Evaluation of Variation in Properties of Concrete By Sugarcane Ash Additive

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DOI: 10.29322/IJSRP.9.03.2019.p8732
http://dx.doi.org/10.29322/IJSRP.9.03.2019.p8732

Abstract- Today construction cost is very high with using basic material like cement, fine aggregate, coarse aggregate. This study include use of waste material as a partial replacement of cement and aggregate. This paper represent the experimental investigation on the effect of sugar cane ash on the compressive strength of concrete. Alternate binder Sugarcane Ash is used as eco-friendly pozzolanic material due to increasing demand of consumption of concrete. The use of these materials may give good, efficient, durable and cost effective construction material resources lead to pollution free environment. In this paper sugar cane ash has been replaced in the ratio of 0%, 5%, 10%, 15%, 20% and 25% by weight of cement in concrete. The outcome of this work indicates that maximum strength of concrete could be attained at 10% replacement of cement with Sugarcane ash in M20 grade concrete and 15% replacement of cement with Sugarcane ash in M25& M30 grade concrete.

Index Terms- Sugar cane Ash, Portland cement, Fine Aggregate, Coarse Aggregates.

I. INTRODUCTION

Now a day its big problem to disposal of waste material due to negative effects of waste. To overcome this problem in concruction industry sugarcane ash(fibrous material obtained after removal of sugar, water and other impurities from the sugarcane) is used pozzolanic material by replace of cement in concrete. Cement having large amount of silica alumina and lime. The amount of cement in construction industry is extensively used. In 1980, there has been an heigher demand of the mineral admixture and in future this demand is to be increase even more[1] by replacing the cement with mineral admixture to increase workability and compressive strength.[5]. The sugarcane ash waste byproduct can be used as mineral admixture due to its high content in silica (SiO_2)[3] which have similar composition can be replaced by weight of cement in concrete then cost could be reduced without changing its quality [2]. Sugarcane ash is one of the main resource for the sugar production after juice extraction from Sugarcane, Sugarcane bagasse waste obtained which on burning give sugarcane ash. This Sugarcane ash creates the environmental pollution due to direct disposal on the open lands and forms garbage in excess that area[4]. Due to pozzolanic activity and their suitability as binders it is partially replace cement[6]. Overcome the environmental effects of waste with disposal at land then Sugar cane ash is used in concrete as cement replacement materials it also reduce the cost of concrete. Silica fume, rice husk ash, fly ash, and ground granulated blast furnace slag are good established wastes material with pozzolans because of high silica content in their chemical compositions. According to Sirirat and Supaporn during the hydration of Cement calcium hydroxide released which reacts with SiO_2 present in the sugarcane ash and water to form additional calcium silicate hydrate which is responsible for the compressive strength in concrete[7].

The study have been carried out on the ashes obtained sugar industries provide an environmental solution for uncontrolled disposal of ash and study pozzolanic activity, supplementry cementitios material, as binders. Bagasse ash is used mainly for land-fill and as filler for building materials. The Sugarcane bagasses ash contains high amounts of un-burnt matter, silicon, aluminum and calcium oxides[8,9].

II. MATERIAL & METHODOLOGY:

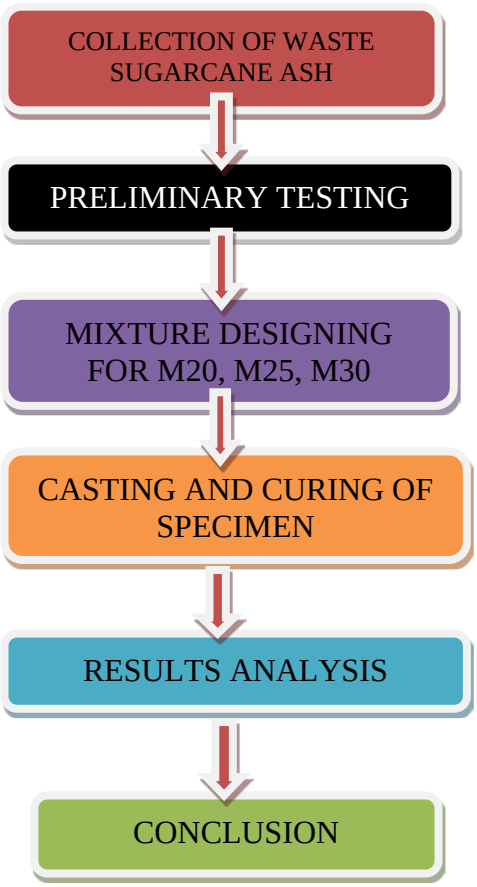
The materials used in these investigations are:

1. Cement & Aggregate: The Cement of 43 grade and Fine aggregate particles of 10mm and 20mm used.

2. Water: Water is used in the site campus acording to the requirements of water for concreting and curing as per IS:456-2000[10].

3. Sugarcane Bagasse Ash: The bagasse ash was sieved through No. 600 sieve**.** The sugarcane bagasse consists of approximately 52% of cellulose, 24% of hemicellulose & 26% of lignin. Each ton of sugarcane produces approximately 26.5% of bagasse. In this, sugarcane bagasse ash was collected during the cleaning operation of a boiler operating in the Siddhi Sugar & allied industries, Ujana located in the city of Latur, Maharashtra.

III. METHODOLOGY



EXPERIMENTAL PROGRAM:

Concrete mixing and casting: A total of 6 concrete mixes were prepared, one of the mixes was made of 100% cement (0% Sugaecane ash), called the reference mix. The remaining 5 mixes were prepared by adding Sugarcane ash content as partial replacement to cement i.e. 5, 10, 15, 20, 25%. The mix design of concrete was done according to Indian Standard guidelines[11]. The compressive test was conducted using a compression testing machine of 2000kN capacity. This test was conducted as per the relevant Indian Standard specifications [12-13]. The strength results obtained from the experimental investigations are showed in Table. All the values are the average of the three trails in each case in the testing program of this study. The results are discussed as follows.

IV. RESULTS AND DISCUSSION

Table and Figure below shows the compressive strength of all 6 mixes determined at the age of 7 and 28 days. At all ages, four mixes containing 5, 10, 15, 20 and 25% respectively Sugarcane ash showed change in compressive strength than the reference mix, mixes at 10 and 15% Sugarcane ash showed good pozzolanic reactivity and incresed compressive strength at 7 day and 28 days.

Table-1: Compressive strength of M20 concrete at 7 Days and 28 Days at different percentage of Sugarcane ash

S. No.	**%** (Admixtures)	**7 days Compressive Strength (MPa)**	**28 days Compressive Strength (MPa)**
1	0	20.33	28.45
2	5	20.82	26.22
3	10	21.75	29.50
4	15	19.56	27.66

5	20	18.33	26.15
6	25	18.00	25.50

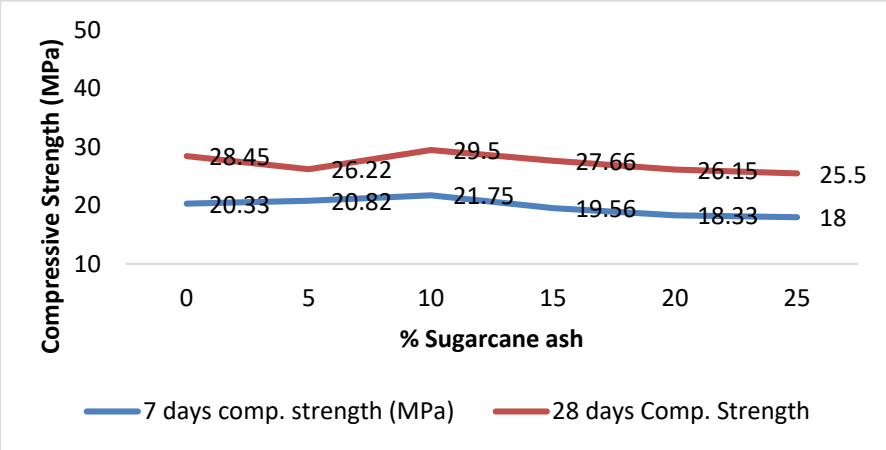


Fig .1 Variation of Compressive strength of M20 concrete at 7 Days and 28 Days at different percentage of Sugarcane ash

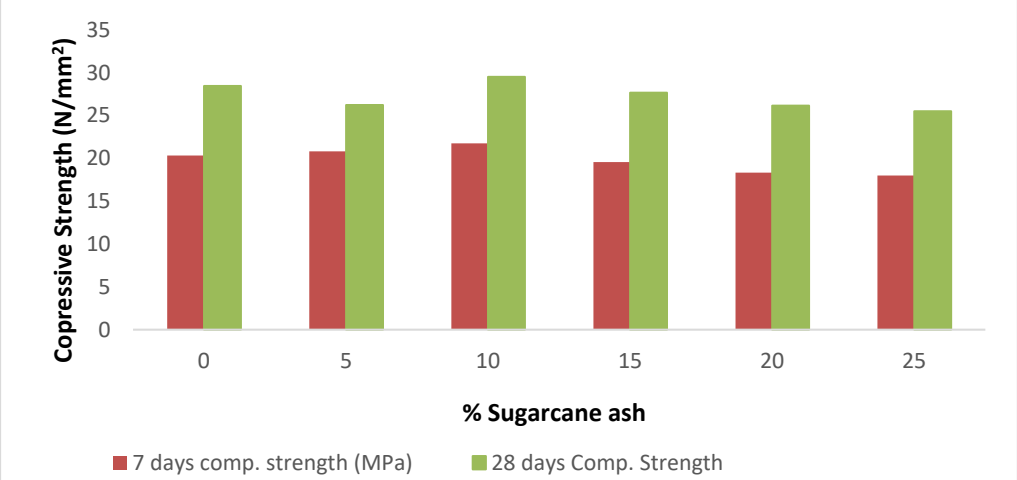


Fig .2 Relationship between Portland Clinker Replacing with Percentage of Sugarcane Ash in Compressive Strength of M20 Grade Concrete

Table-2: Compressive strength of M25 concrete at 7 Days and 28 Days at different percentage of Sugarcane ash

S. No.	**%** (Admixtures)	**7 days Compressive Strength (MPa)**	**28 days Compressive Strength (MPa)**
1	0	25.68	36.36
2	5	24.75	35.55
3	10	25.22	36.98
4	15	26.50	37.33
5	20	24.12	34.56
6	25	23.27	31.75

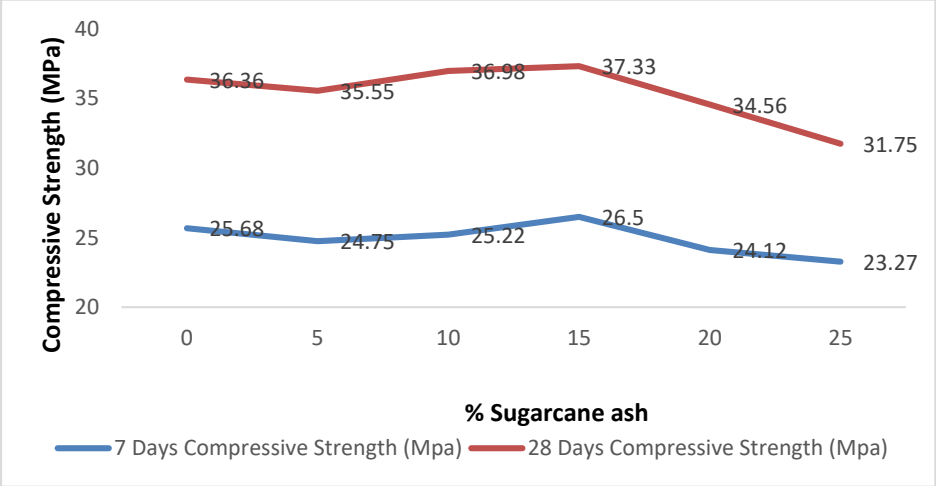


Fig .3 Variation of compressive strength for M25 Grade of concrete at different percentage Sugar cane ash

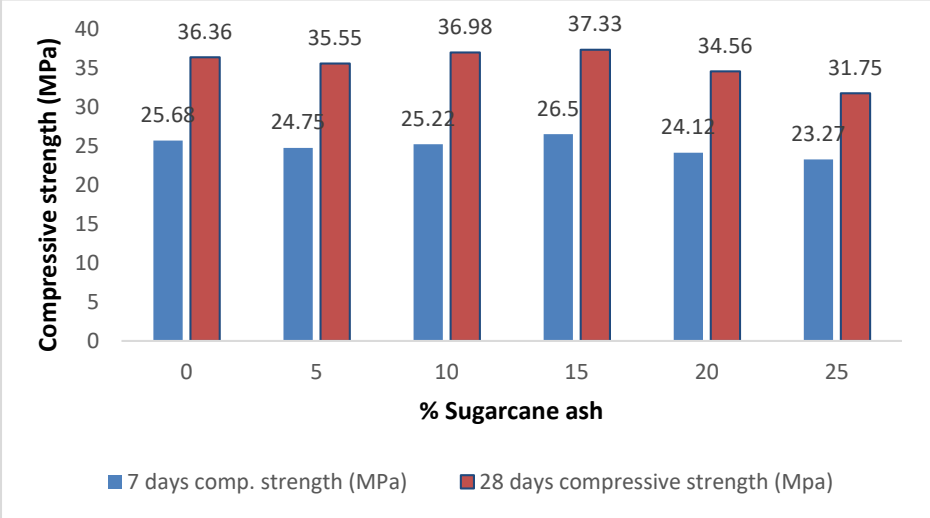


Fig .4 Compressive strength development of M25 concrete at 7 Days and 28 Days at different percentage of Sugar cane ash

Table-3: Compressive strength of M30 concrete at 7 Days and 28 Days at different percentage of Sugarcane ash

S. No.	% (Admixtures)	7 days Compressive Strength (MPa)	28 days Compressive Strength (MPa)
1	0	30.38	40.39
2	5	29.83	39.61
3	10	30.81	40.64
4	15	31.83	42.14
5	20	27.96	38.96
6	25	25.65	35.5

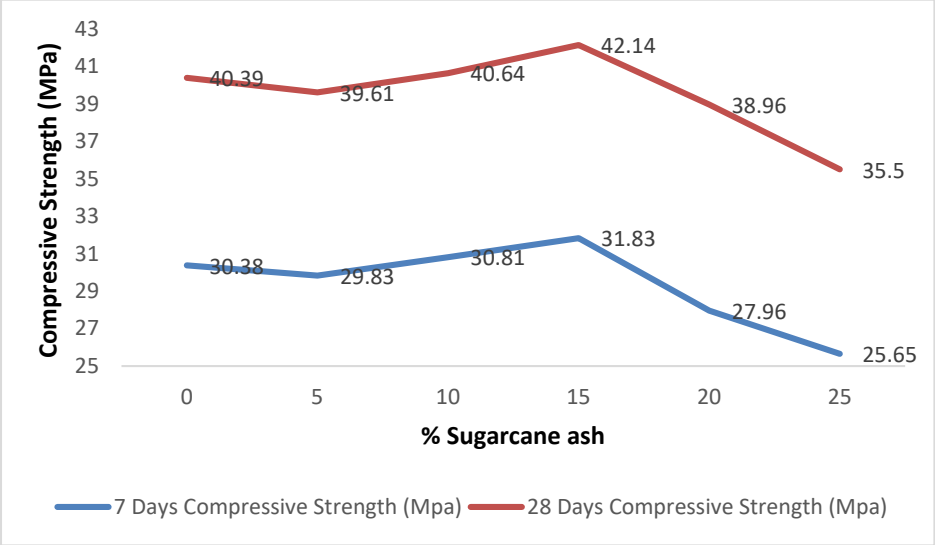


Fig .5 Variations in Compressive strength of M30 concrete at 7 Days and 28 days at different percentage of Sugarcane ash

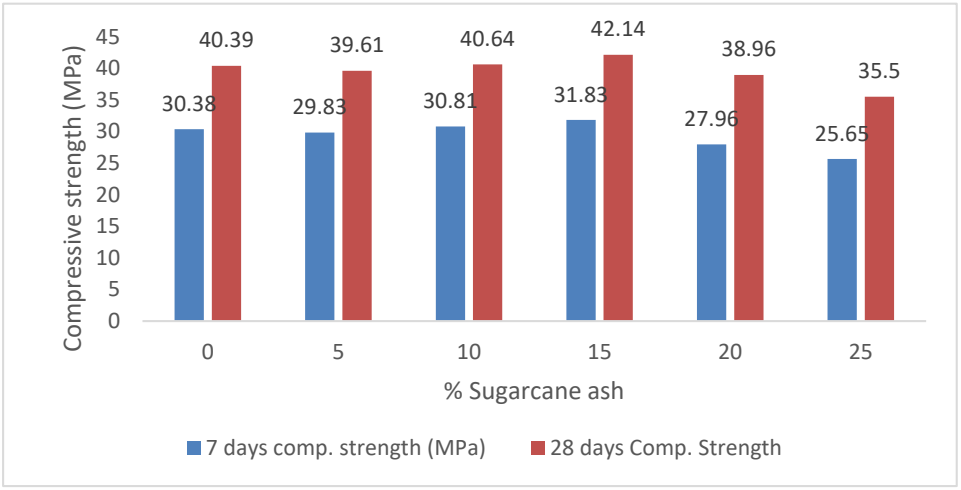


Fig .6 Compressive strength development of M30 concrete at 7 Days and 28 Days at different percentage of Sugarcane ash

V. CONCLUSION

In accordance with the presented results, it is possible to conclude that:

- Compressive strength of concrete has been successfully increased by adding Sugar cane ash. Results confirm that higher strength can be obtained by the optimal level of 15.0% replacement of cement by Sugarcane ash content.
- The use of Sugar cane ash lead to pollution free environment.
    - Sugarcane ash has shown good pozzolanic reactivity due to presence of high silica content.

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