International Journal of Technical Innovation in Morden Engineering & Science (IJTIMES)
Impact Factor: 3.45 (SJIF-2015), e-ISSN: 2455-2584
Volume 2, Issue 5, May-2016

COMPARATIVE STUDY ON COMPRESSIVE STRENGTH OF NORMAL MIX AND LIGNITE COAL FLY-ASH CONCRETE

Mr. Jigar Zala

ASSIST. PROF., CIVIL ENGINEERING DEPARTMENT, ARHAM VEERAYATAN INSTITUTE OF ENGINEERING, TECHNOLOGY & RESEARCH

jigar.zala@hotmail.com

Abstract

Fly ash which is also known as flue-ash, that the residues generated by burning waste materials, and containing the fine particles that produce with the flue gases. Ash which does not rise is termed bottom ash. In an industrial context, fly ash usually refers to ash produced during burning of coal. Fly ash is a waste product which is produced from thermal or coal based power plants. Use of fly ash in the concrete greatly improves many of its properties. Its use reduces hydration of heat, permeability and alkali aggregate reaction, improves workability, increased resistance to sulphate attack and corrosion thus making concrete mass more strong and durable. Besides these advantages, its use also reduces cost of concrete by using required quantity of cement. World over, in many of the developed countries, use of fly ash is one of the essential ingredient of durable concrete. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coal-fired power plants and together with bottom ash removed from the bottom of the furnace is in this case jointly known as coal ash.

Present study aim is to carryout work on lignite coal fly ash as partial replacement with cement. Prepare normal mix concrete and lignite coal fly ash concrete mix and compare compressive strength of cube and cylindrical mould after 3 days, 14 days and 28 days respectively.

Keywords- *Lignite coal fly ash, Compressive Strength, Eco-Friendly, Locally available Waste, Low Cost, OPC Cement, Sustainable..*

I. INTRODUCTION

Cement has been around for at least 12 million years. When the earth itself was undergoing strong geologic changes natural, cement was being produced. It was this natural cement that humans first put to use. Eventually, they found out how to make cement from other materials.

Concrete comprises cement, aggregates (stone and sand of various grades) and water. It typically also contains additives to improve various characteristics such as workability, strength or resistance to chemical attack. It is nearly always reinforced with steel embedded within it, as it has high compressive strength but poor tensile strength.

There are two class of fly ash: 1) Class F fly ash, and 2) Class C fly ash.

Fly ash that is produced from the burning of bituminous coal is typically pozzolanic and is referred to as a Class F fly ash Materials with pozzolanic properties contain glassy silica and alumina that will, in the presence of water and free lime, react with the calcium in the lime to produce calcium silicate hydrates (cementitious compounds).

Fly ash that is produced from the burning of lignite or subbituminous coal, in addition to having pozzolanic properties, also has some self-cementing properties (ability to harden and gain strength in the presence of water alone). it is referred to as a Class C fly ash. Most Class C fly ashes have self-cementing properties.

II. MATERIAL SPECIFICATION & BLOCK DIMENSIONS

2.1. Cement

The cement used in all mixtures is commercially available Ordinary Portland cement of 53 grade confirming to IS 12269:1987 is used in this study. The specific gravity of cement is 3.13.

Figure 1: Cement

2.2. Coarse Aggregate

The fractions from 20 mm to 4.75 mm are used as coarse aggregate. The Coarse Aggregates from crushed Basalt rock, which is locally available being used. The Flakiness and Elongation Index were maintained well below 15%.

Figure 2: Coarse Aggregate

2.3. Fine aggregate

Those fractions from 4.75 mm to 150 microns are termed as fine aggregate. The river sand is used in combination as fine aggregate conforming to the requirements of IS: 383. The river sand is washed and screen, to remove impurities and oversize particles.

Figure 3: Fine Aggregate

2.4. Water

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since it helps to from the strength giving cement gel, the potable water is used as per the requirement.

2.5. Fly-Ash

Class C Fly-ash, the bye- product in burning of lignite coal plants, is collected from Pandhro-Kutch lignite coal Plants, Gujarat. Fly ash conforming to IS 3812 (part-1) is used and uniform blending of fly ash with cement is ensured.

Figure 4: Lignite Coal Fly-ash

2.6. Size of CLC Blocks

We have to prepare a mould as same standard size of cube and cylinder. The standard size of cube mould is 15cm x 15cm x 15cm and cylindrical mould is dia 15cm and height 30cm. So we have casted same size of blocks and check its compressive strength after 7, 14 & 28 days of curing in lab.

III. MATERIALS REQUIREMENTS FOR 9 CUBES & 9 CYLINDERS

Table 1: Material requirement for M20 Mix (1:1.5:3)

	Fly ash (kg) 30%	Cement (kg) 70%	Sand (kg)	Aggregate (kg) (20 mm)	Aggregate (kg) (10 mm)	Water (liter)
Cube	3.6	8.4	16.94	28	11	5.81
Cylinder	5.7	13.3	26.65	42	18	9.14
Total	9.3	21.7	43.59	70	29	14.95

IV. TEST RESULTS

4.1: NORMAL MIX CONCRETE

Table 2: Compressive strength After 3 days for cube

Serial No.	Load (KN)	Area (mm^2) (150 X 150)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	250	22500	11.11	10.73
2.	240	22500	10.66	
3.	235	22500	10.44	

Table 3: Compressive strength After 3 days for cylinder

Serial No.	Load (KN)	Area (mm^2) ($\pi/4 * d^2$)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	180	17671.45	10.18	8.95
2.	150	17671.45	8.48	
3.	145	17671.45	8.20	

Table 4: Compressive strength After 14 days for cube

Serial No.	Load (KN)	Area (mm^2) (150 X 150)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	330	22500	14.66	15.77
2.	375	22500	16.66	
3.	360	22500	16.00	

Table 5: Compressive strength After 14 days for cylinder

Serial No.	Load (KN)	Area (mm^2) ($\pi/4 * d^2$)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	290	17671.45	16.41	16.21
2.	270	17671.45	15.27	
3.	300	17671.45	16.97	

Table 6: Compressive strength After 28 days for cube

Serial No.	Load (KN)	Area (mm^2) (150 X 150)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	410	22500	18.22	18.07
2.	435	22500	19.33	
3.	375	22500	16.66	

Table 7: Compressive strength After 28 days for cylinder

Serial No.	Load (KN)	Area (mm^2) ($\pi/4 * d^2$)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	290	17671.45	16.41	18.20
2.	330	17671.45	18.67	
3.	345	17671.45	19.52	

4.2: LIGNITE COAL FLY ASH CONCRETE

Table 8: Compressive strength After 3 days for cube

Serial No.	Load (KN)	Area (mm^2) (150 X 150)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	295	22500	13.11	10.44
2.	150	22500	6.66	
3.	260	22500	11.55	

Table 9: Compressive strength After 3 days for cylinder

Serial No.	Load (KN)	Area (mm^2) ($\pi/4 * d^2$)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	130	17671.45	7.35	8.48
2.	90	17671.45	5.09	
3.	230	17671.45	13.01	

Table 10: Compressive strength After 14 days for cube

Serial No.	Load (KN)	Area (mm^2) (150 X 150)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	375	22500	16.66	14.73
2.	290	22500	12.88	
3.	330	22500	14.66	

Table 11: Compressive strength After 14 days for cylinder

Serial No.	Load (KN)	Area (mm^2) ($\pi/4 * d^2$)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	250	17671.45	14.14	13.96
2.	260	17671.45	14.74	
3.	230	17671.45	13.01	

Table 12: Compressive strength After 28 days for cube

Serial No.	Load (KN)	Area (mm^2) (150 X 150)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	430	22500	19.11	16.88
2.	400	22500	17.77	
3.	310	22500	13.77	

Table 13: Compressive strength After 28 days for cylinder

Serial No.	Load (KN)	Area (mm^2) ($\pi/4 * d^2$)	Compressive strength (N/mm^2)	Average Compressive strength (N/mm^2)
1.	300	17671.45	16.97	16.59
2.	305	17671.45	17.25	
3.	275	17671.45	15.56	

FOR CUBE

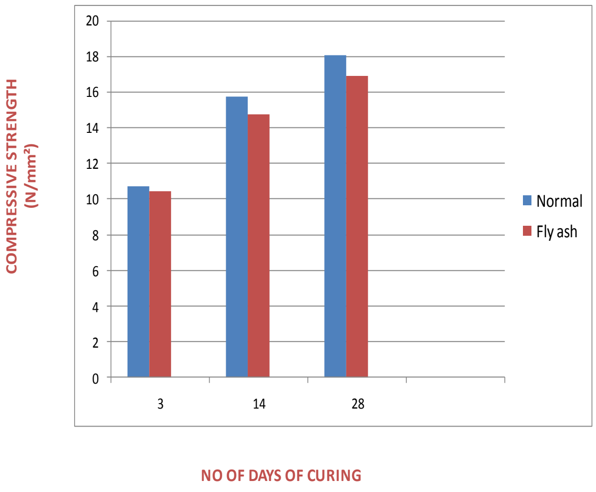

Figure 5: Compressive strength chart for cube

FOR CYLINDAR

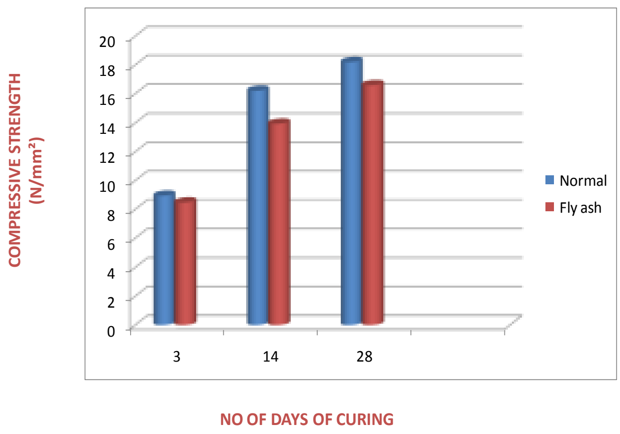

Figure 6: Compressive strength chart for cylinder

No of Days	Average Compressive strength (N/mm^2) **Cube**		Average Compressive strength (N/mm^2) **Cylinder**	
	Normal Mix design	Lignite coal fly Mix design	Normal Mix design	Lignite coal fly Mix design
3	10.73	10.44	8.95	8.48
14	15.77	14.73	16.21	13.96
28	18.07	16.88	18.20	16.59

V. CONCLUSION

Following conclusions are made based on work carried out:

1. As per literature survey, 30% of cement replaced by fly ash can give compressive strength nearer as per IS specification.

2. For cube Compressive strength of Lignite coal fly ash concrete is 6.59 %, which is lower (decrease) than normal mix concrete.

3. For cylinder Compressive strength of Lignite coal fly ash concrete is 8.85 %, which is lower (decrease) than normal mix concrete.

4. In lignite coal fly ash concrete the surface texture is smooth compare to normal mix concrete because of fineness of coal fly ash.

5. After analysis we observed that lignite coal fly ash concrete is cheaper than normal mix concrete and it gives compressive strength which is near to normal mix concrete.

REFERENCES

[1] Ganapati Naidu. P, B. Jagannadh Kumar, S.Adisesh, P.V.V.Satayanarayana(International Journal of Computational Engineering Research / ISSN: 2250– 3005)

[2] Gunavat K.Kate, Pranesh B. Murnal (International Journal of Advanced Technology in Civil Engineering, ISSN: 2231 –5721,Volume-2, Issue-1, 2013)

[3] F Faseyemi V.A (Al Andalus factory for cement products, Qatar)

[4] P. Priyadharshini, G. Mohan Ganesh, A.S. Santhi (IJSER © 2012)

[5] D. Hardjito and B. V. Rangan (Research Report GC 1 Faculty of Engineering Curtin University of Technology Perth, Australia 2005)

[6] M.S. Shetty concrete technology (S.Chand Technical)

[7] A Govt. of India Enterprise, Formerly National Thermal Power Corporation Ltd.

[8] ALF-CEMIND Technology Guide Cement Industries

