A Research Paper on Partial Replacement of Sugarcane Bagasse Ash and Coal Bottom Dust Mixed Concrete

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Abstract— Sugar cane bagasse and coal bottom dust both are a good replacer for the cement concrete admixture. Sugar cane bagasse ash is a good binder material and coal bottom dust is a good replacing element. In the following technical paper we discussed different type of tests such as compressive strength test discussed their results. In the following paper we concentrated on the properties of material and their use in the concrete admixture.

Keywords: Sugar bagasse ash, coal bottom dust, solid waste management

I. INTRODUCTION

Concrete is the most consumed building material in the world due to its excellent mechanical properties and durability. Throughout the world, the concrete industry produces more than 10 billion tons of concrete per year (Meyer 2006). At present, the concrete industry is cursed by the shortage of aggregates and the environmental pollution of cement production. The cement industry has a significant contribution to global warming because the combustion of fuel in the cement kiln and the electricity used to grind the clinker emit a large amount of CO_2. The cement industry is responsible for around 5% of global CO_2 emissions (Worrell et al 2001). In addition, the natural resources of the aggregates are being gradually depleted due to the development of infrastructure throughout the world. The prohibition of mining in some areas further increases the problem of the availability of natural aggregates. Therefore, it becomes very essential and more meaningful to find substitutes for both cement and natural aggregates. In addition, the continuous growth of agricultural and industrial waste is the main cause of many environmental concerns and burdens that can be reduced by using these wastes in concrete construction.The resulting Sugar Cane Bagasse Ash (SCBA) contains high levels of SiO_2 and Al_2O_3, which can help its use as supplementary cementing material (SCM). The use of SCBA as SCM not only reduces cement production that is responsible for high energy consumption and carbon emissions, but it can also improve the compressive strength of cement-based materials such as concrete and mortar (Janjaturaphan and Wanson 2010). This improved compressive strength depends on the physical and chemical effects of the SCBA. The physical effect is also known as the filler effect that is related to the shape, size and texture of the SCBA particles while the chemical effects are related to the ability of the SCBA to participate in the pozzolanic reaction with calcium hydroxide by providing compounds reactive siliceous (Srinivasan and Sathiya 2010).

II. CONCEPT OF SUGARCANE BAGGASE MIXED CONCRETE

Bagasse ash from sugarcane is produced when the bagasse is reused as biomass fuel in the boilers. When this bagasse is burned at a controlled temperature, it results in ash. The ashes obtained from the boiler of a sugar mill. The coal bottom ash is the waste product of the coal power plant. It is an incombustible material produced after the burning of coal in the furnace of coal-fired power plants. The CBA is obtained from the Feroze Gandhi Unchahar thermal power plant.

III. LITERATURE REVIEW

P. Aggarwal (2007) et al worked on, "effect of bottom ash has replacement of fine aggregate in concrete". In the following paper he focused on the experimental investigation of use of bottom ash as 20% replacement of the fine aggregate. He performed various literature review and material study. After having the material study worked on compressive strength test, flexural strength test, splitting tensile strength test. He concluded that the workability of concrete decrease with the increasing the bottom ash content and concrete specimen become less distinct after 20 days.

Ismail et al. (2011) worked on, "influence of elevated temperatures on physical and compressive strength properties of concrete containing palm oil fuel ash construction build mater". He examined the residual compressive strength of concrete containing palm, oil fuel ash (POFA) after exposure to elevated temperature and subsequent cooling specimen from OPC and POFA concrete mix were prepared and were subjected to various temperature levels such as 100,300,500 and 800 degree Celsius. The POFO concrete contains 20% partial replacement of cement by weight. Furthermore the cooling system which include cooling at room temperature by the natural breeze and water spray where involved. Compressive strength test was conducted on control specimen as well as concrete specimen was reviewed through the two cooling systems. It was concluded from the study that the residual performance was found to be higher in POFA concrete than in the normal concrete.

R. Nivashan(2010) et al studied on, "experimental study on sugarcane bagasse ash in concrete". In this paper bagasse ash has been chemically and physically characterised and partially replaced in the ratio of 0%, 5%,10%,15%and 25% by weight of cement in concrete.He worked on material investigation of cement fine aggregate coarse aggregate water sugar cane bagasse ash. After having material quality he performed workability test, compressive test, tensile test and flexural strength test. At least he concluded that the SCBA is in SCBA in blended concrete had significantly higher compressive strength, tensile strength, flexural strength. He

explained that maximum limit of replacing cement by SCBA at 10%.

M.V. Krishna Rao(2011) et al worked on, "effect of elevated temperature on strength of differently cured concrete- an experimental study". in this paper he focused on the temp. quarrying strength weight, concrete, and silica fume. He used M40 grade of concrete performed compressive strength test and effect of elevated temp. on strength. He concluded on the basis of different result table compressive strength, non destructure test losses in weight and compressive strength of specimen after expose to temp. He concluded that concrete give better result at 150 degree celsioud compare to another temp.

1) K. Laxmi priya (2016) et al worked on, "effect on sugar cane bagasse ash on strength property of concrete". In the following paper he focused on replacing ordinary port land cement by sugar cane baggase ash in the ratio of 0%,5%,10% and 20% by weight. He focused on sugar cane bagasse ash by product as amorphous silica and strength. He took M25 grade of concrete for the experimental studies. He worked on basic material cement sugar cane baggase ash fine aggregate, coarse aggregate and water. After having detail study on material he performed following experimental studies by workability, compressive strength, split strength, tensile strength, flexural strength and modulus elasticity. He concluded that compressive strength of admixture is best when he replaced of 10% SCBA get compressive strength 38.077 N/mm2. He got maximum split tensile strength at 10% SCBA replacement and got 3.077 split tensile strength and also the maximum flexural strength 10% SCBA replacement so that 10% replacement of SCBA provide result for Admixture M25.
2) Sirirat janjaturaphan(2010) et al worked on , "Pozzolanic activity of industrial sugar cane bagasse ash". In thish paper he discussed about low amarphous Sio2 content cement mortar made with 10% SCBA replacement to get satisfactory compressive strength and less discriminating. In this paper he focused on bagasse ash and pozzolanic activity supplementary cementitious material. He worked on SCBA material in different four samples. For satisfactory compressive strength with additional composition. After having the study of material he performed compressive strength test and get adequate result. Atleast he concluded that when we used low amorphous Sio2 content. Cement mortar made with 10%SCBA give a satisfactory result as required.
3) K. Ganesan(2007) et al, "Evalution of bagasse ash as supplementary cementitious material". In the following paper he focused on bagasse ash, blended cement, concrete, compressive strength and transport properties. In this paper he studied on the effect of BA content as partial replacement of cement on physical and mechanical properties of hardend concrete are reported.In the following paper he tested BA is an effective mineral admixture, with 20% as optimal replacement ratio of cement. He used OPC conforming by Indian standard code IS 8112-1995. He performed compressive strength test, split tensile strength test, water absorption test, sorptivity and chloride penetration. After performing following test he concluded that up to 20% of ordinary Portland cement can be optimally replaced with well- burnt bagasse ash without any adverse effect on the desirable properties of concrete this activity improve the compressive strength , water permeability and chloride permeation and diffusion.
4) Lavanya M.R (2012) studies on "An experimental study on the compressive strength of concrete by partial replacement of cement of cement with sugarcane bagass ash". In the following experiment study focused on concrete compressive strength , replacement of sugar bagass ash and water cement ratio . In the following study he replaced cement with sugar bagass in various perpotion of 0% 10% 15% 20% 25% and 30% he took various water cement ratio 0.35,0.4 and 0.45 After analysis of material propotion he performed compressive strength and concluded that when we use 15% cement replaced with 0.35 water contant ratio the compressive strength is maximum .
5) M.P .kadam (2013) worked on "effect of coal bottom ash as the sand replacement on the property of concrete with different water content ratio" In the following experimental studies he focused on coal bottom ash split tansil strength flexural strength permibility , modulus of elasticity .he replaced natural sand with coal bottom ash by 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% ans 100% by weight after studuing material quality and physical property material he replaced performed compressive strength test flexural strength test split tensil test and concluded that 20% replacement of coal bottom test dust with sand given maximum compressive strength after 30 to 100% the compressive strength has been decreased .

IV. FUTURE SCOPE

After seen various review and result of the papers we can say that the coal bottom dust and sugar bagasse ash is a good replacing element for the cement and the feeling material. So if we improve the quality of concrete with Economical condition and structural fundamental we can mixed both as a combinder and replacer of concrete material with their different ratio. After their different fundamental ratio and replacing quality we can get a better result in compression to normal concrete performance. The temperature also effect on the material quality so on the different tempreture we get better result also. A W\c ratio is also a important fundamental topic for the replacing of material. So we can say that these three basic parameter can be use to evaluate the quality of concrete in different constructional uses.

V. RESULT

The result of test is conduct on material used in research work the performance of various mixes containing different percentage of SCBA and CBD is discussed .The aim of studying various properties of material used is to check the conformance with codal requirement enable to an engineer to design a concrete mix for a particular strength investigation of OPC43 grade used the physical properties of the cement were obtained on conducting some appropriate test for BIS 8112-2013.

VI. TESTING REPORT

A. Jitendra Kumar Yadav

Project Name	Partial Replacement Of Cement With Sugarcane Bagasse Ash And Coal Bottom Dust

Under The Guidance Mr. Mohd Afaque Khan

B. Basic Test Result

SL. NO.	TEST NAME	RESULT	REMARK
1.	FINESS TEST OF CEMENT (OPC 43)	6%RETAINED ON SEIVE NO.9	OK
2.	FINE AGGREGATE SIEVE ANALYSIS	SAND ZONE 3 CONFORMING	OK
3.	COARSE AGGREGATE SIEVE ANALYSIS	25MM SIZE OF AGGRIGATE	OK

C. Physical Properties Test of OPC

SL. NO.	CHARACTERISTICS	TEST RESULT	STANDARD RESULT (AS PER IS CODE)	REMARK
1.	INITIAL SETTING TIME	45	NOT LESS THAN 30MIN	OK
2.	FINAL SETTING TIME	520	NOT MORE THAN 600MIN	OK
3.	FINESS MODULUS(OPC 43)	6%	10%	OK
4.	COMPRESSIVE STRENGTH	49	NOT LESS THAN 43N/MM^2	OK

D. Characteristics

SL. NO.	TEST NAME	SP. GRAVITY	%WATER ABSORPTION	REMARK
1.	COARSE AGGREGATE (25 MM)	2.637	0.61	OK
2.	FINE AGGREGATE (ZONE 3)	2.62	1.21	OK
3.	CEMENT (OPC 43)	3.15	-	OK

E. Compressive Strength of Concrete (M20) Added 5%Sugar Cane Baggass and Coal Bottom Dust

SL. NO.	SETTING TIME	LOAD (N)	AREA (MM²)	STRENTGH (N/MM²)	STANDARD RESULT (AS PER IS	REMARK
1.	7 DAYS	405.225 x1000	22500	18.01	13.5N/MM^2	OK
2.	14 DAYS	532.125 x1000	22500	23.65	18N/MM^2	OK
3.	28 DAYS	639.00x 1000	22500	28.40	20N/MM^2	OK

F. Compressive Strength of Concrete (M20) Added 10% Sugar Cane Baggas and Coal Bottom Dust

SL. NO.	SETTING TIME	LOAD (N)	AREA (MM²)	STRENGTH (N/MM²)	STANDARD RESULT (AS PER IS	REMARK
1.	7 DAYS	398.7 x1000	22500	17.72	13.5N/MM^2	OK
2.	14 DAYS	530.325 x1000	22500	23.57	18N/MM^2	OK
3.	28 DAYS	623.925 x1000	22500	27.73	20N/MM^2	OK

G. Compressive Strength of Concrete (M20) Added 15% Sugar Cane Baggas and Coal Bottom Dust

SL. NO.	SETTING TIME	LOAD (N)	AREA (MM²)	STRENGTH (N/MM²)	STANDARD RESULT (AS PER IS	REMARK
1.	7 DAYS	443.7X1000	22500	19.72	13.5N/MM	OK
2.	14 DAYS	571.5001 x1000	22500	25.40	18N/MM	OK
3.	28 DAYS	717.750x 1000	22500	31.90	20N/MM	OK

H. Compressive Strength Of Concrete (M20) Added 20% Sugar Cane Baggas and Coal Bottom Dust

SL. NO.	SETTING TIME	LOAD (N)	AREA (MM²)	STRENGTH (N/MM²)	STANDARD RESULT (AS PER IS	REMARK
1.	7 DAYS	410.175 x1000	22500	18.23	13.5N/MM^2	OK
2.	14 DAYS	534.150 x1000	22500	23.74	18N/MM^2	OK
3.	28 DAYS	671.625 x1000	22500	29.85	20N/MM^2	OK

Compressive strength of concrete mixed of-7days, 14daysand 28days is BIS code 8112-2013 is and 20%mixed

SCBA and CBD mixed concrete qube test of compressive strength is 18.23N/mm^2 23.74N/mm^2 and 29.85N/mm^2.

Project Name	Partial Replacement Of Cement With Sugarcane Bagasse Ash And Coal Bottom Dust

I. Under The Guidance Mr. Mohd Afaque Khan

Compressive Strength of Concrete (M20) Added5%, 10%, 15%And20% Sugar Cane Baggas and Coal Bottom Dust With Respect To Slump Value

There for four trial is measure the slump value. The two trail is water cement ratio is 0.55 and two trail is water cement ratio is 0.50.

0	Water Cement Ratio	Water (L)	Cement (kg)	Sand (kg)	Coarse Aggregates (kg)	Average cube strength at 7 days (N/mm^2)	Average cube strength at 14 days (N/mm^2)	Average cube strength at 28 days (N/mm^2)	Slump (mm)
MR1	0.55	186	338.18	747.23	1142.87	18.01	23.65	28.40	35
MR2	0.55	197.16	358.47	728.30	1113.77	17.72	23.57	27.73	110
MR3	0.50	186	372.00	716.74	1143.52	19.72	25.40	31.90	28
MR4	0.50	197.16	394.32	698.20	1113.95	18.23	23.74	29.85	86

VII. CONCLUSION

After study all the fundamental detail of the papers, we can say that the sugar bagasse ash is a good binder element, which can replaced the cement in their different ratio for a better resullt. Sugar baggase ash have a good binding quality. And coal bottom dust use as a replacer of sand or another filling materials.

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