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Effect of Natural Admixture on Mechanical Properties of Fly Ash Mix Concrete

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Abstract - *Common assets are draining worldwide while in the meantime the created squanders from the business are expanding considerably. The feasible advancement for development includes the utilization of nonconventional and creative materials, and reusing of waste materials with a specific end goal to remunerate the absence of characteristic assets and to discover elective ways monitoring the earth. This investigation concentrate on Compressive strength , flexural strength and Bond strength of Conventional Concrete (CC) and Class C fly ash remains mixed solid consolidation with Natural Admixture. Grill hen egg was utilized as Natural admixture (NAD) to consider the impact of NAD with blend extents of 0%,0.25%,0.5%,1% and 1.5% on quality properties. The Class C fly fiery remains was supplanted to bond with different levels of 25%,35%,and 45%.NAD was supplanted to fluid and recognized the ideal substitution level of Class C fly cinder and ideal dose of NAD by keeping up the consistent fluid substance 0.55 to accomplished M20 grade concrete. The compressive strength, flexural strength and bond strength of cement for both CC and FA cement are thought about. At long last results are inferred that the ideal substitution of Class C fly fiery debris is 25% and ideal measurements of NAD is 0.25% taking into account strength results.*

Key Words: Natural admixture; Class C fly ash; compressive strength; Flexural strength and bond strength

1. INTRODUCTION

The fast development of constructional activities results in increase increment usage. The major drawback in usage of cement in bulk quantity, that ends up in liberation of inexperienced house gas (CO2).The green house gas causes to heating and continues mining and extraction of lime stone ends up in unnecessary issues to surroundings. Therefore researches are concentrate on property materials, during this situation chemical and mineral admixtures were introduced. Before invention of chemical and mineral admixtures our people were use some a lot of natural merchandise like surkhi, burnt, coconut shells, mud, clay, starch, jaggrey, lime and egg. Amount those merchandise broiler hen egg was chosen together of the admixture during this analysis

2. LITERATURE REVIEW

Ramesh Babu and Neeraja 1] had revealed that NAD was acting as accelerator when added to binder and also concluded that the 0.25% was optimum dosage of NAD. Class C fly ash with 0.25% NAD was attained higher strength than that of all FA replaced mixes.

Ramesh Babu et al [2] had concluded that all mechanical properties of conventional and Class C fly ash blended concrete exhibits same trend like compressive strength at optimum dosage. Hanifi Binici et al. [3] concluded that replacement of egg shell powder in sand leads to decrease in compressive strength and flexural strength, but it exhibits resistance against radiation effect.

3. EXPERIMENTAL STUDY

3.1 Materials

Concrete can be made utilizing different source materials. The present study Class C fly ash debris and egg were utilized to cast the concrete. The accompanying segments talk about constituent materials utilized for assembling concrete. Compound and physical properties of the constituent materials are displayed in this segment.

3.1.1 Cement

Ultra tech 53 grade ordinary Portland cement was used corresponding to IS 12269:1987 . The physical and compound properties were recorded below.

Table3.1: Chemical Compounds in cement

Particulars	Test result	Requirement as per IS:12269-1987
Chemical composition		
% Silica (SiO_2)	19.30	
% Alumina (Al_2O_3)	5.78	
% Iron oxide (Fe_2O_3)	4.79	
% Lime (CaO)	62.78	
% Magnesia (MgO)	0.85	Not more than 6.0%
% Sulphuric anhydride (SO_3)	2.49	Max. 3.0% when $C_3A>5.0$ Max. 2.5% when C3A<5.0
% Chloride content	0.004	Max. 0.1%
Lime saturation factor CaO $0.7SO_3/2.8SiO_2+1.2Al_2O_3+0.65Fe_2O_3$	0.94	0.80 to 1.02
Ratio of Alumina/Iron Oxide	1.22	Min. 0.66

TABLE 3.2: PHYSICAL PROPERTIES OF CEMENT

Particulars	**Test result**	**Requirement as per IS:12269-1987**
Physical properties		
Specific gravity	3.16	
Fineness (m^2/kg)	314.4	Min. 226 m^2/kg
Soundness		
Lechatlier expansion (mm)	0.9	Max. 10mm
Auto Clave expansion (%)	0.02	Max. 0.08%
Setting time (Minutes)		
Initial	45	Min 30 mints
Final	230	Max. 600 mints

3.1.2 Fly ash

As per ASTM C 618 (2003), Class C fly fiery remains made from Rayalaseema Thermal Power Plant (RTPP), Muddanur, Andhra Pradesh was used

3.1.3 Natural admixture egg

Grill hen egg was utilized as Natural admixture (NAD), Egg white egg whites and yellow yolk was throughly blended and added to concrete. The NAD was supplanted to water at different substitution levels 0%, 0.25%, 0.5%, 1.00% and 1.5% of cementitious material weight by keeping up the fluid to folio proportion (0.55)

3.1.4 Mineral admixture

Class C fly fiery remains (FA) was utilized as an added substance as indicated by ASTM C 618. Table 3.3 demonstrates the properties of Class C fly ash remains.

Table 3.3: Properties of fly ash

Physical properties	**Test results**
Specific gravity	2.16
pH	11.37
Moisture content	0.84%
Chemical properties	
Element	**%**
CaO	15.01
SiO_2	49.45
Al_2O_3	22.78

Fe_2O_3	5.62
$SiO_2 + Al_2O_3 + Fe_2O_3$	77.85
SO_3	1.28
MgO	2.15
Loss on ignition	1.45

3.1.5. Coarse aggregate

Crushed rock stones of size 20 mm and 10 mm were used as coarse total. The mass particular gravity was 2.62 in oven dry condition and water assimilation was0.3% of the coarse total 20 mm and 10mm as indicated by IS 2386 (Part III, 1963) were independently.

3.1.6 Fine aggregate

Typical stream sand was used as fine total. The particular gravity was 2.62 and water ingestion of the fine total was 0.325. The level of the sand was directed by strainer examination as indicated by IS 383 (1970).

4.EXPERIMENTAL PROCEDURE

4.1 Mix design

M 20 evaluation of ordinary solid (CC) was outlined according to IS 10262-2009 [8] and IS 456-2000 [7]. The coveted quality of M 20 evaluation of CC was around 26.6 MPa following 28 days of curing. Class C fly powder mixed blends were readied utilizing the composed M 20 evaluation of CC by supplanting the bond with FA at different levels of 0%, 25%, 35% and 45% of CC concrete weight. In both CC and FA mixed solid, NAD was supplanted in water at different measurements of 0%, 0.25%, 0.5%, 1.0% and 1.5% of cementitious material weight by keeping up consistent fluid – folio proportion (0.55) which influences the compressive quality [7]. Here, fluid alludes to water content with or without egg substitution and cover alludes to cementitious substance. The configuration blend extents are appeared in Table 4.1

Table 4.1Mix design

Sample Notation	Cement (Kg)	Fly Ash (Kg)	Fine aggregate (Kg)	Course aggregate (Kg)	Water (Lts)	% of NAD	Quantity of NAD (Lts)
C-100_FA-0	360 (100%)	0.00 (0%)	745	1150	197.00	0.00	0.00
					196.10	0.25	0.90
					195.20	0.5	1.80
					195.40	1.00	3.60
					191.60	1.50	5.40
C-75_FA-25	270 (75%)	90 (25%)	745	1150	197.00	0.00	0.00
					196.10	0.25	0.90
					195.20	0.50	1.80
					193.40	1.00	3.60
					191.60	1.50	5.40
C-65_FA-35	234 (65%)	126 (35%)	745	1150	197.00	0.00	0.00
					196.10	0.25	0.90
					197.20	0.50	1.80
					193.40	1.00	3.60
					191.60	1.50	5.40
C-55_FA-45	198 (55%)	162 (45%)	745	1150	197.00	0.00	0.00
					196.10	0.25	0.90
					195.20	0.50	1.80
					193.40	1.00	3.60
					191.60	1.50	5.40

4.2 Testing hardened properties of concrete

Three cubes size 150 mm were cast and tested for compressive strength for each age and each mix . Three beams of size 700 mm × 150mm × 150 mm were cast and tested for flexural strength and three cylinders of size 150mm dia and 300 mm height were casted by inserting the reinforcement to test the bond strength as shown in Fig.7 for each age and each mix. The average

of three samples was calculated respectively for each property. The weight and volume of cylindrical specimens were measured before compression test and from that unit weight of concrete (γ_c) was determined for 7, 28 and 56 days of curing. The failue samples were showed in Fig.4.1, Fig4.2 and Fig 4.3

Fig 4.1, 4.2 and 4.3 Compressive strength, Bond strength and flexural Strength

5. RESULTS and DISCUSSIONS

The compressive strength of the cubes were appeared in Table 6 and appeared in Fig 10. From the outcomes it is watched, increment in compressive strength with expansion in Class C fly ash remains up to 35% fly ash substitution at 7 days of curing, subsequently expanding the FA past 35% diminishing in compressive was seen without NAD. The Class C fly fiery remains contains high calcium content that prompts improvement of early strength in Class C fly slag blends than that of CC blends.

In CC blends the compressive strength was essentially expanded at 0.25% NAD at all the ages when contrasted and 0.00% NAD dose blend. The 7 days compressive strength of CC with 0.25% is more significant than 28 days outlined strength. It demonstrates that the NAD goes about as quickening agent to get composed 28 days strength of CC at 7 days of curing. Along these lines expanding the NAD measurement diminishing the strength was watched. This is because of overabundance measurement of NAD prompts development air voids and permeable in solid, it can be finished up from diminishing in unit weight.

compressive strength was seen at 0.25% NAD measurements for all FA blends that is more noteworthy than without NAD dose FA blends. This demonstrates NAD includes building up the quality in FA blends following 28 days curing. The blend C-75_FA-25 blend accomplished higher compressive strength at 0.25% NAD measurement than that of outstanding FA blends at 56 days, which is more noteworthy CC blends.

Table 5.1 Compressive strength of concrete cube

NAD Quantity	0.00%	0.25%	0.50%	1.00%	1.50%
C-100_FA-0					
7 Days	17.12	29.88	25.04	21.24	16.03
28Days	28.57	35.93	30.82	27.40	20.17
56Days	32.05	39.10	35.70	32.97	26.05
C-75_FA-25					
7 Days	18.57	15.95	15.70	12.08	11.10
28Days	27.37	26.97	22.23	17.23	16.90

56Days	30.92	35.07	32.09	31.58	20.17
C-65_FA-35					
7 Days	20.42	15.46	14.95	11.79	10.75
28Days	24.45	22.48	18.97	16.27	15.55
56Days	26.48	28.13	26.90	19.94	17.05
C-55_FA-45					
7 Days	19.58	13.43	12.65	10.10	10.15
28Days	22.68	22.04	17.97	14.79	14.19
56Days	24.23	26.68	25.97	21.92	21.41

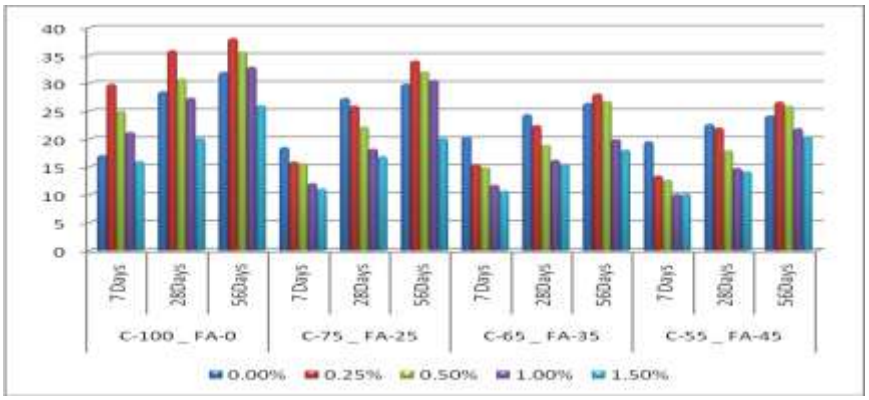

Figure 5.1 Compressive strength of concrete

5.2 Flexural strength

The flexural strength of CC and FA mixed blends were appeared in Table seven and Fig eleven. The flexural strength of CC cement was enlarged with enlargement in age with and while not NAD. The flexural strength of CC mix with zero.25% NAD accomplished higher flexural strength than that of while not NAD, that is like compression. The compressive strength is primary capability of all properties of cement. The expansions at class C flyash remains increments in flexural strength was seen up to thirty fifth fly dross substitution while not NAD dose at seven days, that's additional noteworthy than CC quality. this can be as a result of category C ash rubble impact, it having early strength finding out limit. The reduction in strength was seen with expansion of NAD to FA blends at 7 and 28 days. Following 28 days all the FA blends at 0.25% NAD dose accomplished most significant qualities than that of residual doses. The blend C-75_FA-25 with 0.25% NAD blend accomplished most astounding strength than that of CC blend without NAD blend furthermore it is the most astounding among residual FA blends. The expansion in NAD dose more than 0.25% NAD diminish in quality was seen in all blends following 28 days.

At 56 days the CC blends accomplished most noteworthy flexural strength than that of residual FA mixed blends without NAD. From 0.00% NAD to 0.25% NAD measurements all the blends flexural strength was expansions there by expanding the NAD dose diminish in strength was watched. Among all the blends the CC with 0.25% NAD blend accomplished higher qualities than that of outstanding blends and remaining NAD measurements.

Examines presumed that expansion of NAD enhances the flexural strength of cement. Expansion of admixtures or higher better materials has higher impact on flexural quality of cement. The relationship b/n compressive strength and flexural strength was appeared in Fig 5.3. From the outcome and Fig 5.2 the flexural strength increments with expansion in compressive strength.

Table 5.2 Flexural strength of concrete (MPa)

NAD Quantity	0%	0.25%	0.50%	1.00%	1.50%
C-100_FA-0					
7 Days	3.08	4.09	3.67	3.31	2.79
28Days	4.17	4.49	4.18	3.99	3.52
56Days	4.23	4.72	4.44	4.26	3.79
C-75_FA-25					
7 Days	3.19	2.97	2.92	2.63	2.49

28Days	3.91	3.82	3.53	3.29	3.19
56Days	4.07	4.39	4.31	4.09	3.39
C-65_FA-35					
7 Days	3.29	2.87	2.79	2.57	2.51
28Days	3.77	3.62	3.41	3.07	2.97
56Days	3.82	3.96	3.89	3.42	3.21
C-55_FA-45					
7 Days	3.21	2.63	2.57	2.39	2.29
28Days	3.67	3.49	3.28	3.07	2.81
56Days	3.75	3.92	3.82	3.57	3.31

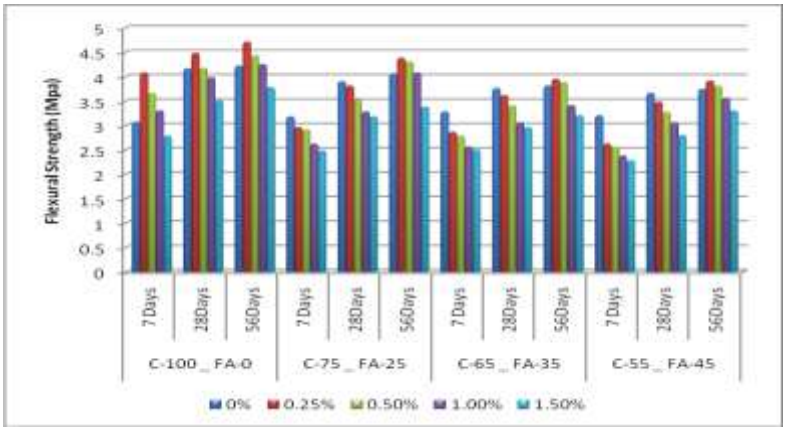

Figure 5.2 Flexural strength of concrete beam

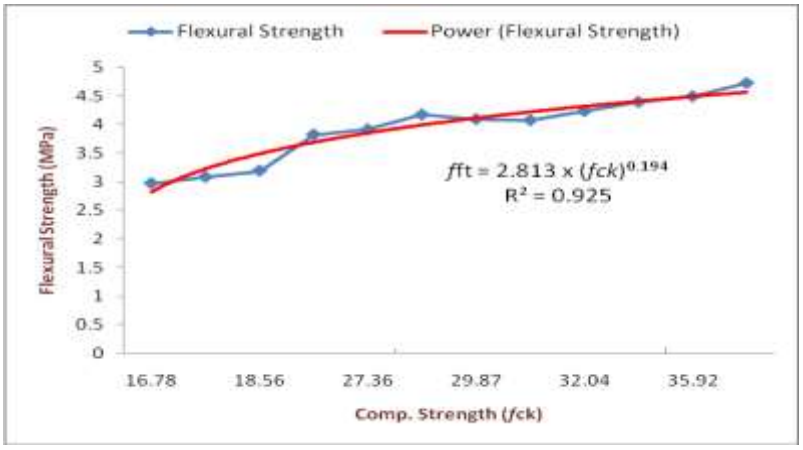

Figure 5.3 Relationship between compressive strength and flexural strength

5.3 Bond strength

The bond strength of all the blends was appeared in Table 8 and Fig 13. From the outcomes the bond strength of CC blends increments with expansion in age for every one of the ages with and without NAD. The bond strength of C-100_FA-0 with 0.25% NAD accomplished higher strength than that of without NAD dose, accordingly expanding the NAD measurement the diminishing in bond strength was seen at all the ages. The bond quality of C-100_FA-0 blend with 0.25% NAD was 32.12%, 12.14% and 9.03% higher that of without NAD at 7, 28 and 56 days. Where as in FA mixed blends increment in Class C fly ash remains bond strength increments up to 35% substitution at 7 days without NAD dose and decline in strength was seen with expansion of NAD for all NAD measurements. At 28 days all FA blends, 25% substitution of accomplished higher strength however it is not as much as C-100_FA-0 blends at 28 days. The same abatement in bond strength was seen by expansion of NAD to FA blends at 28 days moreover. At 56 days increment in bond strength was watched for all FA mixed blends. C-75_FA-

25 blend accomplished higher strength at 0.25% NAD than that of without NAD dose. That is 6.71% higher than that of without NAD measurement. It is plainly watched that up to 28days the expansion of NAD abatements the bond strength for Class C fly ash blends, following 28 days of curing the NAD has effetely included being developed of compressive , flexural strength and bond strength. The same expanding pattern was seen in all FA supplanting blends with 0.25% NAD following 28 days of curing.

Table 8. Bond strength of concrete (GPa)

NAD Quantity	0.00%	0.25%	0.50%	1.00%	1.50%
C-100_FA-0					
7 Days	6.20	8.20	7.50	6.91	6.00
28Days	8.02	8.99	8.33	7.85	6.73
56Days	8.49	9.26	8.96	8.61	7.65
C-75_FA-25					
7 Days	6.46	5.99	5.94	5.21	5.00
28Days	7.85	7.64	7.07	6.40	6.16
56Days	8.20	8.75	8.50	8.29	6.73
C-65_FA-35					
7 Days	6.78	5.90	5.80	5.15	4.92
28Days	7.42	7.11	6.53	6.05	5.91
56Days	7.72	7.95	7.76	6.70	6.37
C-55_FA-45					
7 Days	6.64	5.49	5.33	4.76	4.78
28Days	7.14	7.04	6.36	5.77	5.65
56Days	7.38	7.75	7.64	7.02	6.77

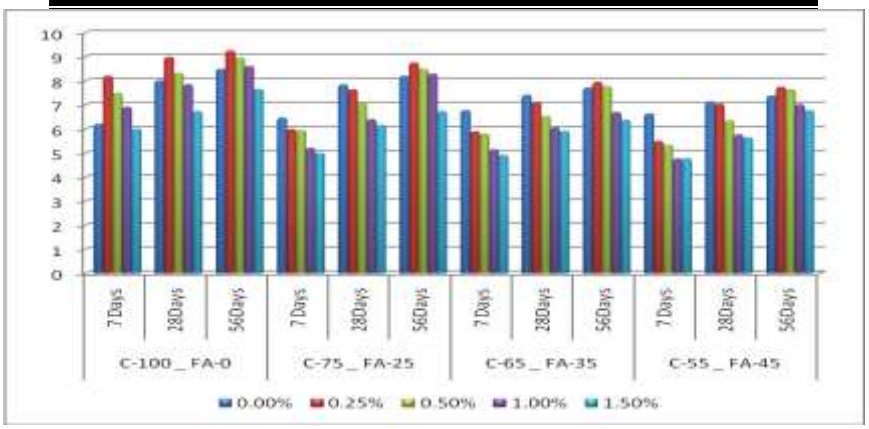

Figure5.4 Bond strength of concrete

6. CONCLUSIONS

The following conclusions have been observed based on the investigation studied on the effect of Natural Admixture (broiler hen egg) on mechanical properties of CC and FA blended concrete.

- NAD effectively concerned to achieved 28 days designed strength of M20 grade concrete combined at 7 days of curing with 0.25% NAD dosage.
- So that NAD can be used as accelerator to enhance the hydration.
- The flexural strength of CC and FA was increased with 0.25% NAD dosage. The flexural strength of C-75_FA-25 combine earned higher strength than that of remaining FA blended mixes.
- The bond strength of CC and FA will also increases with increase in NAD dosage up to 0.25%, thereby decrease in bond strength indicates 0.25% NAD is optimum dose supported all the strength properties.

- The 25% Class C fly ash can be suggested to get design strength of M20 grade concrete.
- The NAD will also increases the flexural strength and bond strength of the each CC and FA concrete.
- Good correlation was found between compressive strength and flexural strength
- Equations to predict the Flexural strength supported on the compressive strength for fly-ash blended with natural admixture are proposed

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