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BEHAVIOUR OF FRESH CONCRETE PRODUCED WITH SLUDGE AND RECRON 3S FIBERS

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Abstract: The sustainable development of construction materials is an essential aspect of current worldwide trends. Reusing post-production waste in the building industry has numerous positive effects on the environment. Since concrete is one of the materials that people manufacture and use the most, it will continue to be an integral element of the surrounding reality. In this study, the relationship between the individual components and parameters of concrete and its compressive strength properties was assessed. During the experimental work, the compressive strength of concrete samples of various classes was measured. Replacement was done with the cement with sludge at 5%,10%,15%,20% and added 2% of Fibers for each proportion. Our exploratory examination consists of an M40-grade design concrete mix. Compression tests were carried out for 7 and 28 days and achieved maximum strength at 10% replacement of sludge with cement and addition of recron 3s fiber

Index Terms - concrete, compressive strength, Sewage sludge, Recron 3S fibre

1 NTRODUCTION

Concrete is the most used construction material in industrialized countries. However, concrete production needs natural resources (water and aggregates) and cement whose production is costly due to the energy required. In order to reduce the use of natural content, sludge from the water treatment plant in Nallachervu, which is used for concrete production as cement. This sludge has disposal problems to reduce the reuse of that resources are about to be tested with different percentages of replacement. This may drastically reduce the sludge content and even the cost of concrete. Disposal of human sewage has become a necessity for societies, today. The construction of treatment plants has caused problems with huge contents of dry sludge. It has been found that each person produces 35 to 85 grams of solid sludge per day. Sludge is a product which is obtained during the treatment of wastewater

1.1 SLUDGE AND FIBER- USE IN CONCRETE

Sludge is a product which is obtained during the treatment of wastewater. The characteristic of sludge differ upon the region and the method of treatment. Sludge are formed after undergoing various steps such as stabilization, composting, anaerobic digestion, and thickening, dewatering and drying. Sludge has a severe negative impact on the environment, which will only become worse as the need for purified drinking water increases in the years to come. Using 5% sludge content in concrete aggregate will have a significant impact

on sludge amounts in the environment, possibly eliminating sludge disposal into the environment for good. Sludge can be used as an aggregate in concrete sidewalks and roads.

2 REVIEW OF LITERATURE

Daniel de Almeida Limaa and Charles Zulanasb (2016) Investigated that Sludge has a severe negative impact on the environment, which will only become worse as the need for purified drinking water increases in the years to come. Using 5% sludge content in concrete aggregate will have a significant impact on sludge amounts in the environment, possibly eliminating sludge disposal into the environment for good.

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

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.

A. D. Mandlik, Prof. S. A. Karale (2018) As we are increasing the percentage of sludge by the weight of cement. We find that there is in compressive strength is for M20 grade is decreasing after 15%. For M30 grade compressive strength decreasing after 10 % replacement of sludge For split tensile test strength was decreasing after 10% replacement of sludge in M20 grade concrete and for M30 it will decreasing after 15% replacement. From above the M20 grade concrete give better result than M30 grade concrete. The test results for flexure will be remaining.

Bharat Nagar*, Prof V. P. Bhargava (2016) On the basis of experiments it was observed that the replacement level of 15 percentages of sludge coarse and fine aggregate ,the compressive strength improves to 24.1 MPa on 28 days, which was in safer limit according to IS456[1].After 15% replacement the compressive strength shows a decreasing value Flexure strength and tensile strength was also show a increasing value up to 15% and after that these values are also tends to decreases.

3 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	2.01%
Normal consistency	33%
Initial setting time (min)	30
Final setting time (min)	60
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/m6^3)	1650	25
Water absorption (%)	4.469	0.0651
Impact value	26.91	-
Crushing value	26.514	-
Fineness modulus	3.38	2.84

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 STP (Sewage Treatment Plant) Sludge :

The residue that accumulates in sewage treatment plants is called sludge (or biosolids). Sewage sludge is the solid, semisolid, or slurry residual material that is produced as a by-product of wastewater treatment processes. Sludge are formed after undergoing various steps such as stabilization, composting, anaerobic digestion, and thickening, dewatering and drying.

Table 3.3 Properties of STP (Sewage Treatment Plant) Sludge :

Properties	Values
Specific gravity	1.85
pH	7.40
Liquid limit (%)	117.10
Plasticity limit (%)	54.26

Fig 3.3

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

3.3 METHOD

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

3.3.1 Mix Design : The mix design for M25 grade of concrete is described below in accordance with Indian Standard Code IS: 10262-1982.

4 EXPERIMENTAL EVIDENCE

Table 4.1: Compressive Strength of specimen with Sludge and Recron 3s fibre for 7 day

	7-DAY OF TEST RESULTS		
Sample Name	**Percentage of Replacement of sludge.**	**Weight (kg)**	**Compressive Strength (MPa)**
5S	5%	7.95	32.21
0S	10%	7.8	31.11
1S	15%	7.75	29.89
2S	20%	7.3	27.21

Table 4.2: 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)**
5L	5%	8.06	51.35
0L	10%	7.75	50..19
1L	15%	7.7	47.5
2L	20%	7.65	43.17

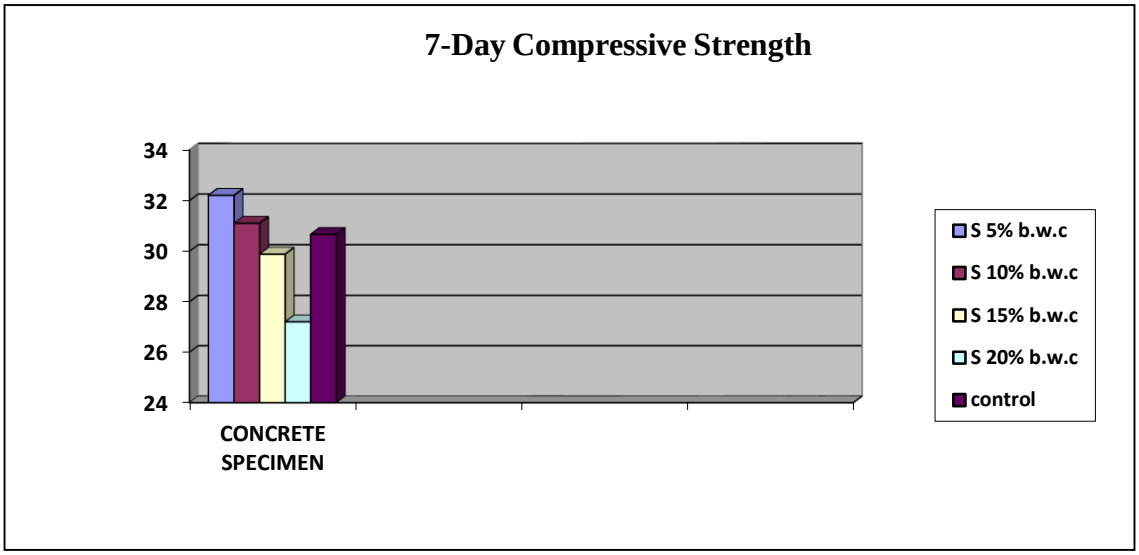

Fig. 4.1: 7-day compressive strength of four specimen

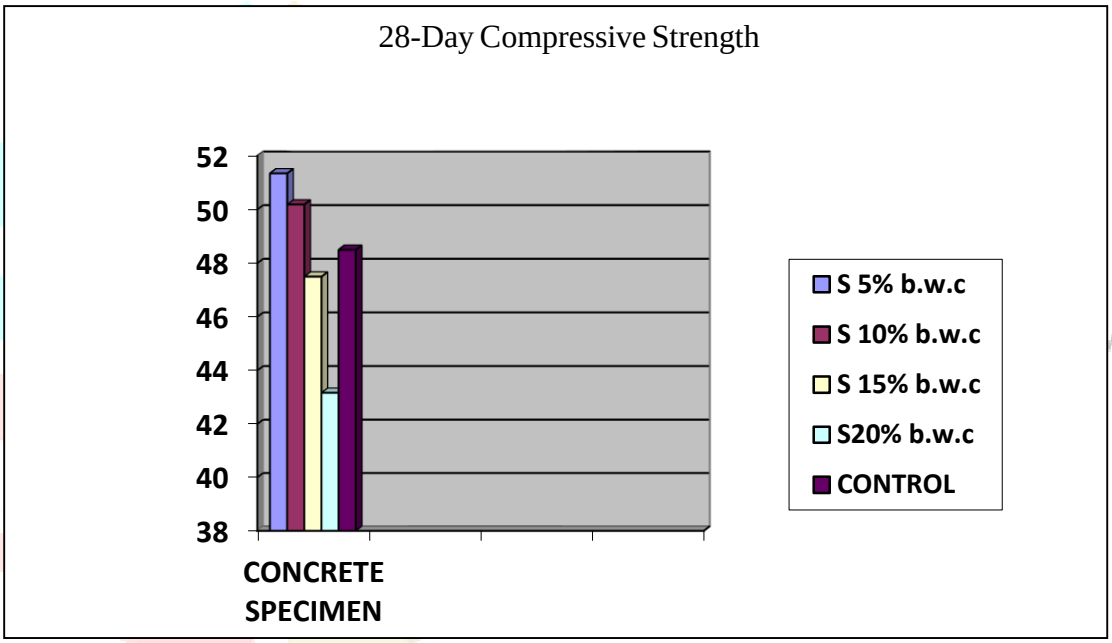

Fig. 4.1: 7 day compressive strength of four specimen

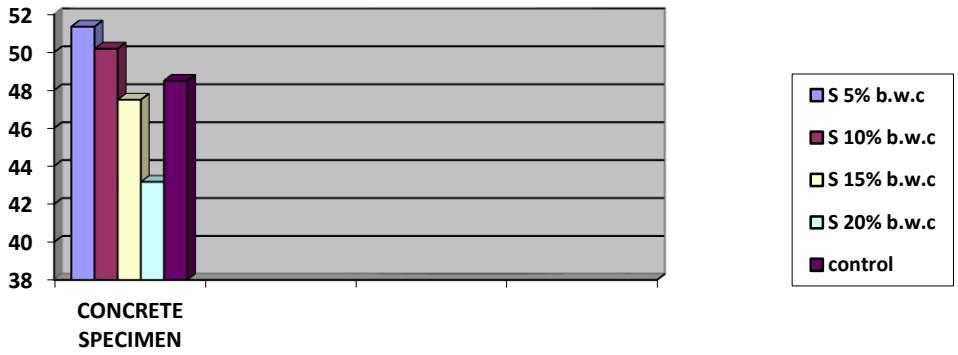

Fig. 4.2: 28-day compressive strength of four specimen

5 CONCLUSION AND DISCUSSION

5.1 CONCLUSION

From the test results, the Compressive strength test of the specimen a number of conclusions can be drawn. These conclusions are justified in the next section. The conclusions drawn are:

- From the compressive strength results, it can be observed that increase in compressive strength of concrete is observed on addition of a certain minimum quantity of sludge and recron 3S fiber. The increase in strength is maximum for percentage replacementof cement with sludge with addition of fibers of 5% and 10 % b.w.c and least for 15% and 20% b.w.c.
- On addition of Sludge and recron 3S fiber there is a substantial increase in the early-age strength of concrete compared to the 28 day increase in strength.

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