# The Development In Agriculture Sector With Special Reference To Sugar Cane Cultivation & Byproduct Of Sugar Industries And Their Utilization In Concrete Based Products - A State Of Art

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***Abstract-*** *As the India is agro-based country and second largest country which have the farming and cultivation activity after China in the globe, the current and upcoming developments in agricultural activity in India will produce the large amount of agricultural waste as the rate of production and rate of demand is on peak. There is urgent call to utilization of these agriculture in a safe manner without producing another by products from these wastes. This paper reviews the utilization of the sugar mill byproducts with focused on the Sugarcane Bagasse Ash (SBA) as a replacement ranges from 10% to 40% to cement that to be used in concrete.*

***Keywords***- Sugar Mills, Sugarcane Bagasee Ash (SBA), Cement Replacement, Byproducts, Safe Disposal.

## I. INTRODUCTION

The increase in development of the construction industry plays vital role in infrastructural developments of India. On the other hand the development of the agricultural activity especially in the cultivation of sugar cane. Around 152 sugar mills exist in Maharashtra and about an average crushed 743 lakh tonnes of sugar canes annually. The byproducts of the sugar manufacturing process can be used in concrete manufacturing process as a partial substitutor. This utilization can be reduce the ultimate load of disposal of these byproducts and load on the surrounding environment.

For any infrastructural activity concrete is the principal ingredient for construction of any structure in which cement is used in large scale and usage of cement in concrete emits CO2 in maximum amount due to its heat of hydration which is an exothermic reaction. When cement comes in contact with water as a byproduct emission of Carbon dioxide takes place and nearly 5-8% of CO2 is emitted every year from concrete. The emission of Carbon dioxide can be controlled by reducing the usage of cement with Fly Ash, Blast furnace slag, Microsillica, etc. was practiced as the technology developed cement can be partially replaced by Sugarcane Bagasse Ash (SBA)

India is the one of the largest producers of sugarcane due to which it produces waste product i.e. Ash is major environmental problem to dispose and Bagasse Ash contain 65-70% of silica. Sugarcane Bagasse ash can be partially replaced to cement at some extent.

The use of Sugarcane Bagasse Ash in cement improves the physical and chemical properties of concrete with reduction of CO2 emission.

## II. LITERATURE REVIEW

property it proof to be a suitable binder and thus becomes an economical concrete mix. Workability was achieved 6.5 cm. water-cement ratio used was 0.48 and optimum strength achieved for 10% replacement in concrete mix. They described the density of concrete decrease with increase in sugarcane bagasse ash content. Thus proof to be a light weight concrete. Abdolkarim Abbasi et.al[2] in 2013 carried out research on partial replacement of SBA with cement by 10%. They studied moisture content burning method of sugarcane bagasse physical and chemical properties of SBA. Chemical property was obtained by carrying out XRF test SBA has high pozzolanic property and also high silica content which contributes in strength of concrete XRT test was done on concrete to study crystalline and non-crystalline structure of sugarcane bagasse ash. Compressive strength was carried out on cubes casted for 7th and 28th days of curing. Which showed increase in strength compared to ordinary concrete of same grade. T.S Abdulkadir. et.al[25] 2014 in their paper stated that, the sugarcane bagasse ash burnt at 700oC. The total contain of alumina, ferric composition is about

80.55%. The density of concrete decrease with increase in percentages of cement. SBA was replaced at 10%, 20%, and 30% respectively and for curing at 7 and 28 days. Due to calorific properties of the waste bagasse ash has been used as principal of fuel to produce electric power.

The concrete formed by partially replacement with SBA has reaction formed by silica, slaked lime, and CaOH2 the result yielded 85% and thus SBA is pozzolanic material. Workability decreases with increase in percentage replacement. The optimum strength was achieved at 10 & 20% replacement that satisfied the ASTM595-85 specification. Hence the results from density indicates that the concrete thus formed is normal concrete.

Mrs. U. R. Kawade et.al[17] (2014) concluded use of sugarcane bagasse ash by partially replacing cement is advantageous. In this they concluded test for M20, M30 and M40 grade of concrete for 7, 28, 56 and 90 days respectively. Test taken on harden concrete were compression, flexure and split tensile. From which states that SBA concrete has higher compressive strength as compare to ordinary concrete/without SBA. The optimum replacement for the same was 15% and introduction of SBA increases workability of fresh concrete so use of super plasticizer is not mandatory. In 2015 T.Malyadri et.al[23] stated that, bagasse ash is causing serious environmental pollution as it mainly contain aluminum oil and silica. The test were carried by replacing at 0%, 5%, 10%, 15% , 25%, and 30% and were tested after curing at 7,28,56 and 90 days. The burnt ash have amorphous silica which have pozzolanic properties. Sugarcane consist about 30% bagasse ash and 10% sugar, silica is the main contain in bagasse ash which is the main cause of replacement of cement. The suitable burning condition was identified as 800oC for formation of sugarcane bagasse ash. The material used were cement of OPC 53 Grade, fine aggregate, course aggregate, water, bagasse ash for preparation of bagasse ash. The water-cement ratio was used as 0.48 and maximum compressive strength, split tensile was achieved at 5 & 10% replacement of cement. For flexural strength maximum strength was achieved at 10%. Experimental Research by Jayminkumar A. Patel et.al[7] in 2015 stated that properties of sugarcane bagasse ash which is similar to cement having pozzolanic property thus cement was partially replace by SBA in concrete use M25 grade of concrete. Compressive strength of the same was tested on CTM. To conclude the feasibility SBA in concrete. Cement has partially replace by 5% of SBA. There after carrying out compression test they obtained results increase in strength. Thus they stated that it is best to use SBA in concrete as compared to landfilling which causes pollution due to small partial released in environment. Water-cement ratio used was 0.49 and procured as per IS specification. Amrita Kumari et.al[4] (2015) paper states that the replacement was carried out for 5%, 10%, 15%, 20%. Tests carried out were compressive, split tensile & flexure strength. To check various results and work on the same grade used in this experimental work is M25 and water cement ratio used was 0.44, 0.45, and 0.46 by use of Sugarcane Bagasse Ash (SBA). The initial and final setting time and consistency increases. The result of SBA represents approximately 0.62% of weight, water cement ratio was 7 days was 0.44 and for 28days was 0.45, 0.46. in this paper they have checked the consistency and initial and final setting time. Mini Vishwakarma et.al[15] (2015) stated that, Environmental pollution can be reduced by using industrial wastes like sugarcane bagasse ash which has same silica content and pozzolanic property as cement possess. Cement was partially replaced by bagasse ash for M30 grade and cubes of concrete was casted for same and curing of same was carried out for 7,14 and 28 days. After carrying out test of compression on CTM machine they procured results in which 5% and 10% replacement of cement was feasible. Thus max compressive strength was obtained for 5%.W/C ratio used was 0.45.T. Subramani et.al[24] (2015) stated that the grade used was M35 and they have replaced coarse aggregate with furnace slag at 50%, 60% and 70% and were tested at 7 and 28 days of curing. Strength increases due to use of furnace slag and also the durability of concrete increase. As the steel slag used has no pozzolanic property it is economical. The replacement of SBA was done at 10%, 20% and 30% respectively, the bagasse was burned at about 800o C. The optimum strength in this experimental study was achieved at 20% replacement with cement. The water cement ratio used was 0.43 for 10% and 20% replacement and 0.35 for 30% replacement. The Research of Piyush Kumar et.al[18] (2015) concluded that, Environmental pollution can be reduced by using industrial wastes like sugarcane bagasse ash which has same silica content and pozzolanic property as cement possess. Cement was partially replaced by bagasse ash for M30 grade and cubes of concrete was casted for same and curing of same was carried out for 7 and 28 days. After carrying out test of compression on CTM machine they procured results in which 5% and 10% replacement of cement was feasible. Thus max compressive strength was obtained for 5% and 10% can be used as optimum replacement. Thus it also helps to reduce the industrial wastes and also an alternative to disposal to bagasse ash Research Paper of M. Ganesh Babu et.al[14] (2015) this paper stated the investigation on using SBA by partially replacing cement for 0%, 5%, 10%, 15%, 25% by weight. Carried out test like split tensile, compression, flexural, modulus of elasticity. Thus after obtaining various results and by carrying various tests they stated that it is feasible to replace SBA with cement up to 15%. Thus partial replacement of SBA in cement result in high pozzolanic property i.e. higher silica content. Increase in

workability was also observed which also has self-compacting ability and also free from segregation. Curing of moulds cased was carried out for 7th and 28th days respectively. K. Lakshmi Priya et.al[12] (2016) concluded that bagasse ash was replaced at 0%, 5%, 10%, 15%, 20% & 25% respectively. The test carried out for fresh concrete are compaction factor and slump cone and for harden concrete were compression strength, split tensile strength & flexural strength. Up to 20% replacement of bagasse ash the concrete mix has been significantly enhanced. The grade used for the concrete mix is M25. Maximum strength was achieved at 10% replacement of SBA with cement. The sugarcane bagasse was burned at about 600oC to 800oC. The paper given by K. Kiran et.al[13] (2017) stated that they replaced the concrete with sugarcane bagasse ash up to 25 %. The bagasse ash was sieved from 150 micron sieve and its specific gravity was 1.83. The replacements were 0%, 5%, 10%, 15%, 20%, 25 % for 7 and 28 days.It concluded that partial replacement can be done up to 15% without any major loss of strength of concrete. The optimum replacement of sugarcane bagasse ash was 5%. They also stated that the mechanical properties of concrete are improved in later ages as it includes secondary hydration in concrete increases the strength Study of K. Akhilesh Reddy et.al[10] (2017) stated property of sugarcane bagasse ash and decided to replace at 4%, 8%, 12%, 16%, 20% from which they concluded that the optimum replacement of SBA concrete is 4% and 8%. Replacement shows less reduction in strength as compared to various test 7 and 28 days were taken for compression, flexure and split tensile test results. Use of sugarcane bagasse ash reduced workability of concrete. Use of sugarcane bagasse ash as partially replacing material for cement can reduce the emission of greenhouse gases for the environment

## III. CASE STUDY

In the application point of view we applied the Sugarcane Bagasse Ash as partial replaced with cement to reduce the consumption of cement and reduction of CO2 emission when heat of hydration takes place in concrete. Concrete Mix was designed as per IS 10262:2009. Design specification for M30 grade concrete for 1 m3 for Cement, Fine Aggregate, Coarse Aggregate, and Water/Cement Ratio was 425.5kg, 812kg, 1031kg, 0.45 respectively. In this bagasse ash was replaced partially by the weight of cement. The strength achieved due to replacement was observed more as compared to OPC concrete and the quantity of cement is reduced. Usage of SBA in concrete helps to reduce the density of concrete without affecting the desire range of compressive strength as density of SBA is less than cement which is 1.98 g/cm3.

## IV. CONCLUSION

From the above cited and studied literatures, the conclusion offered that the utilization of Sugarcane Bagasse Ash in concrete is possible which varies from 10% to 20% replacement to concrete binders. When Sugarcane Bagasse Ash introduced in concrete the compressive strength of concrete increases gradually and heat of hydration will reduce which offers the optimization of crack developments on the top surface. The mechanical properties of concrete improve in later ages as it include secondary heat of hydration, increases strength after 28 days. The particle size of bagasse ash helps to assist in binding of ingredient. The replacement of bagasse ash is possible due pozzolanic property and silica content which are responsible for increase in strength of concrete mix. The use of bagasse ash has proved to be ecofriendly and it is also a best alternative towards clean environment and safe disposal of sugar mill by products.

## REFERENCES

[1] A.V.S.Sai. Kumar, Krishna Rao B.(2014), (IJIRSET), vol.3, issue 3, ISSN: 2319-8753 “A Study on Strength of Concrete With Partial Replacement Of Cement With Quarry Dust And Metakaolin”

[2] Abdolkarim Abbasi, Amin Zargar (2013)(ISSN), pp 716-719 “ Using bagasse ash in concrete as pozzolan”

[3] Almir Sales, Sofia Araújo Lima,(2010) vol30 ISSN1114–1122 “Use of Brazilian sugarcane bagasse ash in concrete as sand replacement”

[4] Amrita Kumari, Prof. Sheo Kumar (IJIRSET) (2015) vol. 4, issue 7 ISSN: 2319-8753 “Experimental Study on Partial Replacement of Cement by Sugarcane Bagasse Ash”

[5] Asma Abd Elhameed Hussein, Nasir Shafiq, Muhd Fadhil Nuruddin and Fareed Ahmed Memon(2014), ISSN 2040-7459, “Compressive Strength and Microstructure of Sugar Cane Bagasse Ash Concrete”

[6] I.Siva Kishore, K. Kiran(2017), (IJCIET), vol8, issue 1, pp.452–455, ISSN:0976-6308 “An experimental study on partial replacement of cement with bagasse ash in concrete mix”

[7] Jayminkumar A. Patel & Dr. D. B Rajiwala (2015) Vol. 15 “Use Of Sugarcane Bagasse Ash in Concrete by Partial Replacement with Cement”

[8] Jayminkumar A.Patel, Dr. D.B.Raijiwala,(2015), (IJIRSET), vol 4, issue4 ISSN:2319–8753 “Experimental

Study on Use of Sugar Cane Bagasse Ash in Concrete by Partially Replacement with Cement"

[9] K Sampath Kumar, U M Praveen, A Prathyusha, V Akhila, P Sasidhar(2016), (IJCIET), vol7, issue3, pp.163–172, ISSN:0976-6308 "A comprehensive study on partial replacement of cement with sugarcane bagasse ash, rice husk ash, stone dust"

[10] K. Akhilesh Reddy & I. Siva Kishor (2017) (IJCIET) Vol.8 Issue 1 pp.847-851"Study on Behaviour of Partial Replacement of Cement With Sugarcane Bagasse Ash for High Strength Concrete Mix "

[11] K. Ganesan, K. Thangavel(2007) (Elsevier)Vol. 515–524 "Evaluation of bagasse ash as supplementary cementitious material"

[12] K. Lakshmi Priya1, R. Ragupathy (IJRET) (2016) Volume: 05 Issue: 04 ISSN: 2319-1163 "Effect of Sugarcane Bagasse Ash On Strength Properties Of Concrete"

[13] K. Kiran & I. Siva Kishor (2017) (IJCIET) Vol.8 Issue 1 pp. 452-455 "An Experimental Study on Partial Replacement of Cement With Bagasse Ash in Concrete Mix"

[14] M.Ganesh babu, G.Shiny priyanka(2015), (IJCERT)vol2, issue 12, pp.1044-1048 ISSN: 2349-7084 "Investigational Study on Bagasse Ash in Concrete by Partially Substitute with Cement"

[15] Mini Vishwakarma1, Rajeev Chandak , R.K. Grover(2015), issue 5, Vol. 4 ISSN 2249-6149 "Study on The Compressive Strength Of The Concrete By Partial Replacement Of Cement With Sugarcane Bagasse Ash."

[16] Moisés Frías, Ernesto Villar, Holmer Savastano(2011) vol 33, issue 4, ISSN:0958-9465 "sugar cane bagasse ashes from the cogeneration industry as active pozzolans for cement manufacture"

[17] Mrs.U.R.Kawade, Mr.V.R.Rathi, Miss.Vaishali D.Girge,(2013), (IJIRSET), vol.2, issue7, ISSN:2319-8753 "Effect of use of Bagasse Ash on Strength of Concrete"

[18] Piyush Kumar & Anil Pratap Singh (2015) (IJCSER) Vol.3 pp. 308-310 "Studies on Partial Replacement of Cement by Bagasse Ash in Concrete"

[19] Prasanna, Prof. Maneeth P.D.,Prof. Brij Bhushan S., Prof. Rohan S. Gurav, (2016), (IJSRD) vol3, issue11, ISSN:2321-0613 "Experimental Investigation on Partial Replacement of Cement by Sugar Cane Bagasse Ash in Cement Concrete"

[20] R Srinivasan, K Sathiya (2010) (IJSLE)Vol. 5, No. 2, pp. 60-66 "Experimental study on bagasse ash in concrete"

[21] Sagar Dhengare, Sourabh Amrodiya, Mohanish Shelote, Ankush Asati, Nikhil Bandwal, Anand Khangan, Rahul Jichkar(2015), (IJCIET), vol6, issue4, pp.94-106 ISSN:0976-6308 "Utilization of sugarcane bagasse ash as a supplementary cementitious material in concrete and motar"

[22] ShivakumarS.A, KarthikM.N, SidramappaS.I, (IOSRJ), ISSN : 2278 -1684,PP337 "Studies on Mechanical properties of concrete using Sugarcane Bagasse Ash (SBA)"

[23] T. Malyadri & J. Supriya (2015) (IJCERT) Vol. 2 pp. 995-1001 "Experimental Study Of Bagasse Ash in Concrete by Partially Replacement with Cement"

[24] T.Subramani, M.Prabhakaran (IJAIEM) (2015) Volume 4, Issue 5 ISSN 2319 – 4847, "Experimental Study On Bagasse Ash In Concrete"

[25] T. S. Abdulkadir, D. O. Oyejobi, A. A. Lawal (2014) (ACTA) "Evaluation of Sugarcane Bagasse Ash as a Replacement for Cement in Concrete Works"