International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 04 | Apr-2018 www.irjet.net p-ISSN: 2395-0072

Eco-Friendly concrete by partial replacement of cement with Sodium Bentonite and FlyAsh

Roobankumar R[1], Niyas Ali A[2], Shahul Hameed.D.K.S[3], Shankar Raj B[4], Syed Ayub Z[5].

[1] *Assistant Professor, Department of Civil Engineering, Dhaanish Ahmed College of Engineering, Chennai, India*
[2,3,4,5] *Department of Civil Engineering, Dhaanish Ahmed College of Engineering, Chennai, India*

Abstract - *The main objective of the project is to find out the effectiveness of fly ash and Sodium bentonite collectively on the concrete strength. In this work it was proposed that the cement is partially replaced in the ratio of 40% of cement with partial replacement of (35% Fly ash and 5% Sodium bentonite, 30% of Fly ash and 10% of Sodium Bentonite, 25% Fly ash and 15% Sodium Bentonite) and recycled materials respectively. For investigating the potential use of Sodium bentonite and fly ash in cement concrete by replacing Ordinary Portland cement (OPC) and evaluate the strength and impact of these materials of concrete. Many of the developing countries are replacing the materials with the materials which are recycled so as to minimize the environmental hazards and safe guarding the natural resources. Cubes and cylinders were casted with M30 design mix and compressive, split tensile strength were studied for 7, 14, 28 days and compared with conventional concrete based on the test results, the various strengths were identified.*

Key Words: Fly Ash, Sodium Bentonite, Tensile Strength, Compressive Strength

1. INTRODUCTION

The protection of environment became a challenge to many of the developing countries, nearly 7% of CO2 production by cement industry, causes huge damage to the environment. Bentonite is second largest available raw material; the production cost of the bentonite is very less compared with Ordinary Portland Cement (OPC) in India. Calcium bentonite is expensive and it has the capacity to increase the volume by addition of water. For investigating the potential use of Calcium bentonite and fly ash in cement concrete by replacing. Many of the developing countries are replacing the materials with the materials which are recycled so as to minimize the environmental hazards and safe guarding the natural resources. Fly ash is the notorious waste product of coal based on electricity generating thermal power plants known for its effect on agricultural land, surface and subsurface water pollution, soil and earth pollution. The use of Fly ash in concrete contributes in the reduction of greenhouse emission with negative impact on the economy. It has been observed that 0.9 tons of co2 is produced per ton of cement production. To improve the environment friendliness of concrete to make it suitable as a "Green building" material. Inorganic residual product are used more efficiency as green aggregates in concrete and the environment is protected from waste deposit. The cement is replaced with material and mineral admixture will improve the strength and durability of concrete. However, people act less alqutruistically and are more likely to cheat and steal after purchasing green product then after purchasing conventional product, Environmentally friendly also eco friendly, natural friendly[8]. Most of the concrete considering from every aspect of raw material manufacture to structural design, construction. Instead, consumption of products which is causing harmful impacts on the environment is gaining further momentum. Such a phenomenon is detrimental to environmental sustainability and therefore requires immediate attention and corrective action.

MATERIALS

Cement used in this experimental work is of 53 grade of Ordinary Portland Cement (OPC), Specific Gravity – 3.12, Standard Consistency – 32, Initial Setting Time – 30 minutes, Final Setting time – 320 minutes are within the limit as per IS 10262-2001. The golden colored, finest form of Sodium Bentonite was purchased from the metro rail project work in Ennore, Chennai. Fly Ash, Class C was purchased from Ennore power house and its Specific Gravity is 2.6. The Coarse Aggregate of 20mm size, angular shape is used and its specific gravity is 2.75. The Fine Aggregate which is used has the specific gravity of 2.52. Normal tap water is used for the concrete mix.

MIX DESIGN OF CONCRETE

The mix design was done from recommended IS: 10262-1982. The concrete mix proportion was 1:1.62:2.95 by weight. The percentage of materials used based mix proportion is tabulated in the below table2.

Table -1: Chemical properties of Ordinary Portland Cement.

S.NO	CHEMICAL PROPERTIES	PERCENTAGE
1	Tricalcium silicate CaO.SiO2 (C3S)	3%
2	Dicalcium silicate 2CaO.SiO2 (C2S)	40%
3	Tricalcium aluminate 3CaO.Al2O3 (C3A)	11%
4	Tetracalcium aluminate 4CaO.Al2O3.Fe2O3	11%

Table -2: Mix Proportions in Kg

MIX PERCENTAGE	W/C RATIO	CEMENT	FLY ASH	SODIUM BENTONITE	FINE AGGREGATE
35% Fly ash 5% bentonite	0.45	6	3.5	0.5	10.5
30% Fly Ash 10% bentonite	0.45	6	3	1	10.5
25% Fly Ash 15% bentonite	0.45	6	2.5	1.5	10.5

Table -3 Compressive strength of concrete

PERCENTAGE	7 DAYS	14 DAYS	28 DAYS
35% Fly ash 5% bentonite	12	15.55	18.88
30% Fly ash 10% bentonite	12.44	16	17.77
25% Fly ash 15% bentonite	12	17.77	21.12

The above table shows, if using 25% fly ash and 15% bentonite the compressive strength of concrete is 21.12 N/mm².

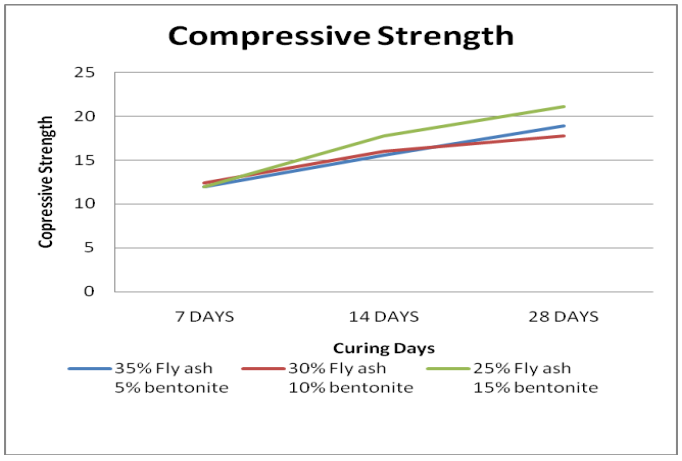

Chart -1: Compressive Strength of concrete

Table -4 Split Tensile Strength of Concrete

PERCENTAGE	7 DAYS	14 DAYS	28 DAYS
35% Fly ash 5% bentonite	2.22	1.75	2.16
30% Fly ash 10% bentonite	2	2.38	1.59
25% Fly ash 15% bentonite	1.59	2.32	2.61

The more tensile strength of concrete is 2.61 N/mm² if using 25% of fly ash and 15% of bentonite than 25% of fly ash & 10% of bentonite.

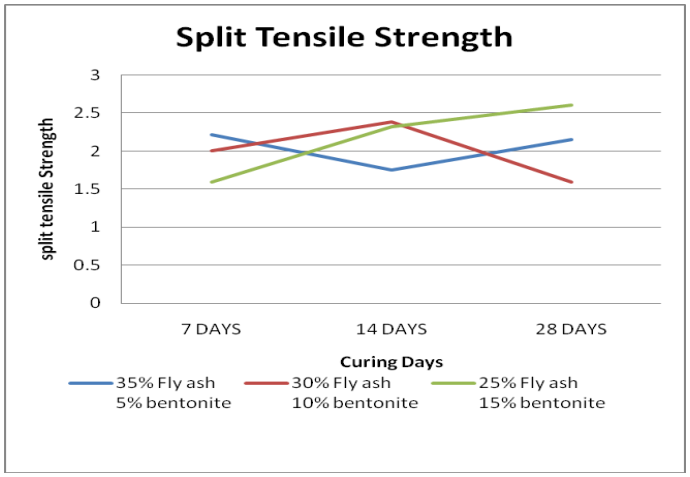

Chart -2: Split Tensile Strength of concrete

Fig 1 Compressive Strength Test

3. CONCLUSIONS

Based on higher than study the subsequent observations are created on partial cement replacement by flyash and sodium bentonite. In which many test performed to ascertain the performance of flyash and sodium bentonite. Fullfilling the condition of partial cement replacement materials we got the result for different percentage of material.

For Compressive Strength, For different percentage of 35% Fly ash 5% Sodium bentonite, 30% Fly ash 10% Sodium bentonite, 25% Fly ash 15% Sodium bentonite we got 28 days result of 18.88 N/mm², 17.77 N/mm², 21.12 N/mm².
For Tensile strength, For different percentrage of 35% Fly ash 5% Sdium bentonite, 30% Fly ash 10% Sodium bentonite, 25% Fly ash 15% Sodium bentonite we got 28 days result of 2.16N/mm², 1.59 N/mm², 2.61N/mm².

Overall that, it is preferred to use the percentage of 25% Fly Ash and 15%Sodium Bentonite for the concrete of partial replacement of cememt.

ACKNOWLEDGEMENT

Authors thank Dhaanish Ahmed College of Engineering, Chennai, India for the support to conduct the research work

REFERENCES

[1] Indian mineral handbook. Part-III: mineral reviews, 52ed edition, Bentonite, Government of India, Ministry of mines, Indian bureau of mines, 2013.

[2] International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 1, January 2017.

[3] International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 4, April 2017,

[4]Suman et al, International Journal of Advanced Engineering Research and Studies, FLY ASH CONCRETE: A TECHNICAL ANALYSIS FOR COMPRESSIVE STRNGTH, IJAERS/Vol. II/ Issue I/ Oct – Dec, 2012/ 128-129.

[5]IMPACT: International Journals of Research in Engineering and Technology(IMPACT: IJRET) ISSN(E):2321-8843: ISSN(P):2347-4599 Vol. 2, Issue 2, Feb 2014, 259-264.

[6]International Journal of Research in Advent Technology (E-ISSN: 2321:9637) Special Issue, National Conference, "Vishwacon'16",19 March 2016.

[7]ARPN Journals of engineering and Applied Science, SSN 1819-6608, Vol 11, No 5, March 2015.

[8]CBS E- journals, bez n bytes, vol. 6, Dec.,2010 ISSN 0976-0458

[9]IIMT College of Engineering, Greater Noida, India(ICETETSM-17) ISBN: 978-93-86171-38-2, 12th April 2017.

[10]Contemporary Management Research Pages 35-46, Vol.9, No. 1, March 2013 doi:10.7903\cmr, 10209.

[11]Karthikeyan M, Raja R P, Nandhini A, Vinodha R. Application on partial substitute of cement by bentonite in cement concrete. International Journal Of ChemTech and Research.

[12]Junaid Akbar, Bashir A, Mahummas S, Salman A, Khan S. Evaluating the effect of bentonite on strength and durability of High-performance concrete. International Journal of Advanced Structures And Geotechnical Engineering. 2013 January; 2(1), 1-5.

[13]Kaci A, Chaouchi M, Andreani P A. Influence of bentonite clay on the rheological behavior of fresh mortars. Cement And Concrete Research. 2011; 41, 373-379.

[14]Lima G D, Mello I, Resnde R, Silva R. Use of bentonite and organobentonite as alteratives of partial substitution of cement in concrete manufacturing. International Journal of Concrete Structures and materials 2014 March; 8(1), 15-26.

[15]Rafat Siddique. Utilization of industrial by-products in concrete. 2nd International conference on sustainable civil engineering structures and construction materials. Procedia Engineering. 2014; 95, 335 - 347.