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Cement Partially Replaced With Sugar Cane Baggasse Ash -Behavior in Sea Water

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***Abstract*— Concrete is a major ingredient of construction materials which is used along with aggregate and water. Admixtures are used to enhance the properties of concrete both chemically and physically. They are used selectively based on the type of work and location of construction. Fly ash, rice husk ash etc are commonly used as admixtures. Now a days, sugarcane baggasse ash is also been used because of its advantages both economically and environmentally. Sugar cane baggasse is product remained after crushing the sugar canes. The pulp is burnt and dumped in the nearby agricultural fields. This tends to a decrease in particulate pollution, land pollution which has been a major problem in this industrial era. On the other side, an enormous increase in population extended the constructions on and off shores which includes dockyards, constructions of major pipe lines, artificial islands etc. Many tests have proved the advantages of sugar cane baggasse ash replaced with sand. With the advancement in trends in civil engineering, these tests are carried out in extreme cases like behavior in sea water compared to normal water. This study deals with partial replacement of cement with sugar cane baggasse ash cement in concrete 0%,5%,10%,15%,20% and 25% is tested in normal water and sea water for 7,28 and 60 days. The results showed the suitability of sugarcane baggasse ash concrete improvement in strength in sea water when compared to normal water.**

***Index Terms*— cement, compressive strength, sea water, sugarcane baggasse ash.**

I. Introduction

Research and development has become one of the main objectives in every developing country. Innovation of new technologies leads to betterment of living at every stage and sector. A project is said to be successful only when it satisfies the main objectives with which it is started. The output should be efficient and economical. Due to increased population; the construction is increased in n number of times. In the same way we are left with very little sources like sand, water, etc. mineral admixtures like rice husk ash, etc are used. In the view of proper usage of waste materials which reduces the severe environmental impact, we take sugarcane baggasse ash as admixture and replace partially with cement.

Sugarcane is vastly cultivated and treated in countries like India, Brazil etc where now it is already in practice that waste products like fly ash, blast furnace slag , etc are used as major raw material of up to 70% in making of bricks and named as fly ash bricks, baggasse ash bricks etc.

Now tests are conducted to see whether the partial replacement of cement by baggasse ashes by 0%,5%,10%,15%, 20% and 25% for curing in normal and sea water for 7,28 and 60 days.

II. Mineral Admixtures in Concreting:

Admixtures are used to improve the physical and chemical properties of cement. The amorphous forms of material which is originated from earth and constitutes minerals majorly are called mineral admixtures. They are mostly drawn from volcanic ashes, debris, wastes powders left after heating husk, coal, baggasse etc. they are very easily available, economical and efficient in working for which they are used in major constituency along with cement.

III. Materials Required:

A. Cement:

OPC -53 GRADE cement is bought from the nearby factory; airtight and away from impurities

B. Sea water:

Sea water is collected from the shore of Sagar nagar; Visakhapatnam where its pH is around 8 which are away from all organic and inorganic impurities

C. Normal water:

Fresh water is collected from the college without impurities. They are measured by neat measuring jars. Water in required quantity was measured by graduated jar and added to the concrete. PH of the water is around 7.

D. Fine aggregates:

Fine aggregate retained on 600 microns sieve, conforming to Zone II as per IS 383-1970 was used as a major ingredient. The fine aggregate is tested for its specific gravity, bulk modulus and gradation as per specifications of IS: 2386-1963

E. Coarse aggregates:

A crushed coarse aggregate of 20 mm procured from the local crushing plant was selected according to IS: 383- 1970 used in batching. Gradation, Fineness modulus, Specific Gravity and Bulk density of the aggregate is tested according to specifications of IS: 2386-1963.

F. Sugar cane baggasse ash:

Sugarcane baggasse collected from the nearby farms in Anakapally, Visakhapatnam, burnt raw material at a temperature of 650 degrees, sieved primarily to segregate the coarse and fine particles. Later they were further fined in ball mill. The sugarcane baggasse ash are pozzolanic, rough, vascular particles whose maximum sizes can vary extensively from 50- 60 μ. The relative density of the ashes on a saturated surface dry basis range between 1.90 and 2.12. The ashes also have high absorption values of 10±12% (according to Lavanya et al 2012).

SCBA: SugarCane Baggasse Ash

IV. Methodology:

For a mixed design, a traditional method is used with a water cement ration 1:1.5:3

A. *Preparation of specimen:*

108 specimens with 100 × 100 × 100mm dimension are made with the ratio of 1:1.5:3. Out of them, 54 are made for SBCA blocks cured in normal water and 54 in sea water. 18 cubes for each set of 7, 28 and 60 days are taken for normal and sea water.

B. *Casting and Curing:*

Moulds of standard size with 100 × 100 × 100mm are taken and greased with oil on all faces. Later this mixture of coarse aggregate, fine aggregate, water in calculated proportions are mixed and placed. Half of them are made with normal concrete and half of them SBCA replaced concrete.
Later SBCA and normal concrete blocks are removed and cured in normal and sea water for 7, 28 and 60 days.

C. *Tests for compressive strength:*

For each series they are removed and tested for compressive strength in compression testing machine available in GITAM university laboratory. 3 sets of result of each specimen is acquired and mean of the 3 indicates its strength, they are tabulated as shown below.
SCBA-Sugarcane Baggasse Ash

V. Tabulation of Results:

Table 1. M 35 *in sea water*

Percentage replacement of baggasse ash	7days	28days	60days
0%	35.5	44.5	**51.5**
5%	38.34	45	**54.9**
10%	42	52	**58**
15%	36.86	43.8	**50**
20%	34	41.5	**45.8**
25%	32.5	40.5	**42**

Table 2. M35 *in normal water*

Percentage replacement of baggasse ash	7days	28days	60days
0%	**31**	**43**	49.6
5%	**32**	**45.8**	54.38
10%	**36.6**	**47.5**	55.66
15%	**30.5**	**40**	47.5
20%	**28.16**	**37.66**	45.33
25%	**27.3**	**35**	43

Figure 1:

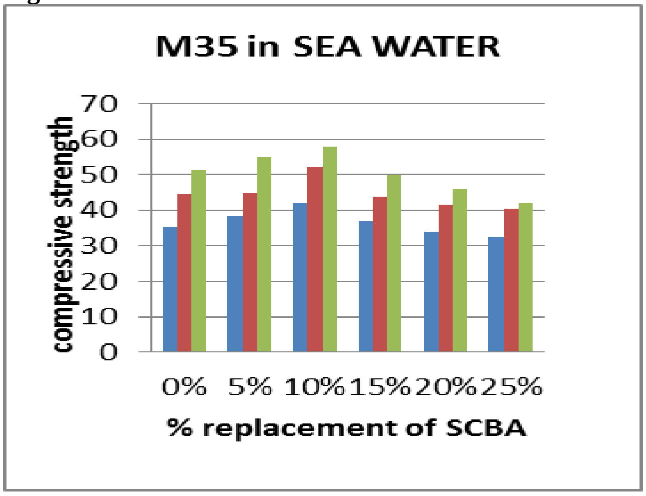
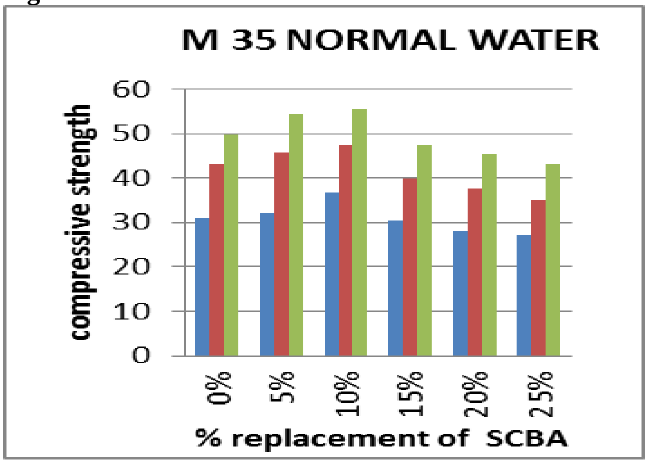


Figure 2:



VI. RESULTS AND DISCUSSIONS:

Figures 1,2 represent the behaviour of SCBA replaced in 0,5,10,15,20,25% cured in normal and sea water for 7,28 and 60 days.

It is shown an increase in strength with time where SCBA replaced in cement in 5,10,15,20,25% in concrete cubes have shown better performance in strength when compared to concrete cubes with cement replaced with 0% of SCBA . It is also shown that specimens made by replacing SCBA performed a strength improvement in sea water than cured in normal water.

Cement reacted with dissolved salts leads to formation of gypsum and complex compounds like ettringite, brucite and aragonite which leads to brittleness, strength loss and disruptive expansion. Addition of SCBA retards the formation of these complex compounds by controlling calcium hydroxide reaction which is major component of cement. This helps in formation of tricalcium alluminate which enhances the durability and strength of concrete. Due to their micro filling ability, they occupy the capillary pores contributing to an increase in strength.

Additionally, the size, bulk density and shape variation of SBCA particles to normal cement particles differs. This enhances the micro filling ability and accelerates the pozzolanic activity of concrete. Besides, it resists the chlorine attack of sea water through forming a impermeable layer into steel which reduces the corrosion in turn leaching.

Due to an active pozzolanic reaction, particles readily react with water and calcium hydroxide, which is formed from cement hydration i.e. cement mixed with water forming additional calcium silicate hydrate or CSH which is a strength contributing factor. This CSH lattice prevents the entry of ingestion of ions into the still. SCBA has silica as its major constituent which is a non reactive compound like cement (which contains calcium oxide). This avoids the crystallization which leads to durability and resistance. That is why it is majorly applicable in coastal areas.

VII. CONCLUSIONS:

1. SCBA replaced in 0%,5%,10%,15%,20% and 25% cured in water has shown more changes in attaining strengths for 7,28 and 60 days where SCBA replaced cement cured in sea water has shown very less change in attaining strength for 7,28 and 60 days.

2. SCBA replaced with cement in 5% 10% in concrete has shown a growth in strength but followed a decrement for 15% , 20%and 25% replacements cured in normal water and sea water for 7,28 and 60 days.

3. SCBA replaced with cement in 5%, 10%, 15%, 20% , 25% in concrete has given a better performance in strength improvement than SCBA replaced with 0% cement in concrete cured in sea water for 7,28 and 60 days.

4. Early strength is attained for 7 days curing when cured in sea water for replacements of 20 and 25%

5. SCBA one of the pozzolanic materials fills the voids and retards the ingestion caused due to exchange of salts in sea water in turn improving the strength.

6. SCBA may be suited for offshore and onshore construction.

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