Effect of use of Sugarcane Bagasse Ash by partial replacement of Cement in Concrete

[1]Mr.Amit Kumar Sahu , [2] Mr. Jagadish Mallick
[1] P.G. student Parala Maharaja Engineering College, Brahmapur
[2] Assistant Professor, Department of Civil Engineering , Parala Maharaja Engineering College, Brahmapur.

Abstract:

The composition of concrete is cement, aggregate and water. With time and use of technology, the scientists discovered the benefits that came with use of admixtures in the concrete production. This project focuses on how Sugar Cane Bagasse Ash (SCBA) can be used to replace cement partially in order to improve the performance of concrete. Recycling of waste construction materials saves natural resources, saves energy, reduces solid waste, reduces air and water pollutants and reduces greenhouse gases. In addition to this, the effective use of recycled waste will act as a substitute for the materials that are conventionally purchased new and by adopting a policy such as this will be able to reduce the cost materials, save energy and help conserve resources. This will also lead to the possibility of reducing costs for companies, even though they will have to pay for the recycled materials. 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.

Key words: Sugarcane Bagasse ash (SCBA), Compressive strength, partial replacement, Greenhouse gases, Hydration.

INTRODUCTION

Ordinary Portland cement is recognized as a major construction material throughout the world. The environmental problem will most likely be increased due to exponential demand of Portland cement. Researchers all over the world today are focusing on ways of utilizing either industrial or agricultural waste, as a source of raw materials for industry. The present study was carried out on SCBA obtained by combustion of sugarcane bagasse. This paper analyses the effect of SCBA in concrete by partial replacement of cement at the ratio of 0%, 5 %, 10%, 15%, 20% and 25% by weight. After mixing, concrete specimens were casted and subsequently all test specimens were cured in water at 7 and 28 Days.

RELATED WORKS

I. G. Nithin Kumar Reddy, G. Harsha Vardhan, S. Vijaya Bhaskar Reddy(2016) gives the partial replacement of cement in concrete with sugarcane bagasse ash and its behaviour in aggressive environments.This study deals with the replacement of cement with Bagasse ash in fixed proportions and analysing the effect of magnesium sulphate on SCBA blended concrete. The Bagasse ash imparts high early strength to concrete and also reduce the permeability of concrete.

II. M.Sambasiva Rao, T.Yaswanth Sai, Vyshnavi Sai ,GVLN Murthy (2015), gives an experimental study on strength properties of concrete by partially replacing cement with sugarcane bagasse ash. Sugarcane bagasse ash (SCBA) is one of the main byproduct can be used as mineral admixture due to its high content in silica (Sio2). This study investigates the strength performance of concrete using partial blends of Ordinary Portland cement 53 grade (kcp) cement, fine aggregate conforming to zone-III.

III. G.C.Cordeiro, R.D.Toledo Filho, L.M. Tavares,E.M.R. Fairbairn(2008) researched about the pozzolanic activity and filler effect of sugar cane bagasse ash in Portland cement and lime mortar. These improvements are associated to physical or chemical effects. This work investigates the pozzolanic and filler effects of a residual SCBA in mortars. Initially, the influence of particle size of SCBA on the packing density, pozzolanic activity of SCBA and compressive strength of mortars was

analyzed. In addition, the behavior of SCBA was compared to that of an insoluble material of the same packing density. The results indicate that SCBA may be classified as a pozzolanic material, but that its activity depends significantly on its particle size and fineness.

IV. K.Ganesan, K. Rajagopal, K. Thangavel(2007) evaluated bagasse ash as supplementary cementitious material. In this study, the effects of BA content as partial replacementof cement on physical and mechanical properties of hardened concrete are reported. The properties of concrete investigated include compressivestrength, splitting tensile strength, water absorption, permeability characteristics, chloride diffusion and resistance to chlorideion penetration. The test results indicate that BA is an effective mineral admixture, with 20% as optimal replacement ratio of cement.

V. Ajay Goyal, HATTORI Kunio, OGATA Hidehiko, Mandula(2006) properties and reactivity of sugarcane bagasse ash. This is used as a fuel to fire furnaces in the same sugar mill that yields about 8-10% ashes containing high amounts of un-burnt matter, silicon, aluminum, iron and calcium oxides.

EXPERIMENTAL INVESTIGATION

In this experimental work, a total of 36 numbers of concrete specimens were casted. The standard size of cube 150mm×150mm×150mm is used. The mix design of concrete was done according to Indian Standard guidelines for M_{20} grade. Based upon the quantities of ingredient of the mixes, the quantities of SCBA for 0%, 5 %, 10%, 15%, 20% and 25% replacement by weight were estimated. The ingredients of concrete were thoroughly mixed in mixer machine till uniform thoroughly consistency was achieved. Before casting, machine oil was smeared on the inner surfaces of the cast iron mould. Concrete was poured into the mould and compacted thoroughly using table vibrator. The top surface was finished by means of a trowel. The specimens were removed from the mould after 24h and then cured under water for a period of 7 and 28 days. The specimens were taken out from the curing tank just prior to the test. The compressive test was conducted using a 2000kNcapacity compression testing machine.

EXPERIMENTAL RESULTS

The strength results obtained from the experimental investigations are showed in tables. 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.

Table-1: Compressive Strength 7 and 28 Days (M_{20})

Mix	**% of SCBA**	**7 Days compressive strength** (MPa)	**28 Days compressive strength** (MPa)
M_0	0	18.55	20.12
M_1	5	20.98	21.14
M_2	10	21.12	21.93
M_3	15	15.18	18.98
M_4	20	11.11	14.28
M_5	25	8.23	10.16

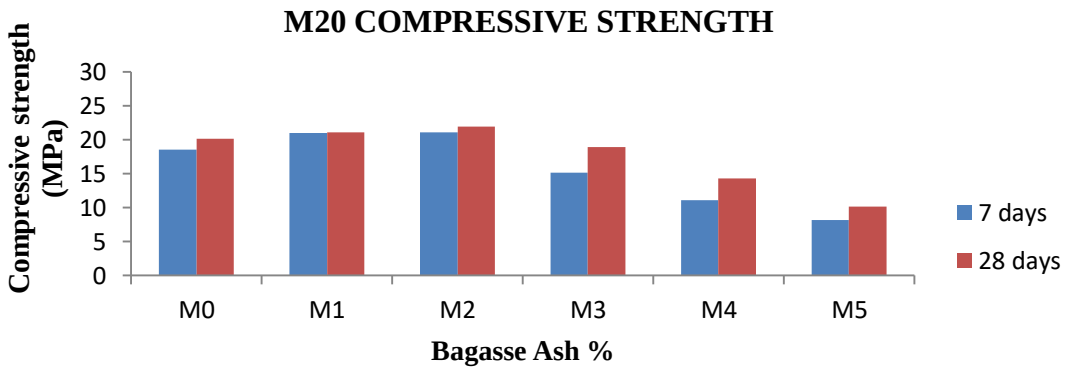

Figure 1: Compressive Strength 7 and 28 Days (M_{20})

Table-2: Slump value of different % replacement of cement

Mix	% Replacement of cement	Slump value in mm
M_0	0	79
M_1	5	74
M_2	10	70
M_3	15	57
M_4	20	30
M_5	25	29

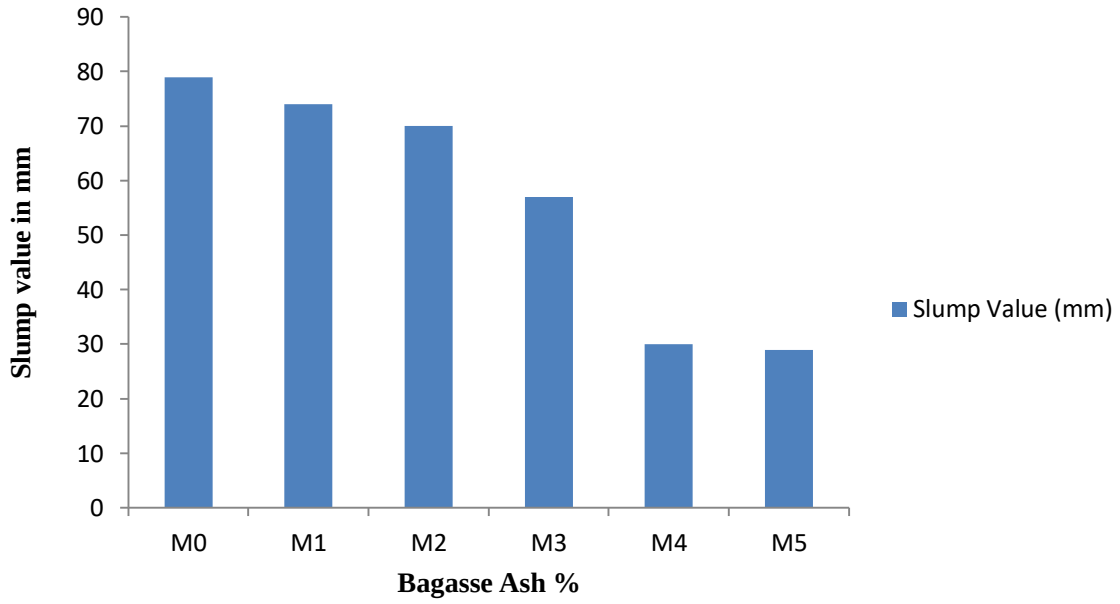

Figure 2: Slump value of different % replacement of cement

CONCLUSION

Based on the conducted experiment and according to the result obtained, it can be concluded that:

- The SCBA concrete gives higher compressive strength than that control concrete

- SCBA concrete performed better when compared to ordinary concrete up to 10% replacement of sugar cane bagasse ash due to presence of high amount of silica in SCBA.
- It is observed that the usage of sugarcane bagasse ash in concrete helps in increasing the resistivity towards sulphate attack.
- It is clearly seen that the 20% cost of cement can be save with better strength than control concrete.
- The utilization of bagasse ash in concrete solves the problem of its disposal thus keeping the environment free from pollution.
- It can be suggested that manufacture for sugar cane, providing a suitable furnace near the factory for burning their bagasse disposal.

REFERENCES

1. IS 456 : 2000 Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards, New Delhi, India
2. IS 10262 : 2009 Concrete Mix Proportioning-Guidelines, Bureau of Indian Standards, New Delhi, India
3. IS 10262 : 1982 Recommended Guidelines For Concrete Mix Design, Bureau of Indian Standards, New Delhi, India
4. Abdolkarim Abbasi and Amin Zargar," Using Baggase Ash in Concrete as Pozzolan", Middle-East Journal of Scientific Research 13 (6): 716-719, 2013, ISSN 1990-9233.
5. Sagar W. Dhengare, Dr.S.P.Raut, N.V.Bandwal, Anand Khangan, "Investigation into Utilization of Sugarcane Bagasse Ash as Supplementary Cementitious Material in Concrete
6. Mrs. U.R. Kawade, Mr.V.R.Rathi, Miss Vaishali D. Girge, "Effect of use of Bagasse Ash on Strength of Concrete" International Journal of Innovative Research in Science, Engineering and Technology Vol. 2, Issue 7, July 2013
7. R.Srinivasan, K.Sathiya, "Experimental Study on Bagasse Ash in Concrete", International Journal for Service Learning in Engineering,Vol. 5, No. 2, pp. 60-66, Fall 2010,ISSN 1555-9033
8. S.Dharanidharan*, L.Rajkumar, B.Karthick, "An experimental study on mechanical properties of concrete by using sugarcane bagasse ash", International journal of engineering sciences & research technology, ISSN: 2277-9655, Scientific Journal (ISRA).