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Experimental Investigation on Strength Properties of Concrete Using Color Adsorbed Fly Ash

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Abstract: The main objective of the project is to solve the waste management of Textile Industries, Thermal Power plants and Steel Manufacturing Industries. The solution for current environmental problems of disposal of fly ash has been dealt by use of Fly ash as an adsorbent and using Color Adsorbed Flyash as partial replacement for cement in concrete. The key importance is to use the waste materials in concrete. In this experimental investigation an attempt is made to study the effect of partial replacement of Cement by Color Adsorbed fly ash properties of Concrete. Also a detailed investigation is made to study the effect on the addition of Color Adsorbed Fly ash on the properties of concrete.

Keywords: *Color Adsorbed Flyash, Adsorption, Fly ash, Material Properties, Textile Effluent*

1. Introduction

Concrete is the largest produced construction material. Aggregates and cement are the important constituents in concrete. They give body to the concrete and affect the economy. Requirement of aggregate is also increasing proportionally as all the materials required for producing cement and concrete. They are obtained from the earth's crust only. Hence, we are exploiting the natural resulting in depletion of the resources. Resources could be saved and preserved by finding an alternative and substitute materials. Thus, an attempt for partial replacement of ingredients of concrete with Color Adsorbed Fly Ash is made.

Heavy metals and dyes are common pollutants, resulting from specific industries (electroplating, fertilizers, pesticides, pigments manufacturing and textile dye finishing) in huge amounts of wastewaters, with compositions ranging from tenth up to thousands of mg/L. For avoiding flora, fauna and health problems, the discharge limits are strict and require advanced wastewater treatment processes.

2. Material Properties

The properties of materials used in the mortar are discussed below:

2.1 Cement

Ordinary Portland cement of 53 grade available in local market was used. The specific gravity of cement that was taken was 3.14.

2.2 Fine Aggregate

The sand sieved through 4.75 mm sieve is used having specific gravity of 2.6. The fine aggregates belonged to grading zone III.

2.3 Coarse Aggregate

Locally available coarse aggregate having the maximum size of 12.5 mm is used. The specific gravity of coarse aggregate that was taken was 2.67.

2.4 Fly ash

Fly ash is used as a replacement for cement. The specific gravity of fly ash that was taken was 2.32.Fly ash is replaced with cement by 5%, 10%, 15% and 20%.

2.5 Water

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Potable water available in the laboratory was used.

2.6 Textile Effluent

Dyes and dyestuffs find use in a wide range of industries but are of primary importance to textile manufacturing. Dye has been collected from Dice King Industries in samalapuram near tirupur, Tamil Nadu, India.

2.7 Pebbles

Pebbles composed of sub-angular, durable and dense grains of predominately siliceous material. Support Pebble that we offer, are spherical in shape and allows even distribution in support beds and good flow

Experimental Investigation

In this investigation the hardened properties of concrete for various partial replacement percentages of Color Adsorbed Fly ash are determined.

Packed Column Set-up

Packed column set-up is made by using single layer fly ash and then effluent is treated with this packed

column set-up.The column is of non-porous, non-reactive and inert. The column is packed with adsorbent materials in plain manner or in alternate layers of adsorbent and inert materials.

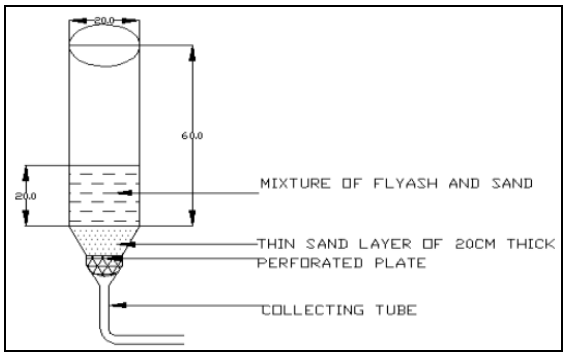

Fig.1 *Packed Column Set-Up*

Mix proportions

Design procedure was formulated for high volume fly ash concrete which was relevant to Indian standard (IS 10262-2009)

Hardened properties of Color Adsorbed Fly Ash Concrete

In order to find the mechanical properties Compressive strength tests were conducted at 7 and 28 days of cube (150 X 150 X 150 mm) specimens. For each combination, two specimens were tested.

In order to find the split tensile strength of concrete 7 and 28 days of cylinder (150 X 300 mm) specimen are cast. For each combination, two specimens were tested.

Fig. 2 *Compressive Strength Test*

The following tables show the 7 days compressive strength of Color Adsorbed Fly Ash in Concrete:

Table I: *7 & 28 Days Compressive Strength of Concrete with Color Adsorbed Fly Ash*

S. NO	*Percentage of Replacement of Color Adsorbed Flyash(%)*	*Compressive Strength*	
		7days(N/mm²)	*28days(N/mm²)*
1	*0*	*23*	*35*
2	*5*	*26.23*	*37.78*
3	*10*	*26.64*	*38.67*
4	*15*	*26.84*	*38.89*
5	*20*	*33.95*	*40*

The following graph shows the variation in the Hardened properties of SCC with fly ash:

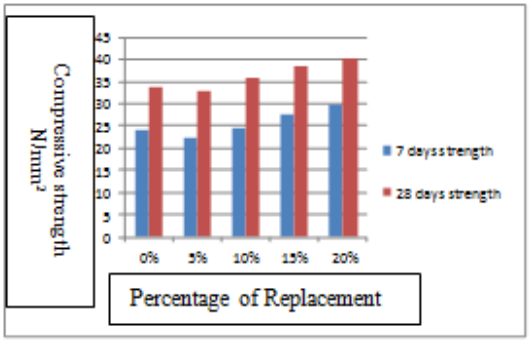

Fig 3: *Chart for Compressive Strength of Concrete with Color Adsorbed Fly Ash*

Fig 4: *Split Tensile Strength*

The following table shows the 7 days split tensile strength of Color Adsorbed Fly Ash in Concrete:

Table II: *Split Tensile Strength of Color Adsorbed Fly Ash in Concrete*

S. NO	*Percentage Replacement of Color adsorbed Flyash(%)*	*Split Tensile Strength*	
		7days(N/mm²)	*28days(N/mm²)*
1	*0*	*2.6*	*3.1*
2	*5*	*3.96*	*4.44*
3	*10*	*4.05*	*4.67*
4	*15*	*3.41*	*4.89*
5	*20*	*4.32*	*5.11*

The following table shows the 28 days split tensile strength of Color Adsorbed Fly Ash in Concrete:

The following graph shows the variation in the split tensile strength of Color Adsorbed Fly Ash in Concrete:

Flexural Strength Test on Beam

As expected, the flexural cracks are initiated in the pure bending zone. As the load increased, existing cracks propagated and new cracks developed along the span.

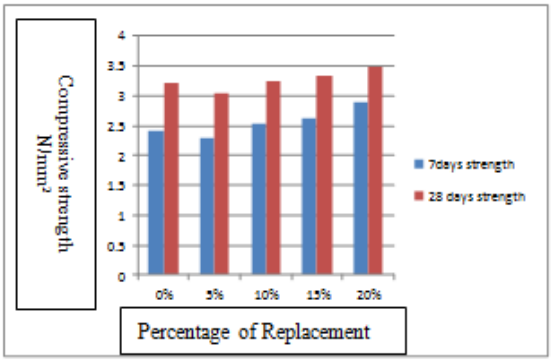

***Fig 5**: Charts for Split Tensile Strength of Concrete with Color Adsorbed Fly Ash*

In the case of beams with larger tensile reinforcement ratio some of the flexural cracks in the shear span turned into inclined cracks due to shear effect of shear force. Near peak load the beam deflected significantly, thus loading that the tensile steel must have yielded at failure. The final failure of the beams occurred when the concrete in the compression zone crushed, accompanied by buckling of the compressive steel bars. The failure mode was typical of that an under reinforced concrete beam. The crack pattern and failure mode of several test beams are shown in figures below:

***Figure 7.**Initial Crack pattern*

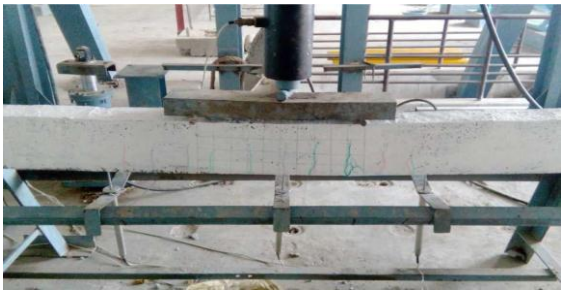

***Figure 8.**Flexural cracks at Ultimate Load*

The following tables show the Split Tensile strength of FRC with Coconut fibre:

***Table III:** Flexural Strength*

Normal Concrete		*Color Adsorbed Flyash Concrete*	
Load (kN)	*Deflection (mm)*	*Load (kN)*	*Deflection (mm)*
0	0	0	0
10	0.18	10	0.25
20	1.33	20	1.3
30	2.52	30	2.55
40	3.25	40	3.36
50	4.02	50	4.05
55	4.55	58	4.8
52	12.3	55	10.78

The following graph shows the variation in the Split Tensile strength of FRC with Coconut Fibre:

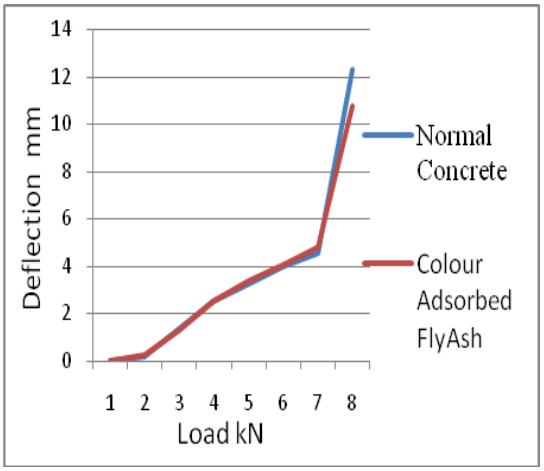

***Figure 7.**Chart for flexure strength of Color adsorbed flyash*

Conclusion

The present work suggests the usefulness of partial replacement of ingredients of concrete with Color Adsorbed Fly Ash. This work aims to provide a environmental friendly solution for disposal of flyash & textile effluent. The Flyash used as an adsorbent has acted well and adsorbed the heavy metals and Color present in the effluent.

Color Adsorbed Flyash have shown increase in compressive and flexure strength properties of concrete. Flexure strength was found to be good at 20% replacement. Hence the use of Color adsorbed flyash gives effective strength to the concrete at 20% replacement.

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References

[1] IS: 456-2000 (reaffirmed 2005) "Plain and Reinforced Concrete – Code of Practice", Fourth Revision, pp.14

[2] IS: 10262-2009. Concrete mix proportioning-Guidelines. New Delhi: Bureau of Indian Standards;

[3] Shetty 2005, concrete techonology, S. Chand & Company Ltd. New Delhi.

[4] IS: 3812-1981, Specification for fly ash for use as pozzolana and admixture, Bureau of Indian Standards, New Delhi.

[5] IS: 383-1970 (reaffirmed 1997) "Specification for Coarse and Fine Aggregates from Natural Source for Concrete", New Delhi.

[6] IS: 8112:2013, Specification for Ordinary Portland Cement,43 Grade (Second Revision).

[7] Radha Das**,** Dept. of Chemical Engineerig, Haldia Institute of Technology, ICARE Complex, P.O. HIT, Haldia, Purba Medinipur -721 657, India, Adsorption Isotherm of Fly Ash for Textile Dying Industry Effluents. Jr. of Industrial Pollution Control 22 (1)(2006) pp 179-184.

[8] U.M. Graham, T.L. Robl, R.F. Rathbone, Center for Applied Energy Research, 3572 Iron Works Pike, University of Kentucky, Lexington, Kentucky 40521 1-8433 and and C.J.McCormick Advanced Pozzolan Technologies, Inc., 175 West Wieuca Rd., NE, Atlanta, Georgia 30342, Adsorptive properties of fly ash.

[9] P Chandrasekaran & R Malathy**,** Department of Civil Engineering, Kongu Engineering College, Perundurai 638 052, India, Research and Development, Sona College of Technology, Salem 636 005, India, Received 26 November 2010; accepted 27 March 2012. Use of Color adsorbed fly ash in brick manufacture

[10] Larry Sutter, Doug Hooton, Scott Schlorholtz & Zeyad Ahmed1, Melanie Keuber Watkins1,Dave Hand,Andre de Groot, Michigan Technological University, University of Toronto, Iowa State University, Methods for Evaluating Fly Ash for Use in Highway Concrete, NCHRP Report 749.

[11] Geetha Varma.V, Dr.Ram Karan Singh and Vaishali Sahu**;** Senior Assistant Professor, Department of Civil Engineering, New Horizon College of Engineering, Bangalore, India Professor and HOD, Department of Civil & Environmental Engineering, ITM University, Gurgaon, India.Assistant professor, Department of Civil & Environmental Engineering, ITM University, Gurgaon, India. A comparative study on the removal of heavy metals by adsorption using fly ash and sludge.

[12] Irina-Isabella Savin, Romen Butnaru; Ioan C. Ştefănescu" Technical Highschool, 51-53, Socola Str., 700268, Iaşi, Romania "Gheorghe Asachi" Technical University of Iasi, Faculty of Textile – Leather Engineering and Industrial Management,53 Mangeron Blvd., Building TEX1, 700050 Iaşi, Romania. Waste Water Characteristics in Textile Finishing Mills.

[13] Zeyad Tareq Ahmed Michigan Technological University; The Quantification of the Fly Ash Adsorption Capacity for the Purpose of Characterization and Use in Concrete

[14] Abdul Karim Shah, Zeenat M. Ali, Abdul Rehman Memon, A. Jabbar Laghari, Moina Akhtar Mughal, Syed Farman Ali Shah, Hussain Saleem, International Journal of Scientific & Engineering Research, Volume 4, Issue 9, September-2013. Exploitation of Low Cost Coal Fly Ash Adsorbent with Coagulants for the Treatment of Industrial Complex Nature Dyes Wastewater.

[15] Abdul Karim Shah, Zeenat Muhammad Ali, Abdul Jabbar Laghari, and Syed Farman Ali Shah, Chemical Engineering Department, Dawood University of Engineering and Technology, Karachi, Pakistan & Dr. M. A. Kazi Institute of Chemistry. University of Sindh, Jamshoro, Pakistan.(05 February 2013). The comparative study of fly ashes adsorption for dyes effluent pollutants.