BEHAVIOUR OF SUGACANE BAGASSE ASH WHEN EXPOSED TO NACL SOLUTION

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ABSTRACT

Construction officials in coastal areas have long been facing the challenge of building and maintaining durable concrete structures in a saltwater environment. Gradual penetration of sea salts and the subsequent formation of expansive and leachable compounds lead to disintegration of structural concrete. The average NaCl concentration of sea water is about 3.5% although it varies from sea to sea depending upon geological location. In this study bagasse ash is used because it is one of the main by product can be used as mineral admixture due to its high content in silica (SiO2).In this study, Bagasse ash has been chemically and physically characterized, and partially replaced in the ratio of 0%, 5%,10%,15% and 20% by weight of cement in concrete. Fresh concrete tests like compaction factor test and slump cone test were undertaken was well as hardened concrete test compressive strength at the age of 7,28 and 60 days was obtained. The result shows that the strength of concrete .Concrete specimens were cured in normal water and NaCl solution and comparison is made between them.

Keywords*: *Bagasse Ash, Concrete, Compressive Strength, Sodium Chloride (Nacl).

I INTRODUCTION

Agricultural and industrial by-products are commonly used in concrete production as cement replacement materials CRMs or as admixtures to enhance both fresh and hardened properties of concrete as well as to save the environment from the negative effects caused by their disposal. Approximately 1500 Million tons of sugarcane is annually produced over all the world which leave about 40-45 % bagasse after juice crushing for sugar industry giving an average annual production of 675 Million tons of bagasse as a waste material. Initiatives are emerging worldwide to strike a balance between the developments in infrastructure and prevention of the environment from contamination by reusing the industrial wastes. The feasibility of using sugarcane Bagasse Ash (SCBA), a finely ground waste product from the sugarcane industry, as partial replacement for cement in conventional concrete is examined. 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. Sugarcane bagasse ash (SCBA) is one of the main by product can be used as mineral admixture due to its high content in silica (SiO2). 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 (*Mrs.U.R.Kawade et al .,*).

II MATERIALS AND METHODS

In the present experimental investigation sugar cane bagasse ash has been used as partial replacement of cement in concrete mixes. On replacing cement with different weight percentage of SCBA, the compressive strength properties are studied at different ages of concrete cured in different environments like fresh water and NaCl solution. M35 grade concrete has been designed in this investigation and specimens of SCBA concrete with partial replacement of cement with SCBA by 5%,10%, 15% and 20% for M35 grade concrete. In this present study cubes casted are exposed to normal water and 5% diluted NaCl solution. The cubes are tested at 7 days, 28 days and 60 days. The details of experimental investigations are as follows.

2.1 Cement

Ordinary Portland cement of 53 Grade from a single batch was used for the entire work and care has been taken to store it in airtight containers to prevent it from being affected by the atmospheric and monsoon moisture and humidity.

2.2 Sugarcane Bagasse Ash

(*Srinivasanan and Sathiya,2010*) observed that Sugarcane bagasse consists of approximately 50% of cellulose, 25% of hemicelluloses 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. In this project sugarcane bagasse ash was collected from the industry and its physical and chemical properties are given in Table 1 and Table 2 respectively.

2.3 Fine Aggregate

The river sand passing through 4.75 mm sieve and retained on 600 μm sieve, conforming to Zone II as per IS 383-1970 was used as fine aggregate in the present study. The sand is free from clay, silt and organic impurities. The aggregate was tested for its physical requirements such as Gradation, Fineness modulus, and Specific Gravity and Bulk modulus in accordance with IS: 2386-1963.

2.4 Coarse Aggregate

Throughout the investigations, a crushed coarse aggregate of 20 mm procured from the local crushing plant was used. The aggregate was tested for its physical requirements such as Gradation, Fineness modulus, Specific Gravity and Bulk density etc. in accordance with IS: 2386-1963 and IS: 383- 1970.

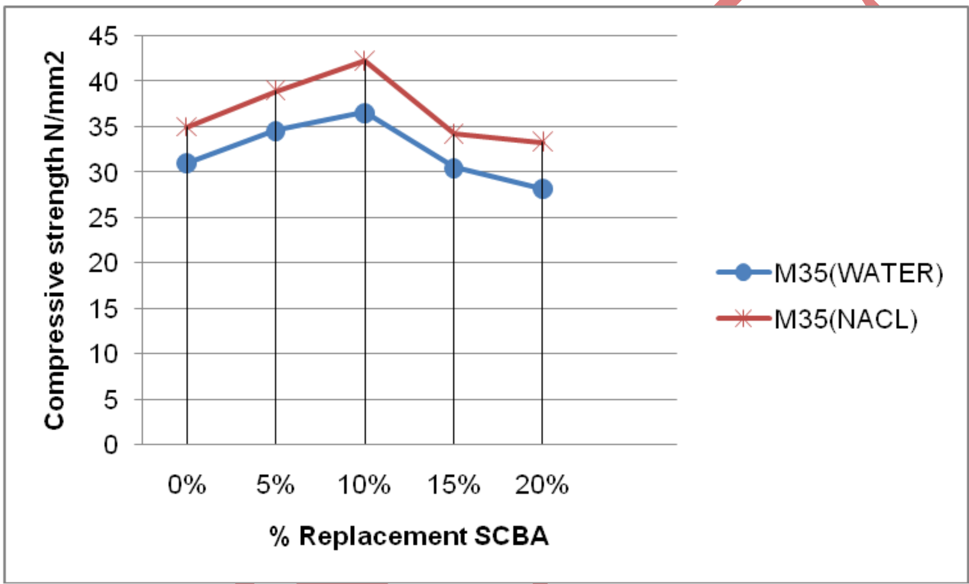
2.5 Water

Fresh portable water with pH value less than 7 free from organic matter and oil which is available in the college campus is used in mixing the concrete. Water in required quantity was measured by graduated jar and added to the concrete. The rest of the materials for preparation of the concrete mix were taken by weigh batching.

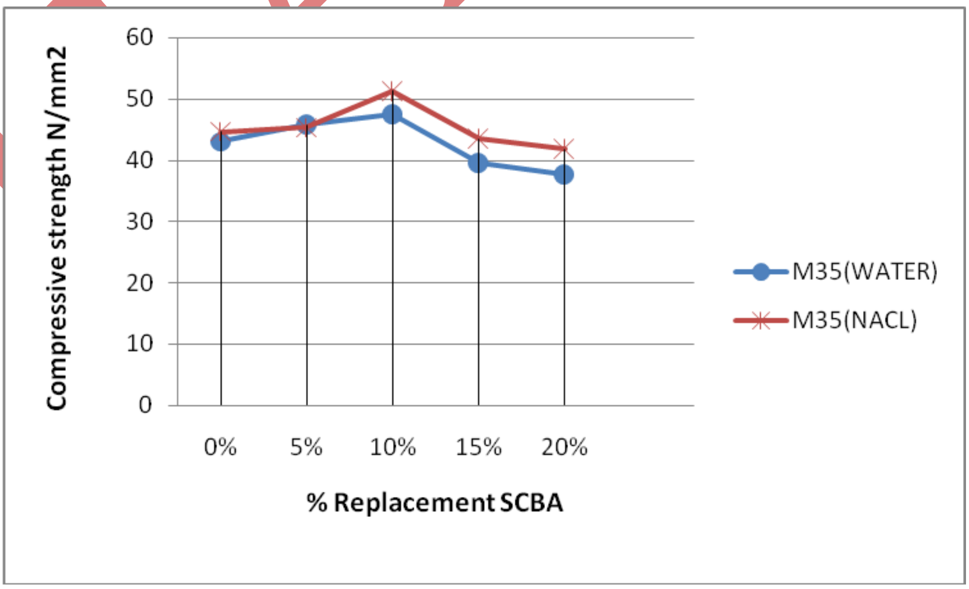
2.6 Curing in NaCl solution

Concrete cubes are cured in 5% diluted Nacl solution with ph value of 8 was maintained constant throughout the curing period of time.

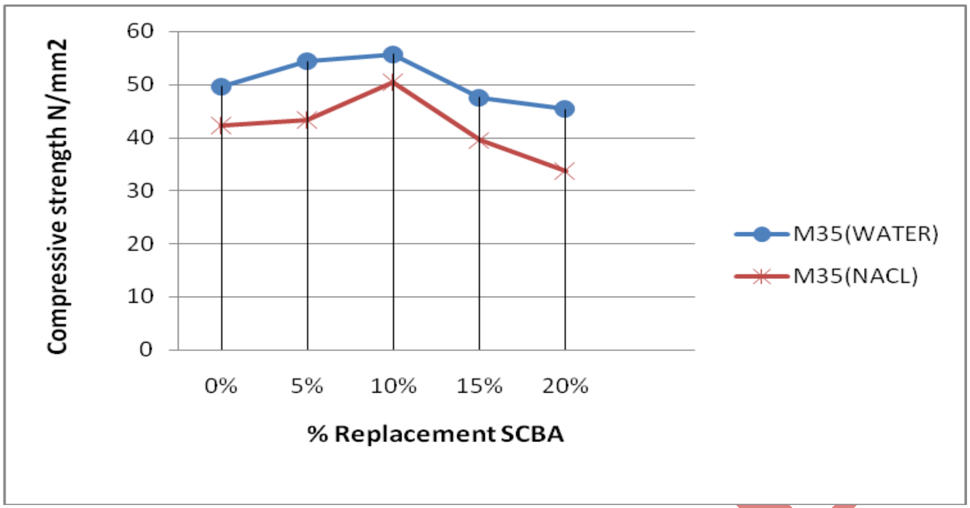
III FIGURES AND TABLES



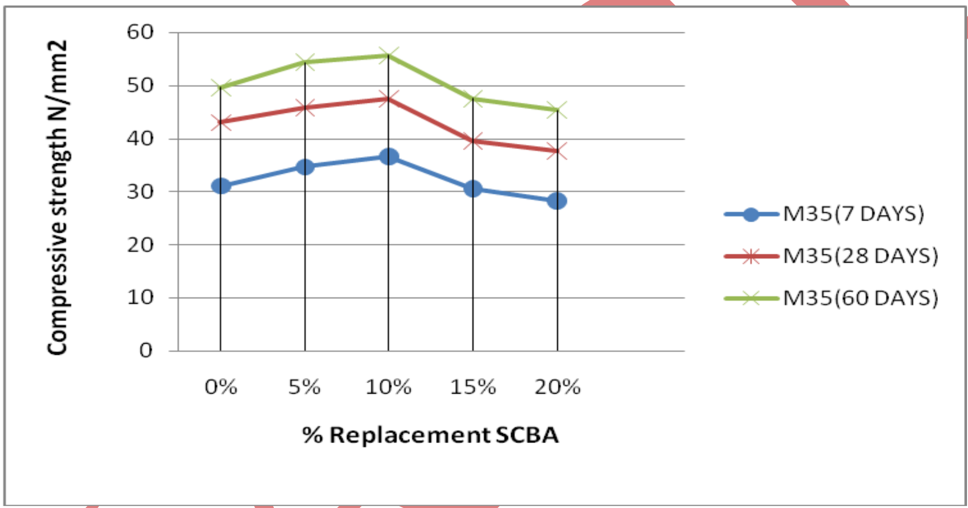
Graph – I: Compressive Strength of Concrete Cubes Cured In Normal Water and NACL for 7days



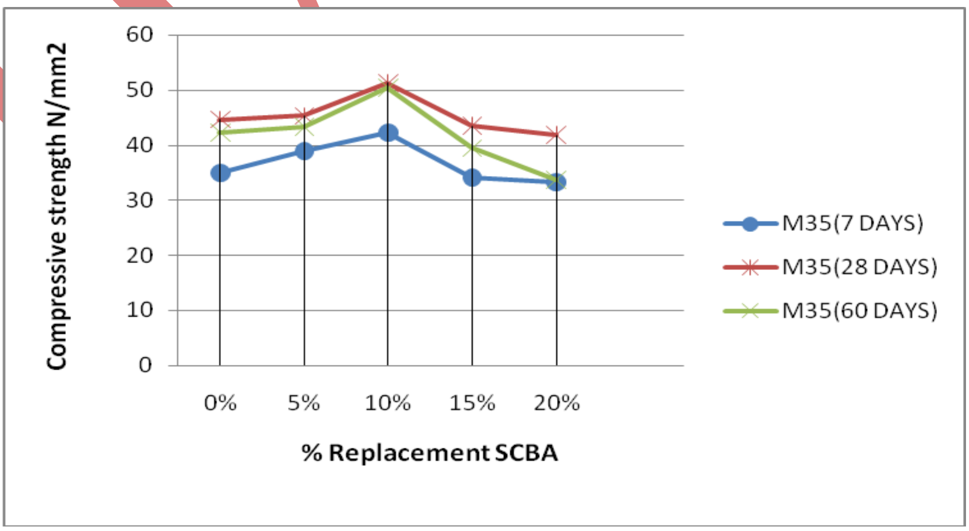
Graph – II: Compressive Strength of Concrete Cubes Cured In Normal Water and NACL for 28days



Graph – III: Compressive Strength of Concrete Cubes Cured In Normal Water and NACL for 60days



Graph – IV: Compressive Strength of Concrete Cubes Cured In Normal Water for 7, 28 and 60 days



Graph – V: Compressive Strength of Concrete Cubes Cured In NACL Solution for 7, 28 and 60 days

Table – I

PHYSICAL PROPERTIES OF SCBA		
Sl. no	Property	Test result
1.	Density	575 kg/m^3
2.	Specific gravity	2.20
3.	Mean particle size	0.1-0.2 µm
4.	Min specific surface area	250 m2/ kg
5.	Particle shape	Spherical

Table – II

CHEMICAL PROPERTIES OF SCBA			
Sl. no	Component	Symbol	%
1.	Silica	SiO2	63.00
2.	Alumina	Al2O3	31.50
3.	Ferric oxide	Fe2O3	1.79
4.	Manganese oxide	MnO	0.004
5.	Calcium oxide	CaO	0.48
6.	Magnesium oxide	MgO	0.39
7.	Loss of ignition	LOI	0.71

IV RESULTS AND DISCUSSIONS

The compressive strength of concrete at 7, 28 and 60days with 5%, 10%, 15% and 20% SCBA replacement and without SCBA replacement in concrete has been pictorially represented in figures 1,2,3,4 and 5.

The SCBA significantly increased the compressive strength of concrete at the ages of 7,28 and 60 days for normal water but compressive strength of concrete increased at the age of 7, 28days and decreased at the age of 60 days when cured in NaCl solution. Concrete cured in NaCl solution has better compressive strength for 7 and 28 days than concrete cured in normal water but decreased for 60 days when concrete cured in NaCl than concrete cured in normal water. The improvement of compressive strength is mostly due to the micro filling ability and pozzolanic activity of SCBA. With a smaller particle size SCBA can fill the micro-voids within the cement particles. Also, the SCBA due to its pozzolanic activity it readily reacts with water and calcium hydroxide, a by-product of cement hydration and produces additional calcium silicate hydrate or CSH. The additional CSH increases the compressive strength of concrete since it is a major strength-contributing compound. Also, the additional CSH reduces the porosity of concrete by filling the capillary pores, and thus improves the microstructure of concrete leading to increased compressive strength.

The increase in SCBA increases the demand in water so this causes limited percentage of replacement since it's difficult to maintain the adequate amount of proportions (*Amir Juma et al .,)*

NaCl solution appears to cause early compressive strength increase in concrete that cannot be maintained long term.

Chlorides are known to exist in pore solution, either chemically bound to hydration products or physically held to surface of hydration products Chlorides interact with calcium silicate hydrate (CSH) at three different levels as either chemisorbed layer on CSH, in the CSH inter layer spaces or be intimately bound in the CSH lattice.

Chloride ions do alter the pore size distribution of hardened cement paste and chloride solutions produce chloroaluminate and appear to cause deterioration by decalcifications that are more noticeable at later days.

Chlorides are also known to promote the leaching of Ca (OH) 2 and promote the formation of porous CSH involving complex reactions. The decalcification effects of NaCl, the formation of porous CSH and the leaching of calcium hydroxide all take their toll on concrete (*Abalaka et al .,*) **.**

V CONCLUSIONS

1. SCBA concrete performed better when compared to ordinary concrete upto 10% replacement of sugar cane bagasse ash when cured in normal water.

2. The compressive strength of concrete with 5%, 10%, 15% and 20% with weight replacement of cement with SCBA cured in normal water for 7, 28 and 60 days has shown an increase in strength.

3. The compressive strength of concrete with 5%, 10%, 15% and 20% with weight replacement of cement with SCBA cured in NaCl solution has shown increase in strength for 7 and 28 days but there is a decrease at an age of 60 days.

4. Both SCBA and normal concrete cured in NaCl solution has shown an perceptible increase in compressive strength for 7 and 28 days than concrete cured in normal water but for a longer period of curing in NaCl solution i.e for 60 days there is a decrease in strength. there is a decrease in strengths at the age of 60 days when concrete cured in NaCl solution.

5. Utilization of the waste material Sugar Cane Bagasse ash can be advantageously used as a replacement of cement in the preparation of concrete even when it is exposed to chloride attack.

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