

Experimental Study on Sugarcane Bagasse Ash - An Effective Source for Partial Blending with Cement for M40 Grade of Concrete

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ABSTRACT: Concrete is the second largest product on earth after water consumed by human beings. It is used for construction of buildings, bridges, monuments etc. in which cement is key ingredient which contributes the strength. Cement not only binds together the materials but it also contains Bogue's compound which is primary reason in strength of concrete, but recently due to high utilization of cement and its manufacture leads to increase in greenhouse gasses i.e. carbon dioxide. Thus due to increase in CO₂ emission is imperative to control the emission or find an alternative. Therefore use of industrial waste like fly ash, bagasse ash, blast furnace slag are recent search to an alternative to cement. Sugarcane Bagasse Ash (SBA) is agro-industrial waste which has pozzolanic property as possessed by cement. It is replaced with cement partially by the weight of cement for M40 grade of concrete. The replacements were 10%, 20%, 30% and 40%. Specimens are casted for above replacement and tested for compressive strength, split tensile strength and flexure strength.

KEYWORDS: - Sugarcane Bagasse Ash, Polycarboxylic Acid, Sugar Industry, Agricultural Waste.

I. INTRODUCTION

India is second largest country in production of sugarcane after Brazil. It produces tonnes of bagasse after extraction of juice so, bagasse is utilized for generation of electricity in some industries. After burning at 700-800°C it produces Sugarcane Bagasse Ash (SBA). When it is disposed in open environment like land filling small bagasse ash particles is carried along with air and while inhaling it can come in contact of human being and causes various types disease. Thus it is very important to find to find disposal alternative or reutilization of Sugarcane Bagasse Ash. Recent studies on replacement of cement encouraged of sugarcane bagasse ash in concrete. Cement which is produced on large scale for construction purpose. It is main constituent of concrete as it responsible for strength in concrete. Thus manufacturing of cement has led to emission of greenhouse gas i.e. Carbon dioxide. Hence India as developing nation and its urbanization due to rapid growth has led increase in utilization of cement. To reduce dependency on cement producing greenhouse gas industrial waste like SBA is used

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II. MATERIAL AND METHODS

CEMENT: For M40 mix the cement used was Ordinary Portland Cement 53 grade of moderate exposure condition for type II. The mix proportion used for this grade was 1:1.79:3.38. The weight of cement for M40 concrete mix was 414 kg.

FINE AGGREGATE: The fine aggregate used was in the form of crushed sand and they were sieved by passing through 475 mm IS sieve. The specific gravity of fine aggregate was 2.94. Fine aggregate used in concrete mix was available on site

COARSE AGGREGATE: The aggregate used were of size 20 mm and specific gravity was 3.09. Various test performed like abrasion, soundness as it required for calculation of mix design. Also water absorption was considered on site for varying the water/cement ration accordingly. Aggregate used which available on site.

WATER: water used which was available on site and satisfied the specification required for the preparing the concrete mix water was 0.38 for M40 grade of concrete and various according to the site conditions.

SUGARCANE BAGASSE ASH (SBA): The Sugarcane Bagasse after burning at 800°C to 1200°C produces Ash. The sugarcane Bagasse ash having higher silica content helps in reduction of carbon dioxide emission from concrete. After removing moisture it mixed with cement thoroughly at 10%, 20%, 30% and 40% replacement respectively. The ash was in black colour so it required less amount of admixture due contain of sugar in it.

CHEMICAL ADMIXTURE: Polycarboxylic acid is partially depolymerized lignin as curing agent through base catalysed depolymerization (BCD) lignin based polycarboxylic acid was a soft solid, glycerol tris (GTA) temperature was also synthesized and used as a curing agent. Dynamic mechanical properties and thermal stability of a cured epoxy resin where examined using Dynamic Mechanical analysis comparable Hexa-hydrophthalic anhydride (HHPA) cured resin could be greatly regulated by using GTA and HHPA as curing agent.

III. INVESTIGATIONAL DETAILS

This study consist of casting and testing of cubes, cylinders and beams which were 45, 30 and 30 in numbers respectively. The size of specimen used were 150x150x150 mm for cube, 150x300 mm for cylinder and 150x150x700 mm for beam. The mix design was carried out by using IS 10262:2009 for M40 grade concrete. For mix proportion water/cement ratio taken as 0.38. The mix proportion used for 1 m³ concrete was 1:1.79:3.38. Hand compaction and vibrator was used for compacting of specimen. The moulds were removed 24hr after the casting and kept for curing for 7days, 28days and 90days for cube and 28days, 90days for cylinders and beams.

Compression Testing Machine (CTM) having 2000 KN capacity was used for cubes and Universal Testing Machine (UTM) having capacity 600 KN capacity was used for cylinders and beams.



Fig -1: Showing Casting of Cube

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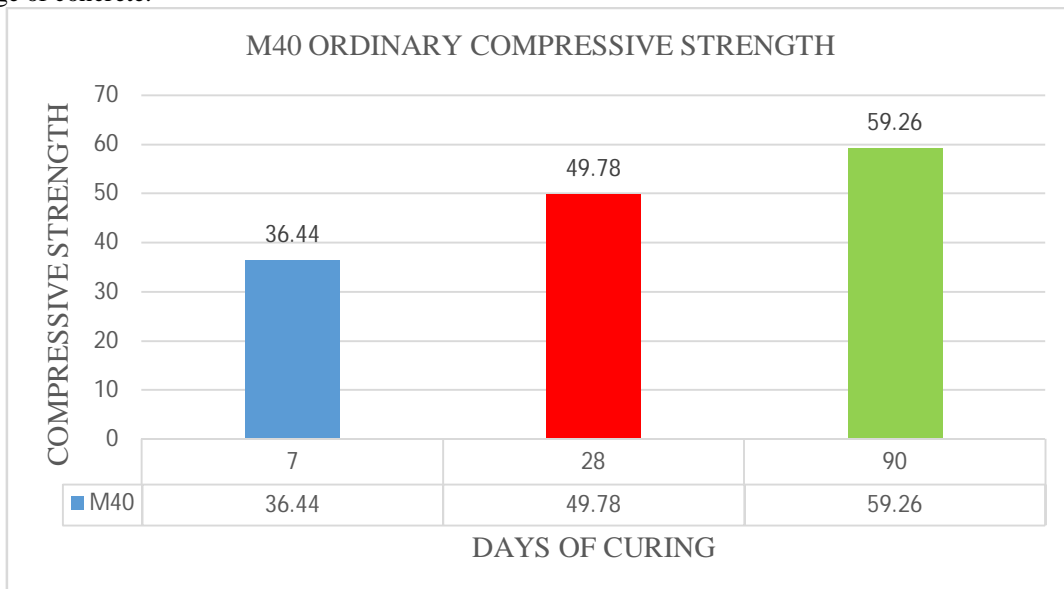
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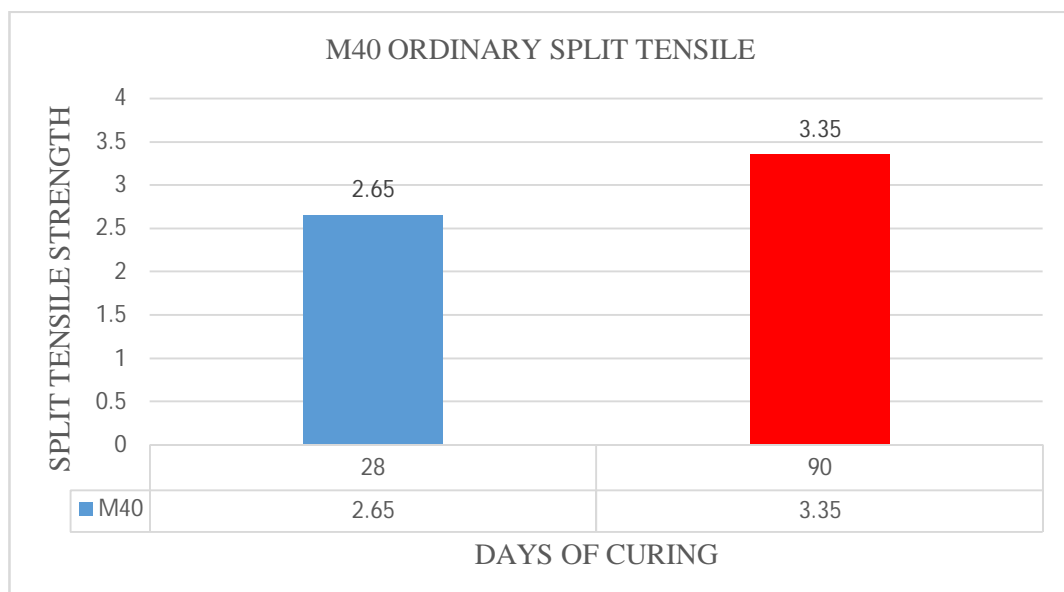
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IV. RESULTS AND DISCUSSIONS

After the casting, tests were conducted on the specimens containing M40 grade of concrete which were replaced by 10%, 20%, 30% and 40% of SBA with cement. The optimum replacement percentage for SBA which increased strength was 10%. It was also seen that replacement can be done till 20% without reduce in strength of concrete. It was observed that for split tensile strength was reduced for 90 days with respect to 28 days. Flexural strength also increases in later age of concrete.



Graph No.3.1: Showing Results of Ordinary M40 Grade Concrete for Compressive Strength



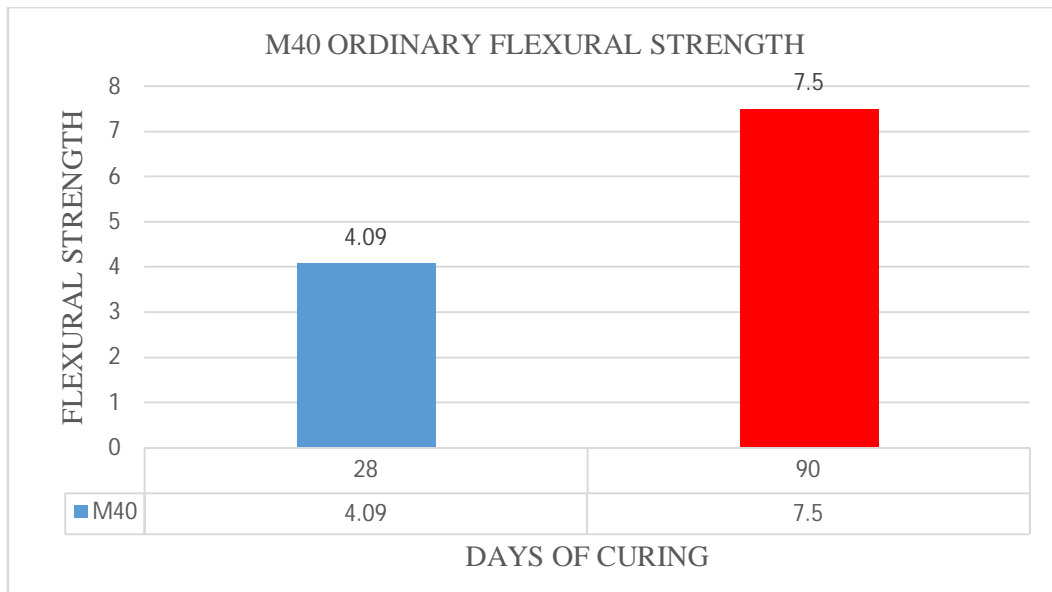
Graph No.3.2: Showing Results of Ordinary M40 Grade Concrete for Split Tensile Strength

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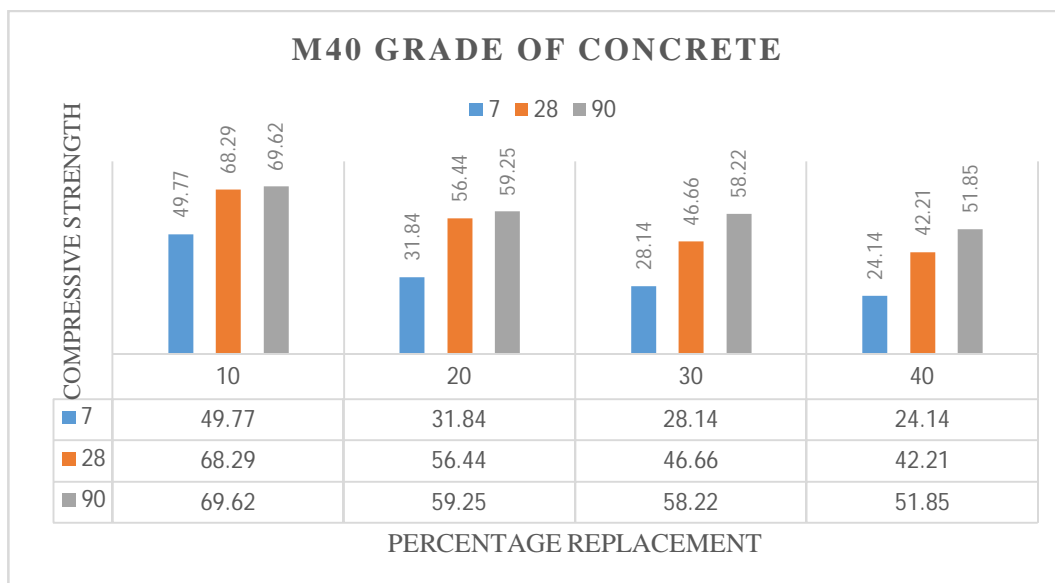
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Graph No.3.3: Showing Results of Ordinary M40 Grade Concrete for Flexural Strength



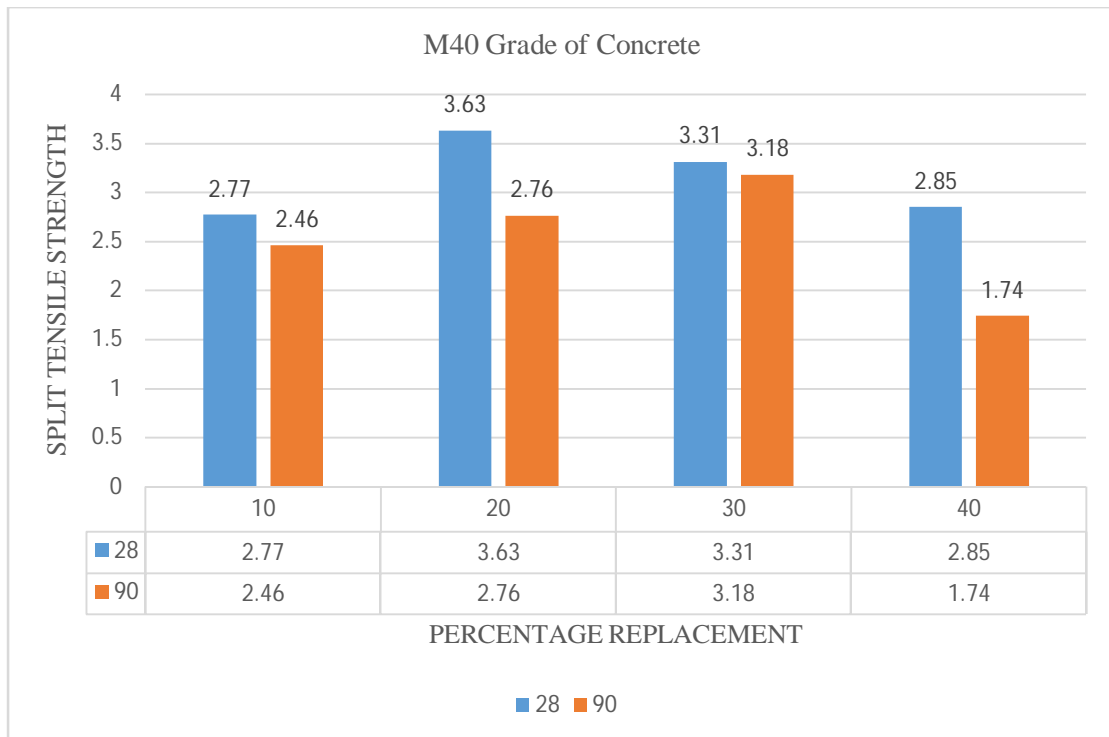
Graph No.3.4: Showing Results of M40 grade Concrete for Compressive Strength

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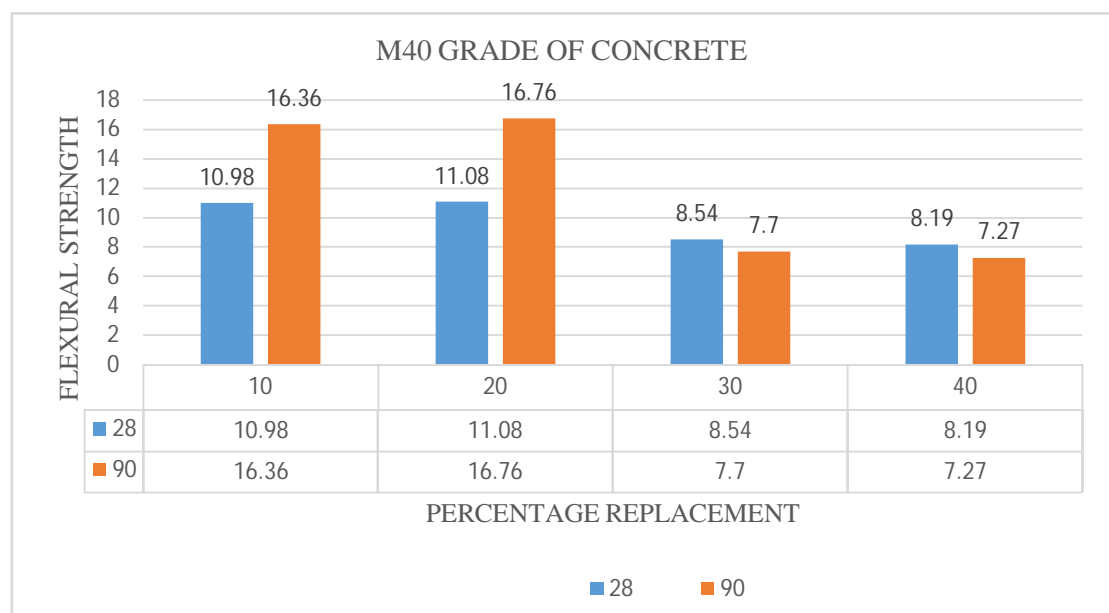
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Graph No.3.5: Showing Results of M40 Grade Concrete for Split Tensile Strength



Graph No.3.6: Showing Results of M40 Grade Concrete for Flexural Strength

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V. CONCLUSIONS

Replacement of Sugarcane Bagasse Ash (SBA) in concrete was done in 10%, 20% 30% & 40% by the weight of cement in M40 grade concrete in this experimental work in which various values of compressive strength, split tensile and flexural test results were obtained. The strength increased in concrete was when compared to ordinary concrete. The compressive strength was achieved at early days of curing which was at 7th day itself when it was compared with ordinary one. The compressive strength results specified that replacement of SBA with cement can be done at 10% replacement. The split tensile strength noted was less due to use of artificial sand in concrete which possess brittle property leading to early breaking point. Use of SBA in concrete reduces the CO₂ emission in atmosphere which concludes that it is ecofriendly material. As the workability increases in concrete after addition of SBA therefore use of super plasticizer can be avoided. Usage of SBA also reduces disposal problem of Sugarcane Bagasse in environment. It also reduces the density of concrete as the SBA density is less than cement.

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