INVESTIGATION OF EFFECT ON VARIOUS FIBRES ON THE MECHANICAL PROPERTIES OF BAGASSE ASH BLENDED WITH HIGH PERFORMANCE CONCRETE

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Abstract - *High performance concrete is a concrete mixture, which possesses high durability and high strength when compared to conventional concrete. It contains one or more of cementious materials. HPC is usually consists of fly ash, Silica fume or ground granulated blast furnace slag and usually a super plasticizer. Cement is the one of the main component in the concrete mix. Now a day's portland cement production consumes large amount of energy and has notable impact on environment. So the 20% of cement is replaced with bagasse ash. Bagasse ash is a fibrous matter that remains after sugarcane is crushed to extract their juice. But the addition of bagasse ash cause reduction in strength of concrete, and to avoid this problem fibers is used. The impact of bagasse ash content as a replacement of cement has been investigated on physical and mechanical properties of high performance concrete. The effect of fibres on mechanical properties of bagasse ash blended with high performance concrete is investigated. The natural and artificial fibres are added to compare the effect on concrete. The replacement of cement with 5% of silica fume, super plasticizer (0.6% to 0.8% by weight of cement) was added to this.The properties of concrete investigated include compressive strength, split tensile strength, flexural strength etc. The properties are tested to compare the strength characteristics. From the result obtained it is clear that the percentage addition of fibers increases the mechanical properties of high performance concrete increases.*

Key Words: Bagasse ash, Polypropylene fibre, Sisal fibres, Fly ash, High-performance concrete.

1. INTRODUCTION

High Performance concrete works out to be economical, even though its initial cost is higher than that of conventional concrete because the use of High Performance concrete in construction enhances the service life of the structure and the structure suffers less damage which would reduce overall costs. Industrial wastes, such as blast furnace slag, fly ash and silica fume are being used as supplementary cement replacement materials. In addition to these, agricultural wastes such as rice husk ash, wheat straw ash, and sugarcane bagasse ash are also being used as pozzolanic materials and hazel nutshell used as cement replacement material. High Performance concrete works out to be economical, even though its initial cost is higher than that of conventional concrete because the use of high Performance concrete in construction enhances the service life of the structure and the structure suffers less damage which would reduce overall costs. The Sugarcane bagasse is partly used as fuel at the sugar mill. Only a few studies have been reported on the use of bagasse ash (BA) as pozzolanic material in respect of cement paste. The impact of bagasse ash content as a replacement of cement has been investigated on physical and mechanical properties of hardened concrete, including compressive strength, splitting tensile strength, chloride diffusion, and resistance to chloride ion penetration (Noor-ul Amin 2011).

The effects of fibres on mechanical properties of bagasse ash blended high performance concrete are evaluated. In the first phase included evaluation of water consistency, initial setting time, and final setting time of bagasse ash blended high performance concrete. In the second phase, studies on concrete specimens were conducted. This included tests on compressive strength, splitting tensile strength.

1.1 OBJECTIVES

1) The effect of various fibres on mechanical properties of bagasse ash blended with high performance concrete
2) Different strength characteristics are studied such as compressive strength, split tensile strength, water absorption, and Sorptivity etc to compare the strength characteristics of different fibres used in the high performance concrete.

2. MATERIALS

Cement: Portland Pozzolana Cement was used for this study. The specific gravity of cement was founded to be 3.16 as per IS 2720-Part3.

Coarse Aggregate: Locally available coarse aggregate having maximum size of 20mm was used. The specific gravity was found to be 2.84.

Manufactured Sand: Manufactured sand is a substitute of river for construction purposes sand produced from hard granite stone by crushing. The size of manufactured sand (M-Sand) is less than 4.75mm.

Admixture: Sikament -170 is used as the super plasticizers, which is a high range water reducing concrete admixture for promoting accelerated hardening and free flowing concrete.

Water: Portable tap water was used for the preparation of specimens and for the curing of specimens.

Bagasse ash: Sugarcane bagasse as obtained as a byproduct of sugar processing may be used as a raw material.

Silica fume: Silica fume is a by product of producing silicon metal or ferrosilicon alloys. The specific gravity of silica fume is taken as 2.2

Fly ash: Fly ash is a by-product of the combustion pulverised coal in electric power generation plants. The specific gravity of fly ash is taken as 2.28.

Sisal fiber: Its fibre is too tough for textiles and fabrics. The colour of this fiber is soft gray ash

Polypropylene fiber: Polypropylene fibres of 6mm diameter, having the specific gravity 0.91 are used.

3. TESTS ON CONCRETE

In order to find out the hardened properties of concrete such as compressive strength 28days, split tensile strength, flexural strength respectively.

3.1 MIXING AND CASTING OF SPECIMENS

The concrete after workability was used for casting test specimens. Moulds were used to cast the specimen. Cement, sand and aggregate were taken in mix proportion 1:1.2:2.2 which correspond to M50 grade of concrete. The maximum size of the aggregate is 20 mm. The cube moulds were used for compression test specimens. The 0.1, 0.2, 0.3, 0.4, and 0.5% of fibres are added to the concrete mix by weight of concrete. The water cement ratio is taken as 0.35. The mixing is done and then placing the concrete in moulds. The dry and wet mixing of all materials is shown in Fig-1.

Fig-1: Mixing of all materials, dry mixing & wet mixing

Each layer was compacted with the standard tamping bar and the strokes of the bar were uniformly distributed across the cross section of the mould. The damping bar of 16mm diameter and 60cm long, the lower end was butted pointer. After the top layer was compacted, the surface of the concrete was finished in level with top of the mould using a trowel. The specimen is demoulded the after 24 hours. Fig-2 shows casted specimens and demoulded specimens.

Fig-2: Casted specimens & Demoulded specimens

4. RESULTS AND DISCUSSIONS

4.1 Compressive strength

For compressive strength test, cube specimens of dimensions 150 x 150 x 150 mm were cast for bagasse ash blended high performance concrete. Superplasticized (0.6% to 0.8% by weight of cement) was added to this. The 0.1%,0.2%, 0.3%, 0.4%, 0.5% of sisal and polypropylene fibres are added to this mix. The Vibration was given to the moulds using table vibrator. The bagasse ash is constant for every mixes. 20% replacement of cement with bagasse gives optimum strength. The twenty eight days compressive strength was determined for every mixes.

Fig-3: Compressive strength test before failure& after failure

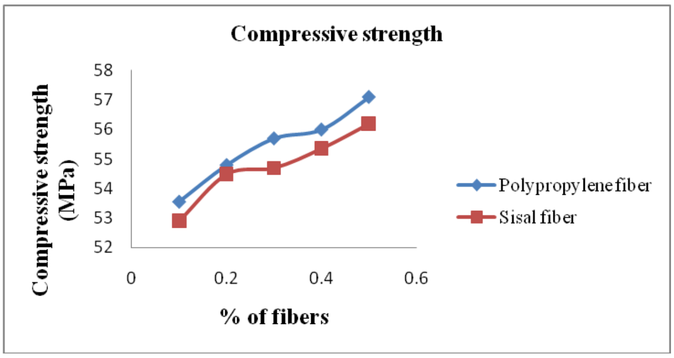

Chart-1: Variation of compressive strength

While using sisal and polypropylene fibers in the concrete the compressive strength goes on increasing. By the addition of fibers in the baggasse ash blended high performance concrete the compressive strength increases with increasing the fibre content.

4.2 Split tensile strength

For Split tensile strength test, cylinder specimens of dimension 150 mm diameter and 300 mm length were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank where in they were allowed to cure for 28 days.

Fig-4: Tensile strength before failure & after failure

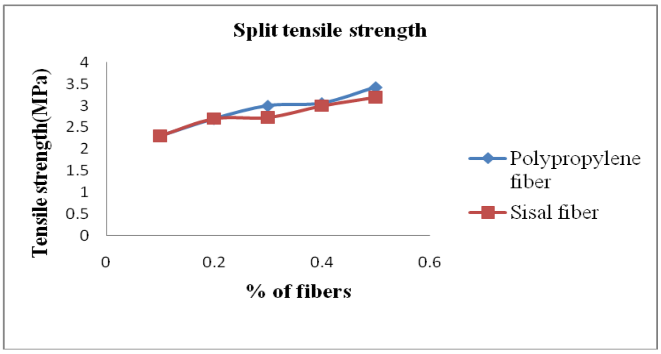

Chart-2: variation of tensile strength

The result shows that the tensile strength of polypropylene and sisal fibre reinforced high performance concrete. To increases the percentage of fibre added to this concrete mix the tensile strength is also goes increasing.

4.3 Flexural strength

For flexural strength test beam specimens of dimension 100x100x500 mm were cast. The specimens were demoulded after 24 hours of casting and were transferred to curing tank where in they were allowed to cure for 28 days.

Fig-5: Flexural strength before failure & after failure

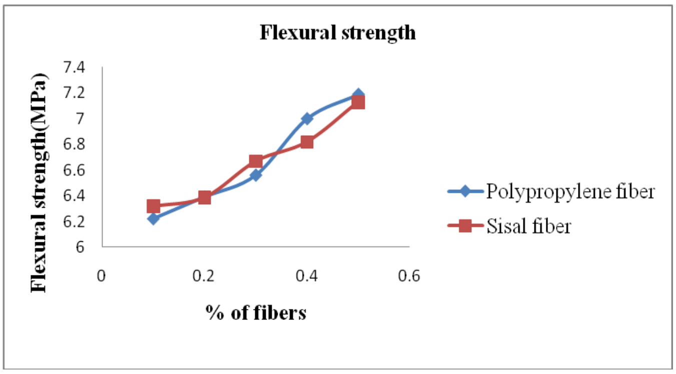

Chart-3: variation of flexural strength

5. CONCLUSIONS

There is a gradual increase in the compressive strength when the percentage of polypropylene and sisal fibers increased. There is a 4% of increase in compressive strength of polypropylene fiber reinforced concrete when compare to normal concrete. 2.3% increase in compressive strength of sisal fiber reinforced concrete when compare to normal mix concrete.

The tensile strength of bagasse ash blended high performance concrete was increased with addition various fibers in the concrete mix. There is a 21.41% increase in the tensile strength of concrete with addition of polypropylene and 14.28% increase in the addition of sisal fibers in the concrete mix.

The flexural strength increases when the percentage of fibers increased. There is a 10.10% increase in flexural strength of concrete with addition of polypropylene fiber and 9.18% increase in the addition of sisal fiber in the concrete mix.

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