"PARTIAL REPLACEMENT OF CEMENT IN CONCRETE WITH SUGARCANE BAGASSE ASH"

Akhilesh Jangade , Kajal Vaishnav , Pallavi Chandrakr , Novita Janghel , Mayank Dubey , Rahul Yadav , Shashikala Sahu , Graduate Student Civil Engineering Department , Raipur Institute Of Technology, Raipur,
Madhu Sahu : Assistant Professor , Civil Engineering Department , , Raipur Institute Of Technology, Raipur,(C.G.)

ABSTRACT

Cement production is held responsible of polluting the atmosphere with carbon dioxide (CO2). The researchers have shown that manufacturing of one ton of cement releases about half ton of carbon dioxide into the atmosphere. So, there is a need to produce alternative cement instead of ordinary Portland cement (OPC). Waste materials such as sugarcane bagasse are difficult to dispose which result in environmental hazard. The Bagasse ash imparts high early strength to concrete and also reduce the permeability of concrete. The Silica present in the Bagasse ash reacts with components of cement during hydration and imparts additional properties such as chloride resistance, corrosion resistance etc. Therefore the use of Bagasse ash in concrete not only reduces the environmental pollution but also enhances the properties of concrete and also reduces the cost. This study investigates the use of sugarcane wastes in concrete, where two forms of sugarcane wastes were used in this study. The first form was using the sugarcane bagasse ash as partial replacement of cement in both mortar and concrete mixes, where, in mortar, the used ratios were 5, 10, and 20% of the total weight of cement. But in concrete, the used ratios were 5%, 10%, and 15%. The samples were tested in compression and split tension. The results showed that the optimum ratio of using sugarcane bagasse ash as a partial replacement of cement was 5%. Similar results were obtained in both mortar and concrete sample. For the bagasse fiber, adding the fiber to the concrete mixture led to the reduction of compressive strength. But on the other hand, the addition of bagasse fires reduced the crack width formed in the slab.

Key Word Sugarcane Bagasse Ash, Expensive, Communities

INTRODUCTION

Concrete is typically an enormous individual material element in built environment. If the concrete can be reduces without decreasing the performance or increasing the cost, significant environmental and economical benefits may be realized. Concrete mainly comprises of Portland cement, sand, aggregate and water. Sugarcane bagasse ash is cementations material that can act as a partial replacement for Portland cement without significantly compromising that compressive strength. SCBA is a byproduct of sugar factories found after burning sugarcane bagasse. Sugarcane is one of the major crops grown in 110 country and its total production is over 1500 million tons. India itself produces 300 million tons of sugarcane per year it causes about 30% of sugarcane bagasse and 8 to 10% of bagasse ash. The amount of silica present in a bagasse reacts with component of cement and not only reduce the environmental pollution but also enhance the properties of cement.

The component of SCBA contain Sio2 66.89%, Al2O3 29.18%, CaO 1.92%, Mgo 0.83% with can be used as an alternative source to replace cement by SCBA partially. Concrete property will maintained with the advance mineral and mixture such as SCBA powder and partial replacement of cement 0%, 10%, 20% and 30% .Compressive strength of SCBA concrete with different dosage of SCBA was studied as a partial replacement of cement. Environmental sustainability is at steak both in terms of damage caused by the extraction of raw material and Co2 emission during cement manufacture. This brought presser on the researcher for the reduction of cement consumption by partial replacement of cement by supplementary material which is naturally occurring, industrial waste or by product that are less energy intensive.

From the structural point of view, when cement is replace by SCBA, lower heat of hydration and higher obstructed to sulphate and chloride intrusion. Lately some attention has been given to the use of natural pozzolonas like SCBA as partial replacement of cement. The various methods use to improve the durability of concrete, and to achieve high performance concrete, the use of SCBA is relatively new approach. The present paper focus on the investigating characteristics of M20 grade concrete with partial replacement of cement with SCBA by replacing cement 0%,10%,20% and 30% . the cubes and cylinder are tested for compressive strength and split tensile strength respectively.

SCOPE OF THE WORK:

The of the present work is to carry out a detailed analysis of the following sub-systems for the prescribed conditions

1. Concrete mix design for M35grade of concrete
2. Casting of concrete cubes of M35 grade of concrete with different percentages of SUGARCANE BAGASSE ASH (0%, 5%, 10%, 15%, 20%, 25%)
3. Cubes are subjected to normal & HCL curing.
4. Testing of specimens at various ages.
5. Plotting graphs and comparing the compressive strengths of sugarcane bagasse ash blended concrete cubes in normal and HCl curing.

conditions and other properties of the raw materials including the soil on which the sugarcane is grown, it has been reported that the silicate undergoes a pozzolonas reaction with the hydration products of the cement and results in a reduction of the free lime in the concrete.

LITERATURE REVIEW

M.Vijaya Sekhar Reddy, I.V.Ramana Reddy, December 2012 studied the behaviour of High Performance Concrete (HPC) which is being the most used type of concrete in the construction industry. They replaced cement with Supplementary cementing materials (SCM) like fly ash, silica fume and metakaolin. The mix design adopted was M60, cubes were casted and cured for 90 days in 5% HCl(PH=2), NaOH, MgSo4 and Na2So4.

They concluded that there was a considerable increase in service life of the concrete structures and reduction in heat of hydration by using the supplementary cementing materials in concrete. They observed the maximum and minimum percentage of reduction in strength of concrete when concrete was replaced with fly ash were 12.64% and 1.92%.

Dr. P. Srinivasa Rao et al., studied the durability characteristics of metakaolin blended concrete by adopting M20 grade of concrete. An attempt was made with H2So4 and HCl. Steel fibres with 60 as aspect ratio at 0%, 0.5%, 1.0%, and 1.5% of volume of concrete are used. They concluded that the percentage weight loss was reduced and compressive strength was increased in the case of fibre reinforced concrete and concrete containing 10% metakaolin replaced by weight of cement when compared to concrete and the percentage weight loss was less when immersed in HCl and H2So4.

P. Murthi and V. Siva Kumar 2008 studied the resistance of acid attack of ternary blended concrete by immersing the cubes for 32 weeks in sulphuric acid and hydrochloric acid solutions. Binary blended concrete was developed using 20% class F fly ash and ternary blended concrete was developed using 20% fly ash and 8% silica fume by weight of cement.

They concluded that the ternary blended concrete was performing better that the ordinary plain concrete and binary blended concrete. They observed that the mass loss for 28 and 90 days of M20 PCC specimens were 19.6% and 16.1% respectively. They also observed that the time taken for reduction of 10% mass loss when immersed in 5% H2So4 and 5% HCl solutions was 32 weeks.

METHODOLOGY

This experimental work was adopted to determine the fresh (workability) and mechanical properties (compressive and splitting tensile strength) of concrete blended with various proportions such as 0%, 5%, 10%, 15% and 20% of sugarcane bagasse ash as partial replaced of cement in concrete. For this investigational study, two types of standard concrete samples (100x100x100 mm cube and 200x100mm cylinder) both types of samples were cured after 7 and 28 days. In this regard, for each curing days, three concrete cubes were tested for compressive strength and three cylinders used for indirect tensile strength of concrete on a universal testing machine (UTM). Finally, the average value for all three samples at each ratio was taken as the final result of a particular test.

OBERAVATION TABLE

Days	Normal cube strength (N/mm2)	Mixed cube		Compressive Strength Of Mixed Cube (N/Mm2)
		% SCBA	% FA	
7DAYS	26.6	20%	5%	17.66
		20%	10%	18.00
		20%	15%	16.32
14DAYS	30	20%	5%	20.00
		20%	10%	21.16
		20%	15%	22.40
28DAYS	40	20%	5%	25.11

		20%	10%	30.22
		20%	15%	27.77

RESULT AND DISCUSSION

The compressive strength of the concrete mixes obtained after 7, 14 and 28 days of curing are finished. Three cubes of each curing were tested and average of results were noted. It is found that the replacement of cement by SCBA & FA will achieve their target mean strength in all age. The comparison of result of compressive strength using cube specimen of M20 grade of concrete for different percentage of SCBA & FA. Target mean strength of M20 was 26.6 N/mm2.20% SCBA & 10% FA gives 30.22N/mm2 compressive strength. It is seen that increase in percentage of SCBA & FA, percentage of water requirement will also be increase

CONCLUSION

This research was successfully carried out, to the establishment of SCBA as an alternative cement replacement material in concrete. After the detailed investigation the following conclusions have been drawn.

• SCBA in concrete gives the higher compressive strength as compared to the normal strength concrete, hence optimal results were found at the 5% 10% and 15% replacement of cement with SCBA. • The usage of SCBA in concrete is not only a waste-minimizing technique; also it saves the amount of cement.

• The replacement of cement with SCBA increases the workability of fresh concrete; therefore, use of super-plasticizer is not essential.

• It is recommended that future research should be performed to assess the use of SCBA in concrete for several properties of concrete for example modulus of elasticity, flexure test, split tensile test, drying shrinkage etc.

REFERENCES

1. M.Vijaya Sekhar Reddy, I.V.Ramana Reddy, "Studies on durability characteristics Of high performance concrete" International journal of advanced scientific and technical research, issue 2 volume 6, December 2012 ISS 2249-9954. 2. Dr. P. Srinivasa Rao et al., "Durability studies on steel fibre reinforced metakaolin blended concrete".

3. P. Murthi and V. Siva Kumar, "Studies on Acid Resistance of Ternary Blended concrete", Asia journal of civil engineering (building and housing) Vol.9, No.5 (2008).

4. A.K. Al-Tamimi and M. Sonebi, "Assessment of self-Compacting Concrete immersed In Acidic Solutions".

5. B.Madhusudhana Reddy et al., "Effect of Hydrochloric Acid on Blended cement and silica fume blended cement and their concretes", International journal of science and technology volume 1 no. 9, September, 2012

6. Beulah M. Asst Professor, Prahallada M. C. Professor, "Effect of replacement of cement by metakaolin on the properties of high performance concrete subjected to hydrochloric acid attack", IJERA ISSN: 2248-9622 vol.2, Issue 6, NOV-DEC 2012, pp.033-038.

7. G. Siva Kumar et al., "Preparation of Bio-Cement using SCBH and its Hydration Behaviour".

8. H.S Otuoze et al., "Characterization of SCBH and ordinary Portland cement blends in concrete".

9. Mr. Lavanya M.R et al., "An Experimental study on the compressive strength of concrete by partial replacement of cement with SCBA".

10. R.Srinivasan et al., "Experimental study on bagasse ash in concrete".

11. U.R.Kawade et al., "Effect of use of bagasse ash on strength of concrete", International journal of innovative research in science, Engineering and technology.(July 2013)

12. Lourdes M.S Souza et al., "Hydration study of SCBA and Calcium Hydroxide pastes of various initial C/S ratios".

13.Abdolkarim Abbasi and Amin Zargar," Using Bagasse Ash in Concrete as Pozzolana".

14. Piyanut Muangtong et al., "Effect of Fine Bagasse Ash on Workability and Compressive Strength of Mortars".

15. Asma Abd Elhameed Hussein et al., "Compressive Strength and Microstructure of Sugar Cane Bagasse Ash Concrete".