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EXPERIMENTAL INVESTIGATION ON USE OF FLY ASH WITH RECRON 3S FIBERS IN CONCRETE

[1] **P DEEPAK**, [2] **B VENKAT RAM** , [3] **K TEJA, [4] S.MANASA**

[1]BTECH STUDENT, [2] BTECH STUDENT, [3] BTECH STUDENT

[1]CIVIL DEPARTMENT,

[1] KOMMURI PRATAP REDDY INSTITUTE OF TECHNOLOGY, HYDERABAD, INDIA

Abstract: Concrete is a homogeneous mixture of cement, aggregate, water, and admixtures. In concrete, fly ash is used as a cementitious material. Fly ash is a by-product of thermal power plants. To fulfill the need for electricity which produces many tons of fly ash. To utilize this waste many scientific experiments ar done on this..

As a result, a comparative study is carried out, and the use of fly ash as a cement replacement in concrete can be analyzed and compared. The variation in compressive strength of concrete at 35%,40%,45% & 50% of fly ash and the addition of Recron 3s fibres is performed.

Index Terms-: Fly Ash, Cement, Fine Aggregate, Coarse Aggregate, Recron 3s fibre.

I INTRODUCTION

1.1 GENERAL

Concrete is the most important material for any construction work like building construction and cement concrete pavement. There are some modifications performed in concrete by the introduction of fly ash in the concrete. Fly ash is a cementitious material so cement is partly replaced by fly ash in concrete. Fly ash is a waste product of thermal power plants in large quantities. To fulfil the need for electricity large amount of coal is burned in the thermal power plant which produces a million tonnes of fly ash. Fly ash contains SiO2, CaO, and Al2O3. Fly ashes are classified into Class C and Class F. Class C ashes are generally derived from Sub-bituminous coal, which contains more than 20% of CaO. ClassF ashes are derived from bituminous and anthracite coal which contain less than 10% CaO

1.2 FLY ASH AND FIBER- USE IN CONCRETE

Fly ash is the finest of coal ash particles. It is called fly ash because it is transported from the combustion chamber by exhaust gases. Fly ash is the fine powder formed from the mineral matter in coal, consisting of the noncombustible matter in coal and a small amount of carbon that remains from incomplete combustion. Fly ash is generally light tan in color and consists mostly of silt-sized and clay-sized glassy spheres. Properties of fly ash vary significantly with coal composition and plant operating conditions. In the United States, approximately 50 million tons of fly ash is reused annually.

Fly ash is referred to as either cementations or pozzolanic. A cementations material is one that hardens when mixed with water.

II REVIEW OF LITERATURE

Z.H Mohebi et al. (2014)study showed a similar trend where workability reduced with an increase in fibre dosage 0.15%,0.30% and 0.45% and it is considered that there exists an inverse relation between fibre dosage and workability

Vikrant et al. (2011)study showed a different trend, with an increase in the length of both the fibres the strength factor also increased. PPF in concrete showed an increase of 11.32% in compressive strength when compared with the control specimen..

Akim choudappa yallappa, Marabathina maheswara rao and vinod nagpure.(2015) For concrete with addition of polypropylene (Recron-3s) fibers, as the amount of fibers content increases (0.25%, 0.5%, 0.75% and 1%) the workability decreases. For 20% and 30% fly ash content the compressive and split tensile strength is more for 0.5% and 0.25% fibers addition respectively and for 40% fly ash the compressive and split tensile strength is more for 0.75% fiber content. Beyond 0.75% addition of fibers there is no significant increase in the strength for all the mixes containing fly ash.

Prathamesh D Pawaskar, Vaibhav Shirodkar (2003) The Workability of concrete measured from slump cone test, as the percentage of Recron 3s fiber increases in mix slump value decrease. Hence it can be concluded that with the increase in the fiber content workability decreases. To evaluate flexural strength of plain cement concrete and fiber reinforced concrete.

Ridha Nehvi, Prashant Kumar and Umar Zahoor Nahvi (2016) Study revealed significant superiority of 0.5% recron 3s exhibiting highest compressive strength of 40.1 MPa after 28 days of curing with an average strength of 35.6MPa. 3% Recron 3s was observed to improve compressive strength by 23.38% after 28 days of curing.

.**Marthong C and Agrawal T.P(2012)** have stated that the normal consistency increases with an increase in the grade of cement and fly ash content. Setting time and soundness decreases with the increase in the grade of cement. The use of fly ash improves the workability of concrete and workability increases with the decrease in the grade of cement. Bleeding in fly ash concrete is significantly reduced and other properties like cohesiveness, pumping characteristics, and surface finish are improved.

MATERIALS AND METHODS

3.1 Properties of Cement

Portland slag cement of 43 grade conforming to IS: 455-1989 is used for preparing concrete specimens. The properties of cement used are given in the Table 3.1.

Table 3.1 Properties of cement: Portland Pozzolana Cement of grade 43 (IS 455-1989)

Properties	Values
Specific Gravity	3.16
Fineness	4.01%
Normal Consistency	28%
Initial setting time (min)	30
Final setting time (min)	600
Compressive strength (28days)	43 MPa

Fig 3.1 cement

3.2 Properties of fine and coarse aggregate

Sand as fine aggregates are collected from locally available river and the sieve analysis of the samples are done. It is found that the sand collected is conforming to IS: 383-1970. For coarse aggregate, the parent concrete is crushed through mini jaw crusher. During crushing it is tried to maintain to produce the maximum size of aggregate in between 20mm to 4.75mm. The coarse aggregate particle size distribution curve is presented in Fig. 3.1. The physical properties of both fine aggregate and recycled coarse aggregate are evaluated as per IS: 2386 (Part III)-1963 and given in Table 3.2.

Table 3.2 Properties of fine and coarse aggregate: IS : 383-1970 and IS : 2386 (Part III)-1963

Properties	Coarse Aggregate	Fine Aggregate
Specific gravity	2.73	2.46
Bulk density (kg/m^3)	1650	23
Water absorption (%)	4.469	0.0651
Impact value (%)	65	-
Fineness modulus	7.82	2.78

Fig 3.2

Fig 3.3

3.3 Properties of Water

Tap water was used in this experiment. The properties are assumed to be same as that of normal water. Specific gravity is taken as 1.00.

3.4 Properties of fly ash :

Fly ash is a by-product of thermal power plants and is widely used as an ingredient in cement concreteTable 3.3 Properties of STP (Sewage Treatment Plant) Sludge :

CHARACTERISTICS	VALUES
Specific Gravity	2.07
Fineness	20%
Bulk Density	1200 kg/m^3
Color	Light grey

Fig 3.4

3.5 Properties of Recron 3S fibres:

Recron 3S is a polypropylene fibre used as secondary reinforcement in concrete to arrest cracks, increase impact resistance and improve quality.

Table 3.4 Properties of Recron 3S fibres:

Property	Specification
Cross-section	Triangular
Diameter	35-40 micron
Color	White
Cut length	12mm
Specific gravity	1.36
Relative density	0.89-0.94 g/cm^3

Fig 3.5

3.6 MIX DESIGN

Table 3.5 Material Ratio

	CEMENT	FINE AGGREGATE	COARSE AGGREGATE	WATER
Kgs	450	614	1141	180
proportions	1	1.364	2.535	0.4

Table 3.6 QUANTITIES OF MATERIALS

Cement in Kgs	Percentage % of Replacement	Fly ash quantity in Kgs	Cement content after replaced by fly ash in Kgs	Contain of Recron 3s fiber of 2 % of total quantity in grams
1.822	35	0.637	1.185	30
1.822	40	0.728	1.094	30
1.822	45	0.819	1.003	30
1.822	50	0.911	0.911	30

IV EXPERIMENTAL INVESTIGATION

4.1 Compressive Strength Test Results

Table 4.1: Compressive Strength of control specimen for 7 day

7-DAY TEST RESULT		
Sample	**Weight (kg)**	**Compressive Strength (MPa)**
Control specimen	8.25	30

Table 4.2: Compressive Strength of specimen with Sludge and Recron 3s fiber for 7 day

	7-DAY OF TEST RESULTS		
Sample Name	**Percentage of Replacement of sludge.**	**Weight (kg)**	**Compressive Strength (MPa)**
35	35%	8.05	25
40	40%	7.95	26
45	45%	7.75	28
50	50%	7.65	24

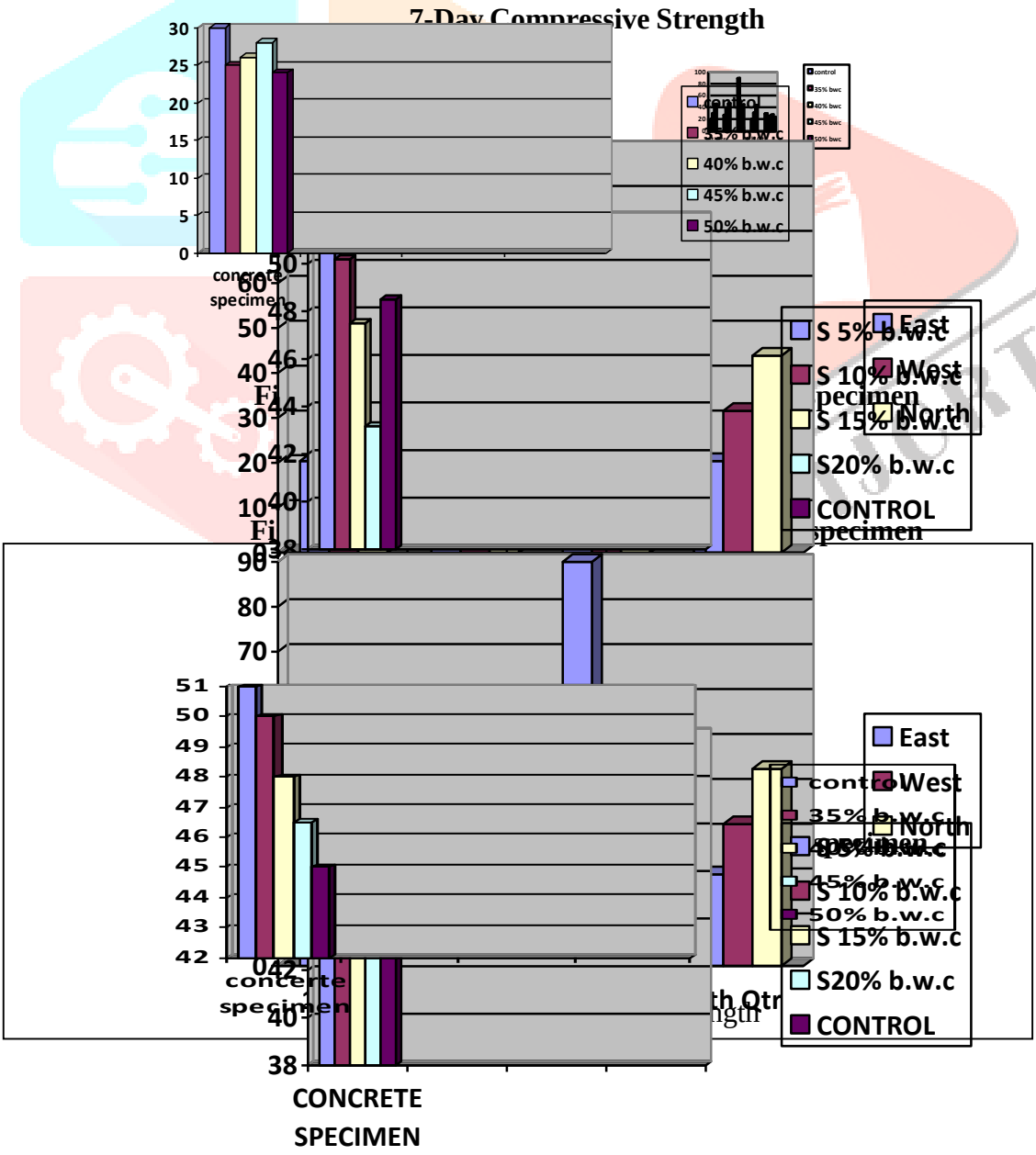
Table 4.3: Compressive Strength of specimen with sludge and Recron fibre for 28 days

28-DAY TEST RESULT		
Sample	**Weight (kg)**	**Compressive Strength (MPa)**
Control specimen	8.3	51

Table 4.4: Compressive Strength of specimen with sludge and Recron fibre for 28 day.

	28-DAY TEST RESULT		
Sample Name	**Percentage of Replacement of sludge.**	**Weight (kg)**	**Compressive Strength (MPa)**
F5	35%	8	50
F0	40%	7.85	48
F1	45%	7.7	46.5
F2	50%	7.55	45

4.2 GRAPHICAL REPRESENTATION



V CONCLUSION

- By the experiment we came to know about the compressive strength of concrete mixes decrease with increase in presence of Fly Ash.
- With the increase of fly ash in concrete there is a progressive increase in strength from 7 to 28 days which is indicative that early strength of concrete is reduced with increase in proportion of fly ash.
- The optimum limit of mixing of Fly Ash is around 40% to 45% and more than that may not be safe for different concrete mixes.

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