EXPERIMENTAL INVESTIGATION ON STRENGTH PROPERTIES OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH SUGARCANE BAGASSE ASH

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Abstract:-India is the second largest country of sugar production after Brazil. As a result of which, there is an increase in the amount of bagasse as a by-product from the sugar mill. Sugar cane bagasse ash (SCBA) is the waste product of the combustion of bagasse for energy in sugar factories due to which it is easily available and cheap. SCBA is disposed of in landfills and is now becoming an environmental burden. In this Investigation work concrete cubes, beams and cylinders of M25 and M30 grade were casted and tested to examine various properties of concrete like, compressive strength, split tensile strength, flexural strength and workability. Sugar cane bagasse ash (SCBA) was partially replaced with cement at 3, 6, 9 and 12 % by weight of cement in concrete.

Keywords compressive strength split tensile strength, flexural strength and Sugar cane bagasse ash

I. INTRODUCTION

Recently sugarcane bagasse ash (SCBA), which is a byproduct of sugar factories, found after burning sugarcane has some cementatious properties. SCBA has been tested in some parts of the world for its pozzolanic property and has been found to improve the properties of the mortar and concrete when mixed up to a desired proportion like compressive strength, water tightness in certain limits fineness too. The pozzolanic property of sugarcane bagasse ash is the result of silicate content of the ash. The silicate content in the ash may vary from SCBA ash to others ash depending on the burning and other properties of the raw materials like the soil on which the sugarcane is grown.

Because of harmful impact of concrete construction on environment like increase in temperature and global warming, it is the time to go with some nontraditional materials for construction work. Now a days researches has been carrying out to replace cement in concrete. Most of these cement replacement materials are byproducts of different industries and agricultural wastes. Blast furnace slag, silica fume, fly ash and rice husk can be cited as an example

Mr Prashant O Modani has obsereved that the partial replacement of SBA through fine aggregates gave positive results with the replacement of about 10% to 20%. In this research, the partial replacement of cement by SBA with varying percentages that is 3%,6%,9% & 12% respectively.

Bagasse is a cellulose fiber which remainsafter the extraction of juice from sugarcane. The bagasse ash is about 8-10% of the bagasse and contains unburned matter, silica and alumina.

The SBA used in this present study was taken from **Maa Rewa Sugar factory which is located in Shahpura, Jabalpur district of MP State, India.** For this study, fresh SBA taken from the furnace was used. It was cooled in air by applying a small quantity of water.

II. MATERIALS AND METHODOLOGY

1. CONCRETE :- In this experimental work a design mix of M25 and M-30 grade was used for making the reinforced concrete specimens for 55 mm slump, The slump cone test was performed to determine the workability of concrete for desired slump

2. CEMENT:-For making concrete OPC 43 grade cement (JP cement) was used.Thespecefice gravity of cement used was 3.15 and the fineness modulaswas 2940 Normal Consistency 29.5%, Vicat initial setting time (minutes) 75, Vicat final setting time (minutes) 370 and soundness was 2mm.

3. FINE AGGREGATES:-The fine aggregates used in this investigation was Narmada River sand passing through 4.75 mm sieve with specific gravity of 2.64.

4. COARSE AGGREGATES :-Machine crushed broken stone angular in shape was used as coarse aggregates. Two fraction of coarse aggregates were used, 20mm size having specific gravity of 2.85, and 10mm size having specific gravity of 2.85.

5. WATER :-Ordinary tap water clean, potable free from suspended particles and chemical substances was used for both mixing and curing of concrete.

6. SUGARCANE BAGASSE ASH:-After the bagasse combustion, a new by-product Sugar Cane Bagasse Ash (SCBA) is formed and can be used as a pozzolona and substitute cement. The chief constituent of SBA is SiO_2, Al_2O_3,Fe_2O_5,Cao and K_2O. The following laboratory tests were performed on aggregates as per relevant IS code and mix design of M25 and M30 grade of concrete. The laboratory test programmed is summarized below.

1. Physical properties of coarse aggregates (20mm and 10mm size)
   - Sieve analysis and fineness modulus
   - Specific gravity
   - Water absorption
2. Physical properties of cement
   - Fineness
   - Specific gravity
3. Physical properties of fine aggregates
   - Sieve analysis
   - Specific gravity
   - Water absorption
4. Mix design (M 25 grade) as per IS 10262:2009
5. Preparation of specimens
6. Concrete Cube of size 150x150x150 mm
7. Mortar Cube of size 70.5x70.5x70.5mm

- Concrete Cylindrical columns of Dia 150mm and length 300 mm.
- Concrete beams 0f size 150x150x700 mm.

8. Testing of cubes for compressive strength.
9. Testing of beams for flexural strength.
10. Testing of cylindrical columns for Split tensile strength.

III. RESULTS

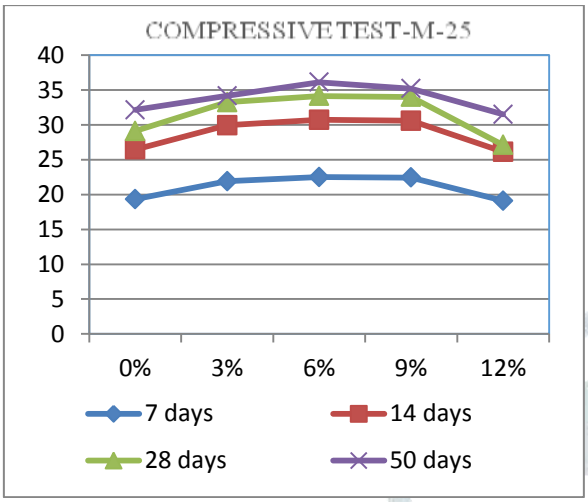

Fig 1. Compressive strength with partial replacement of cement (0%, 3%, 6%, 9% &12%) with SBCA

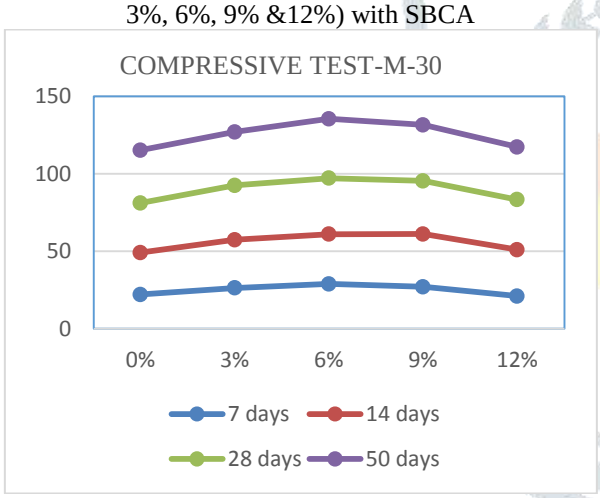

Fig 2. Compressive strength with partial replacement of cement (0%, 3%, 6%, 9% & 12%) with SBCA

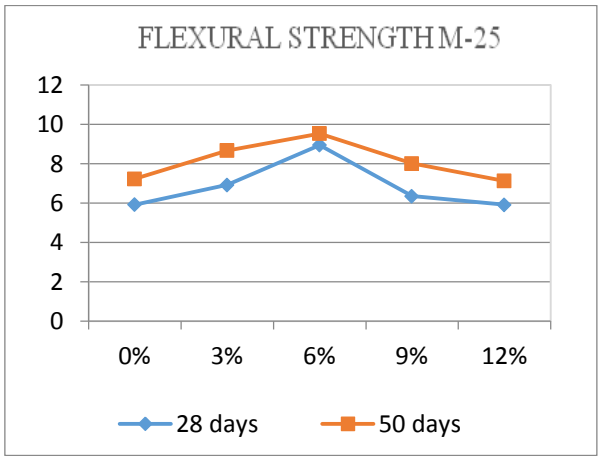

Fig.3.Flexural tensile with partial replacement of cement (0%, 3%, 6%, 9% &12%) with SBCA

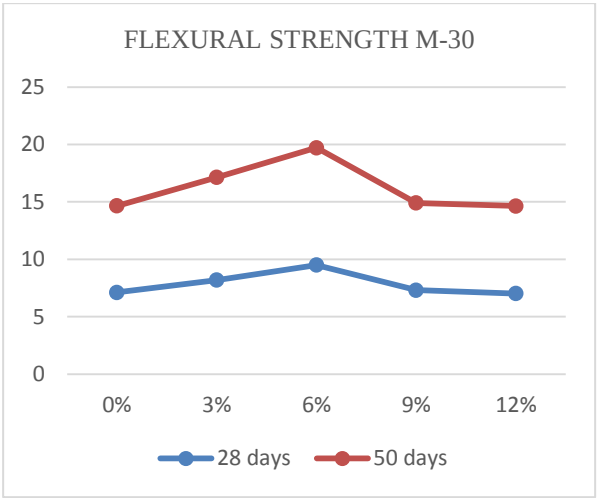

Fig 4.Flexural tensile with partial replacement of cement (0%, 3%, 6%, 9% & 12%) with SBCA

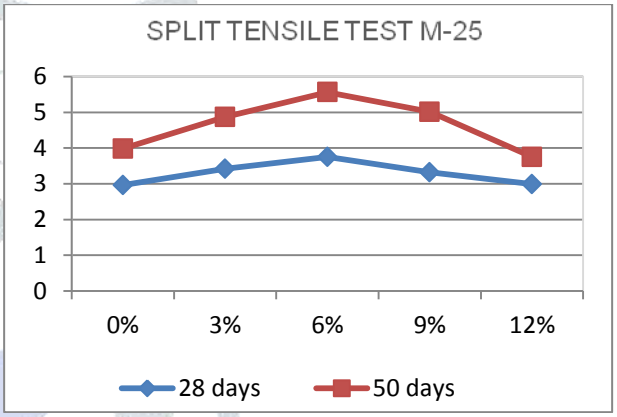

Fig 5. Split tensile with partial replacement of cement (0%, 3%, 6%, 9% &12%) with SBCA

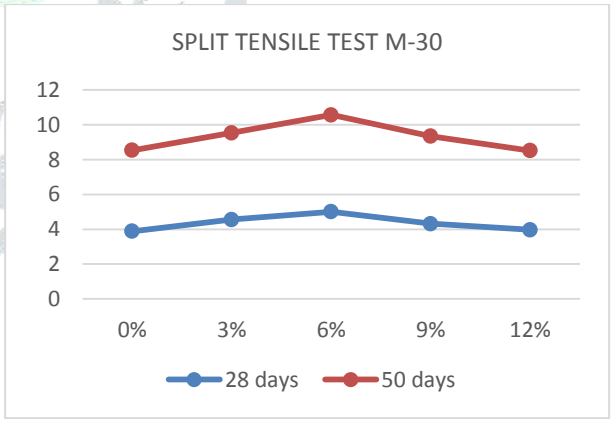

Fig 6. Split tensile with partial replacement of cement (0%, 3%, 6%, 9% &12%) with SBCA

IV. CONCLUSION

After performing the tests onM25 and M30 concrete with partial replacement of cement (0%, 3%, 6%, 9%, 12%) with SBCA, it has been observed that the compressive strength, flexural strength and split tensile increases with increase in percentage of SBCA and it is maximum for 6% and then starts decreasing.

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