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Experimental Investigation on Concrete, Replaced with GGBS and Bottom Ash as Cement and Fine Aggregate

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Abstract

Present Concrete has occupied an important place in construction industry in the past few decades and it is used widely in all types of constructions.cement is a major constituent material of the concrete which produced by natural raw material lime and silica.In the world there is no cement construction industry to do research work on cement replacing material also the concrete industry constantly looking for supplementary cementations material with the objective of reducing the solid waste disposal problem.The present sttudy investigate The study on replaced by cement with ggbs and sand with bottom ash.the study crried out the physical and chemical properities of the materials .The experimental compressive strength finded for M_{30} grade concrete with 10%,20%, and 30% replaced by cement with ggbs and sand with bottom ash

Keywords:

Ggbs;
Bottom ash;
Compressive strength.

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1. Introduction

Concrete is binder material.It is mixture of cement, fine ggregate, coarse aggregate and water.The global consumption of cement and natural sand is too high due to its extensive use in concrete.The demand for cement and natural sand is too high in developing countries due to its rapid infrastructural growth.To over come this problem cement is replaced by ggbs and sand is replaced by bottom ash.In India, the production is about 7.8 million tonnes of GGBS as a by-product obtained in the manufacture of pig iron in the blast furnace.Bottom ash is part of the non-combustible residue of combustion in a furnace or incinerator. In an industrial context, it usually refers to coal combustion and comprises traces of combustibles embedded in forming clinkers and sticking to hot side walls of a coal-burning furnace during its operation

1.2 literature review

Kamran and Usman (2004): conducted a research on GGBS which was collected from steel mills in Karachi (Pakistan) and pulverized to a very fine degree from a pulverizer. They found that there was an appreciable increase in the workability of concrete with increasing percent replacement of cement with GGBs

M.P Kadam,Dr.Y.D.Patil explained in IJAT-CE: Effect of col bottom ash ash as sand replacement on the properties of concrete with different w/c ratio.They were investigated ntural sand is replaced with coal bottom ash by 0%,10%,20%,30%,40%,50%,60%,70%,80%,90% and 100%.

1.3 Materials used

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- Cement 53 grade replaced by GGBS at 10%,20%&30%
- Sand replced by bottom ash at 10%,20%&30%
- Coarse aggregates
- Potable water
- Fosroc conplast sp 430(admixture)

1.3.1 Ground Granulated Blast Furnace Slag (GGBS)

GGBS is obtained from making of iron.This is the by-product of the iron manufacturing indu000stry.Iron ore,coke and limestone are fed into the furnace and the resulting molten slag floats above the molten iron at a temperature of about 1500^0C TO 1600^0C.GGBS is off–white color substantially lighter than Portland cement.

1.3.2 Bottom ash

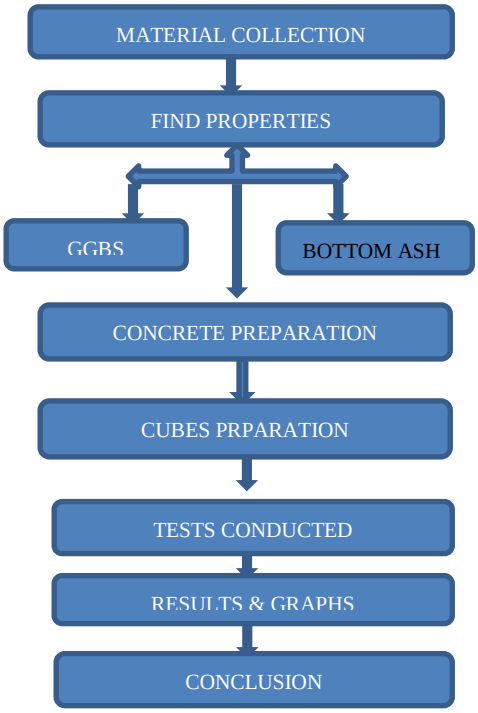
Bottom ash is the by-product of coal combustion.The rock detritus filled in the fissures of coal become separated from the col during pulverization.At present india is the third largest consumer of coal.Nearly about 524 millions tons of coal is burnt in coal fired as themal power annually.

1.3.3 Fosrock conplast sp 430

It is a mineral admixture.Admixtures is used to give special properties to fresh or hardened concrete. Admixtures may enhance the durability, workability and strength characteristics of a given concrete mixture. Admixtures are used to overcome difficult construction situations such as hot or cold weather placements, pumping requirements, early strength requirements or very low water-cement ratio specifications. Conplast SP-430 has beenspecially formulated to give high water reductions up to 25% without loss of workability or to produce high quality concrete of reduced permeability. Three mixes were studied with GGBS & bottom ash using a water binder ratio of 0.40.

2. Research Method

Research methodlogy flow chart



2.1 Physical properties of ggbs and bottom ash

Table 1: Physical properities of ggbs

s.no	Properity	Values
1	Colour	White
2	Water absorption	0.75%
3	Specific gravity	2.77
4	Residue on 45 micron sieve	3.0%

5	Finess	395m^2/kg

Table 2: Physical properities of bottom ash

s.no	Property	Values
1	Specific gravity	2.13
2	Dry unit weight	10.28 kn/m^3
3	Plasticity	None
4	Absorption	1.9

3. Results and Analysis

3.1Compressive sttrength test: According to IS: 516-1959

Compression test on the cubes is conducted on the 300T compression testing machine.The cubes are placed in the compression testing machine and the load on the cube is applied at a constant rate upto the failure of the specimen and the ultimate load is noted.The cube compressive strength of the concrete mix is then computed.A sample calculation for determination of cube compressive strength is present in below tables. This test is conducted for the cubes at 3 days, 7 days and 28 days.

Compressive strength = $\frac{P}{A}$

Where, p = maximum load in kg applied to the specimen
A = cross sectional area of the cube on which load is applied (150 X 150 mm)

Figure1: Cubes casted

Figure 2: Compressive strength test

Figure 1 indicates the cubes casted up to 3days, 7 days and 28 days, Figure 2 Indicates the cubes tested.

3.2 compressive strength results

Table3: Compressive strength for m30 grade concrete replaced by cement with 10%GGBS and sand with 10% bottom ash

S.no	10% of GGBS replaced at cement and 10% bottom ash at sand	Compressive strength in 3days(N/mm^2)	Compressive strength in 7days(N/mm^2)	Compressive strength in 28days(N/mm^2)
1	Cube-1	14.60	19.99	38.5
2	Cube-2	19.23	21.05	28.9
3	Cube-3	15.02	22.50	31.98
Average strength		16.28	21.15	33.1266

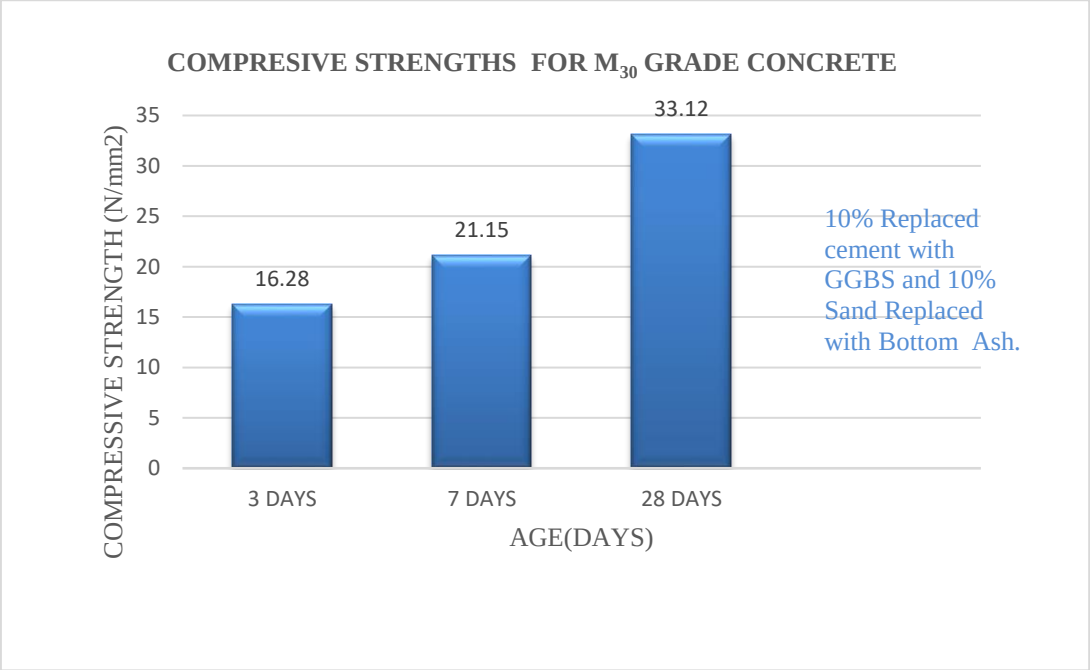
Table 4: Compressive strength for m30 grade concrete replaced by cement with 20 %GGBS and sand with 20% bottom ash

S.no	20% of GGBS replaced at cement and 20% bottom ash at sand	Compressive strength in 3days(N/mm^2)	Compressive strength in 7days(N/mm^2)	Compressive strength in 28days(N/mm^2)
1	Cube-1	9,79	15.24	23.98
2	Cube-2	9.76	15.98	24.5
3	Cube-3	9.28	16.14	27.5
Average strength		9.61	15.78	25.32

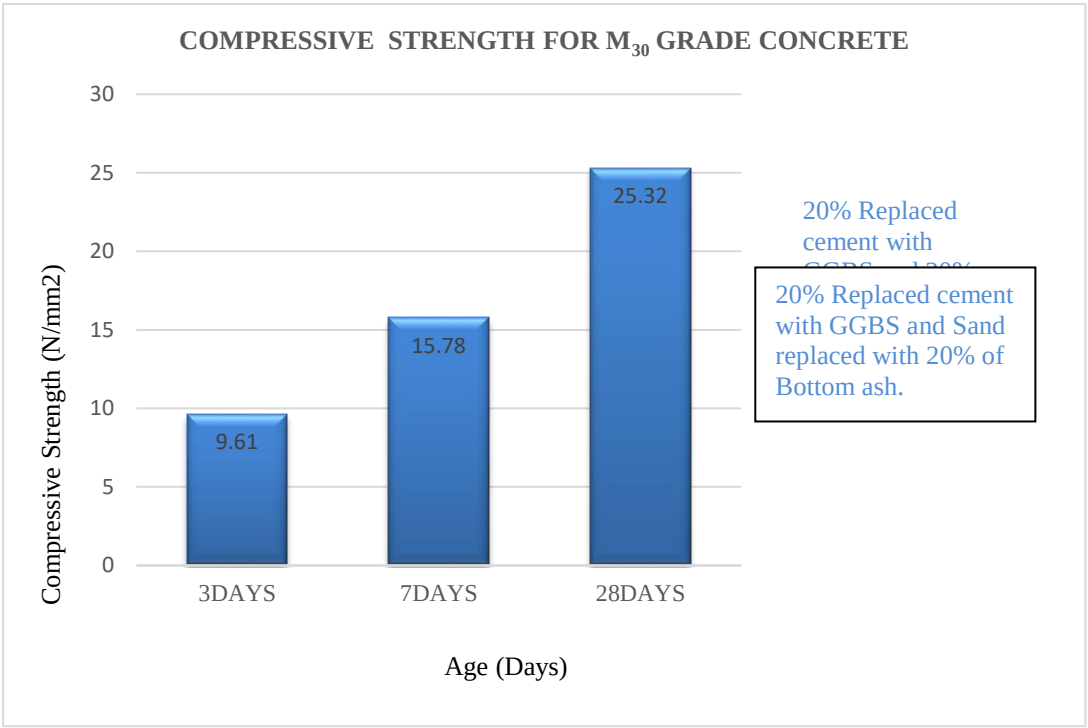
Table 5: Compressive strength for m30 grade concrete replaced by cement with 30 %GGBS and sand with 30% bottom ash

S.no	30% of GGBS replaced at cement and 30% bottom ash at sand	Compressive strength in 3days(N/mm^2)	Compressive strength in 7days(N/mm^2)	Compressive strength in 28days(N/mm^2)
1	Cube-1	9.23	10.64	14.46
2	Cube-2	8.97	12.79	19.20
3	Cube-3	9.65	10.2	16.23
Average strength		9.28	11.21	16.63

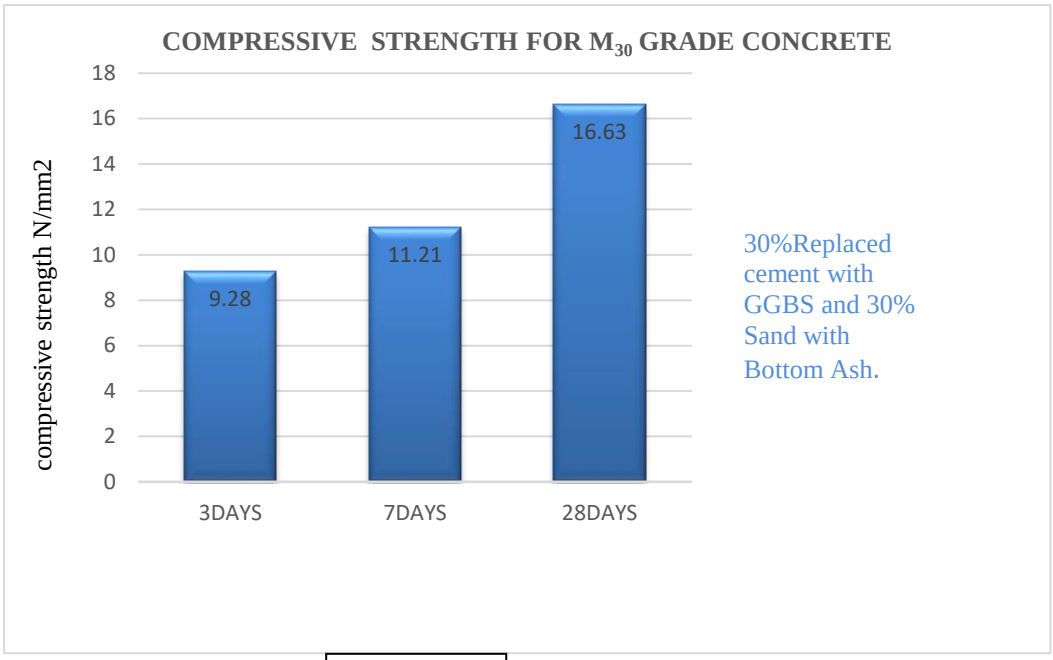
3.3 Graphs



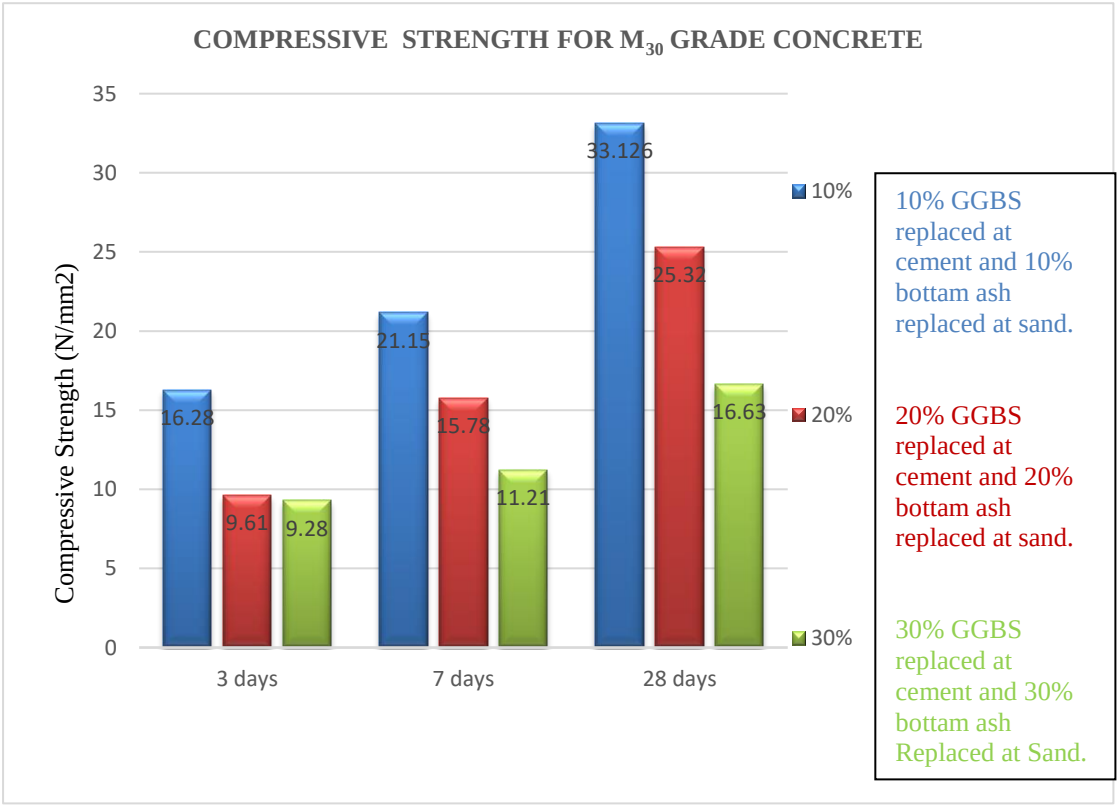
Graph 1: Compressive strength for m30 grade concrete replaced by cement with 10% GGBS and sand with 10% bottom ash



Graph 2: Compressive strength for m30 grade concrete replaced by cement with 20% GGBS and sand with 20% bottom ash



Graph 3: Compressive strength for m30 grade concrete replaced by cement with 30% GGBS and sand with 30% bottom ash



Graph 4: Compressive strength for m30 grade concrete replaced at different % by cement with GGBS and sand with bottom ash.

3.3 DISCUSSIONS

- The compressive strength of M_{30} grade concretefor 3, 7 and 28 day's was increased up to 10% replacement of cement and sand and after that the compressive strengths were decreased from 20% to 30% replacement with adding admixture.
- The compressive strength of concrete cubes casted with partial replacement of Cement with GGBS and Sand with Bottom Ash up to 10% replacement withadding superplastcizer (conplast Sp 430) using in concrete were comparatively increased 28 days strength i.e 33.12 N/mm2 and the compressive strength is decreased with increasing percentages of with 20%,30% replacements.
- The usage of Bottom ash in concrete reduces workability due to the increase in water demand.
- Compressive strength of concrete with replacement of sand with bottom ash is lower than the normal concrete specimens at all the ages
- The life span of construction will be more when the usage of GGBS for the construction. So the usage of GGBS for the construction purpose will be economical and safe

4. Conclusion

- The M30 concrete given good result at cement replaced with 10% GGBS and sand replaced with 10% bottom ash at 3days, 7days&28 days compred to 20%&30% replacements.
- It Minimize the cost of construction.
- The replaced material of GGBS and bottom ash Decrase the disposal problem and also controls the environmental pollutions.
- The life span of construction will be more when the usage of GGBS for the construction. So the usage of GGBS for the construction purpose will be economical and safe.
- Bottom ash used as fine aggregates replacement enables the large utilization of waste product.

References

[1] Kamran Muzaffar Khan "EFFECT OF BLENDING OF PORTLANDCEMENT WITH GROUND GRANULATED BLAST FURNACE SLAG ONTHE PROPERTIES OF CONCRETE" in 29th conference on our world inconcrete & structures: 25 - 26 august 2004, Singapore
[2] M.P.Kadam, DR.Y.D.Patil "EFFECT OF COAL BOTTOM ASH AS SAND REPLACEMENT ON THE PROPERTIES OF CONCRETE WITH DIFFERENT W/C RATIO" in International Journal of Advanced Technology in Civil Engineering, ISSN: 2231 –5721, Volume-2, Issue-1, 2013.
[3] Malkit Singh et al., "EFFECT OF COAL BOTTOM ASH ON STRENGTH AND DURABILITY PROPERTIES OF CONCRETE" in department of civil engineering Thapar University, patiala-147004 Punjab (India) 2015
[4] Nataraj et al., "BOTTOM ASH CONCRETE" in International Journal of Advanced Research in Mechanical and Production Engineering and Development Volume: 1 Issue: 1 08-Jun-2013,ISSN_NO: 23207256
[5] Peter W.C. Leung & H.D. Wong "FINAL REPORT ON DURABILITY AND STRENGTH DEVELOPMENT OF GROUND GRANULATED BLASTFURNACE SLAG CONCRETE "in this report is largely based on GEO Special Project Report No. SPR 1/2010 produced in July 2010
[6] Reshma Rughooputh and Jaylina Rana "PARTIAL REPLACEMENT OF CEMENT BY GROUND GRANULATED BLAST FURNACE SLAG IN CONCRETE" in Journal of Emerging Trends in Engineering and Applied Sciences (JETEAS) 5(5): 340-343 © Scholar link Research Institute
Journals, 2014 (ISSN: 2141-7016)
[7] S.P.Sangeetha1, P.S Joanna "FLEXURAL BEHAVIOUR OF REINFORCED CONCRETE BEAMS WITH PARTIAL REPLACEMENT OF GGBS" in American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume-03, Issue-01, pp-119-127.