete using sugarcane bagasse ash(SCBA) as replacement for cement by weight at 0%, 5%, 10%, 15% and 20% and expanded polystyrene (EPS) beads as 100% replacement for coarse aggregate respectively.

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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 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.

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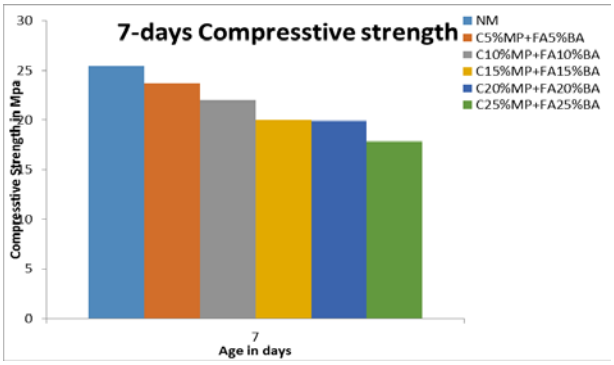
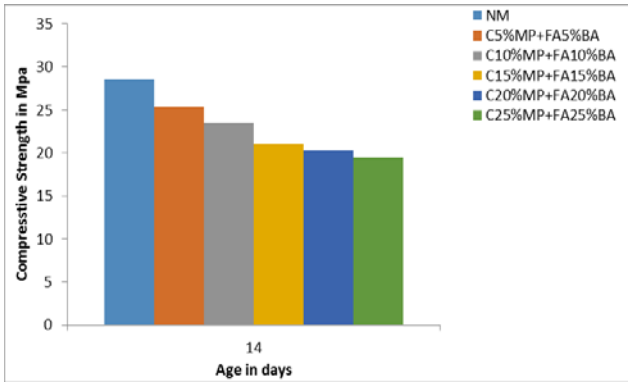
Leaving the waste materials tothe environment directly can cause environmental problem. Hence the reuse of waste material has been emphasized. Waste can be used to produce new products or can be used as admixtures so that natural resources are used more efficiently and the environment is protected from waste deposits.

IV. EXPERIMENTAL RESULTS



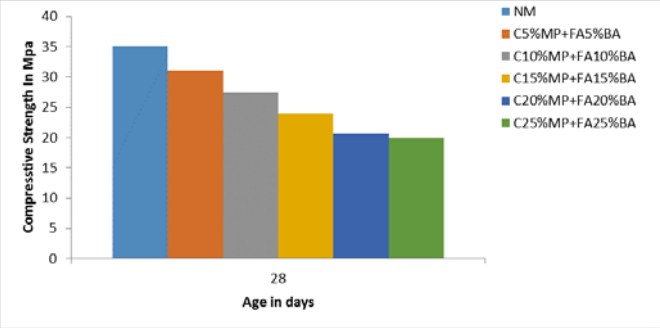
Graph .1: 7th day compressive strength of M30 grade concrete

The above graph indicates that the compressive strength of 7 days with various percentage of Marble powder replaced in cement and bagasse ash replaced with fine aggregate in the concrete mixes. The normal concrete give a compressive strength compared to the different mixes proportion. Let consider the optimum strength gained after 14 days curing period is C5%MP+FA5%BA replacement and strength increase in percentage of marble powder and bagasse ash and decreases with the reaming replacement percentage of marble powder and bagasse ash.



Graph .2: Compressive strength tests for 14 days

The above graph indicates that the compressive strength of 14 days with various percentage of Marble powder replaced in cement and bagasse ash added to the fine aggregate in the concrete mixes. The normal concrete give a compressive strength compared to the different mixes proportion. Let consider the optimum strength gained after 14 days curing period is C5%MP+FA5%BA replacement and strength increase in percentage of marble powder and bagasse ash and decreases with the reaming replacement percentage of marble powder and bagasse ash.



Graph .3: Compressive strength test for 28 days

The above graph indicates that the compressive strength of 28 days with various percentage of Marble powder replaced in cement and bagasse ash added to the fine aggregate in the concrete mixes. The normal concrete give a compressive strength compared to the different mixes proportion. Let consider the optimum strength gained after 28 days curing period is C5%MP+FA5%BA replacement and strength increase in percentage of marble powder and bagasse ash and decreases with the reaming replacement percentage of marble powder and bagasse ash.

V. CONCLUSION

- At the replacement of Ordinary Portland Cement by marble dust and fine aggregate by bagasse ash from 5% to 10% results in a better compressive strength.
- The compressive strength results of the concrete have revealed that the concrete with 5% cement replacement by marble dust and fine aggregate by baggase ash have shown a compressive strength improvement at 28 days over the control concrete with the 100% Ordinary Portland Cement.
- Partial replacement of cement by marble dust and fine aggregate by baggase ash increases workability of fresh concrete; therefore use of super plasticizers is not substantial.
- The workability of concrete containing bagasse ash decreases slightly as the bagasse ash content increases which is due to the higher water demand of bagasse ash.

VI. FUTURE SCOPES

- Here author will explain the future of his/her research. To check the effect of different percentage replacement of cement by bagasse ash on the properties of the high strength concrete (M35,M40,M45…etc.,)
- Further this work will be carried out to check the strength of the concrete with different water cement ratio.

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