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Experimental investigation on replacement of cement by waste paper sludge ash in concrete

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Abstract - Waste Paper Sludge Ash (WPSA) is a waste material collected from the Paper Industry. WPSA is used as cement replacement in producing mortar and was investigated on its chemical, physical and mechanical properties. Construction material with natural resources now become limited and causes of air pollution and environmental problems,This work examines the possibility of using waste paper sludge ash as partial replacement of cement for new concrete .In this study waste paper sludge ash was partially replaced as 5%,10%,15%,20% and 25% in place of cement in concrete for M-40 mix tested for its compressive strength,tensile strength and water absorption up to 28 days of age and compared with conventional concrete.Form the result obtained ,it is found that Waste Paper Sludge Ash can be used as cement replacement up to 5% by weight and particle size less than 90μm to prevent decrease workability.

Keywords

Cement, fine aggregate (M-sand), coarse aggregate, waste paper sludge ash, sulphonated Naphthalene Formaldehyde SP430.

1 INTRODUCTION

In order to make concrete industry sustainable, the use of waste materials in place of natural resources is one of the best approaches. Paper mill sludge is a major economic and environmental problem for the paper and board industry. An enormous quantity of waste paper sludge is generate0d all around the world. In India, 0.7% of total urban waste generated comprises of paper sludge. UK produces over 1.5 million tons of waste paper sludge annually.Paper mill sludge is a major economic and environmental problem for the paper and board industry. This research will summarize the behavior of concrete with the waste paper sludge ash by replacement of cement in the range of 5%, 10%, 15% ,20% and 25% which may help to reduce the disposal problem of sludge and enhance the properties of concrete.

As wastepaper sludge ash contains higher percentage of silicon dioxide SiO2, it may provide extra strength to concrete. This project will try to study the design parameters of concrete on inclusion of waste paper as partial replacement of cement

OBJECTIVES

Investigation of utilization of paper waste as additional material in concrete mixes to be used for various construction projects, ensuring that the resulting concrete has proper compressive strength.

To prepare mixes containing various proportions of the paper waste.

To determine the fresh concrete properties such as slump value compaction factor and vee bee test.

To determine the hardened concrete such as compressive, split tensile strength and flexural strength .

Comparison of results conventional and hardened concrete.

2 MATERIAL AND PROPERTIES

2.1 CEMENT

Ordinary Portland cement of ultratech brand of 53 grade confirming to IS 12269-1987(9) was used in this

study.Special care was taken to ensure that the cement is cement is from the latest batch of packing. Specific gravity of cement.

2.2 FINE AGGREGATE (M-Sand)

Those fractions from 4.75 mm to 150 micron are termed as fine aggregate.In this investigation locally available M-sand is used as fine aggregate, confirming to grading zone II as per IS 383-1997

2.3 COARSE AGGREGATE

Coarse aggregate include natural aggregate, locally available crushed stone of 20 mm down sizes confirming to IS:383 have been used as coarse aggregate.The physical properties of coarse like specific gravity,fineness modulus etc.are tested in accordance with IS 2386 - 1963.

2.4 WASTE PAPER SLUDGE ASH

The waste paper sludge is procured from Aadithya Aswin paper mills Pvt Ltd, Sathyamangalam, Erode (district).

The specific gravity of waste paper sludge ash(Fig 1) was found to be 2.3. Chemical composition of waste paper sludge ash is presented in Table 1

Figure1: Paper sludge ash

TABLE 1: Chemical composition of waste paper sludge ash

S.No	Constituents	Hypo sludge In(%)
1	Silicon(SiO2)	59.47%
2	Calcium Oxide	8.69%
3	Alumina and Ferric Oxide	10.45%
4	Magnesium Oxide	3.13%

2.5 WATER

Water is important ingredient of concrete as it actually participates in the chemical reaction with cement. Here potable water was used for the mixing and curing. Water cement ratio is 0.45

3 EXPERIMENTAL RESULTS

The strength characteristics of concrete using paper sludge ash was compared with the conventional concrete based on the experimental values.

3.1 COMPRESSIVE STRENGTH

The development of strength was assessed by maturity testing an effective way of assessing the compressive strength of concrete can be determined shown in Fig 2. The tests are carried for different cement replacement levels by paper sludge ash 5%,10%,15%, 20% and 25% for an curing period of 7,14 and 28days test result on Table 2.

Figure2. Compression test

Table 2: Test results on Compressive strength

Trial	Compressive strength (N/mm²)		
	7 days		**7 days**
T-1 0%)	27.65	T-1 0%)	27.65
T-2 (5%)	33.57	T-2 (5%)	33.57
T-3 (10%)	33.04	T-3 (10%)	33.04
T-4 (15%)	27.21	T-4 (15%)	27.21
T-5 (20%)	31.15	T-5 (20%)	31.15
T-6 (25%)	30.25	T-6 (25%)	30.25

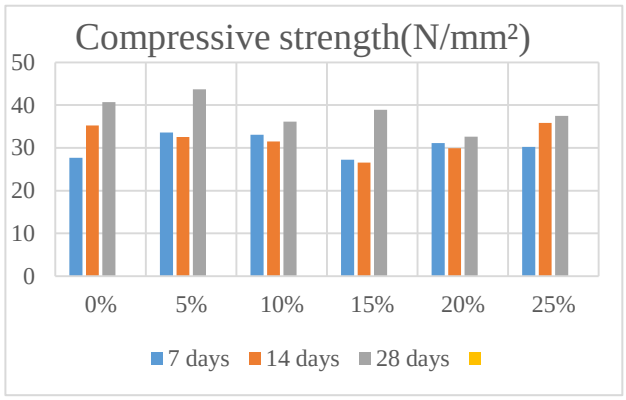

Fig.3 Results for Compressive strength test

3.2 SPLIT TENSILE STRENGTH

The Split tensile test was conducted to determine the tensile strength of concrete can be determined shown in Fig 3. The tests are carried for different cement replacement levels by paper sludge ash 5%,10%,15%, 20% and 25% for an curing period of 7,14 and 28days test result on Table 3.

Figure 4. Split tensile test

Table 3: Test result on Split tensile strength

Trial	Split tensile strength (N/mm²)	
	7 days	14 days
T-1 (0%)	1.52	2.34
T-2 (5%)	2.23	2.21
T-3 (10%)	2.02	2.0
T-4 (15%)	1.89	1.71
T-5 (20%)	2.13	2.2
T-6 (25%)	1.981	2.41

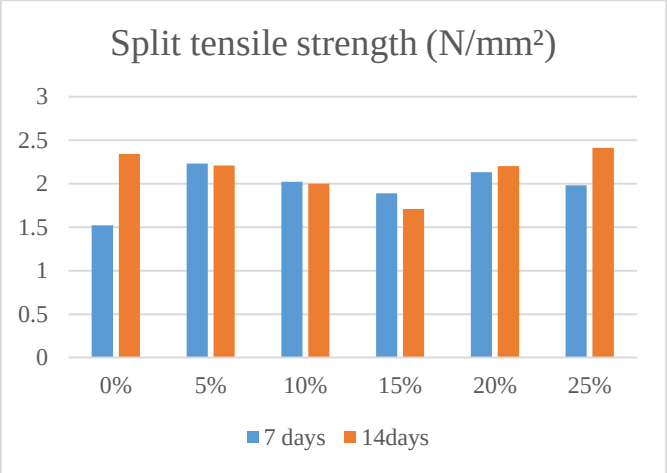

Fig.5 Results for Split tensile strength test

3.3 FLEXURAL STRENGTH

The flexural strength is one among the direct methods through which tensile strength of concrete can be determined shown in Fig 4. The tests are carried for different cement replacement levels by paper sludge ash 5%,10%,15%, 20% and 25% for an curing period of 7,14 and 28days test result on Table 4.

Figure 6. Flexural strength test

Table 4: Test result on Flexural strength

Trial	Flexural strength(N/mm²)	
	7 days	14 days
T-1 (0%)	3.63	4.16
T-2 (5%)	3.67	3.81
T-3 (10%)	3.8	3.71
T-4 (15%)	3.6	3.7
T-5 (20%)	3.5	3.8
T-6 (25%)	3.75	4.21

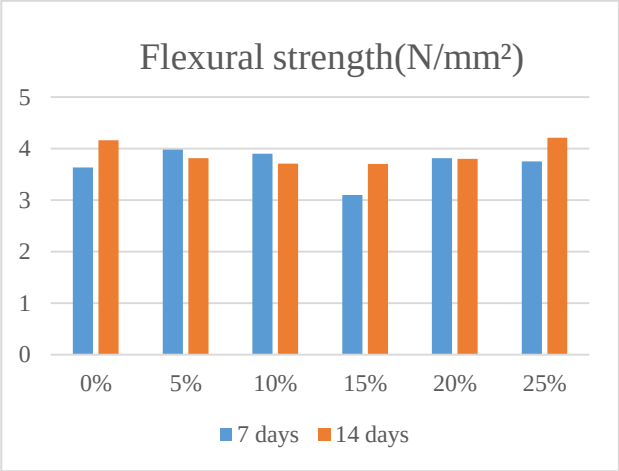

Fig.7 Results for Flexural strength test

4 CONCLUSION

Form the tests result of Compressive strength test,split tensile strength test and flexural strength test on the basis of the investigation carried out on the use of industrial waste in paper waste sludge ash (hypo-sludge) as partial replacement of cement in M-40 grade of concrete made of differents mix with 5%, 10%, 15%, 20% and 25% considered for the study the following conclusions are been listed;

Waste paper sludge ash can be used as partial replacement of cement of only 5% to 25% by varying either w/c ratio, proportions of ingredients in concrete , mis of concrete or adding admixtures in the concrete.

The work ability of concrete increased with the increase in paper sludge ash content of cement replacement at same water-cement ratio.

From the result of compressive strength,split tensile strength and flexural strength, the value range should be increases for 5% replacement of cement using paper sludge ash on 28 days test compare to conventional concrete.

By the above replacement the compressive strength of concrete increases by 25% to that of conventional concrete at 7days and 14 days test.

REFERENCES

- International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 5, Special Issue 9, May 2016
- IOSR Journal of Engineering (IOSRJEN)
- Study of Concrete Involving Use of Waste Paper Sludge Ash as Partial Replacement of Cement Sajad Ahmad, M. Iqbal Malik, Muzaffar Bashir Wani, Rafiq Ahmad
- International Journal of Civil Engineering and Technology (IJCIET)Volume 8, Issue 4, April 2017
- WASTEPAPER SLUDGE AS A PARTICAL REPLACEMENT OF CEMENT Harsh K. Mistry, Kaushal D. Patel,Final year, B.Tech, Student
- Assistant Professor, Civil Engineering Department, SVKM's NMIMS MPSTME, Shirpur.
- Prof.Jayeshkumar pitroda, Dr.L.B.Zala and Dr.F.S Umarigar,innovative use of paper industry waste (hypo sludge) in design mix concrete, IJAET, Vol.4,issue1,mar.2013.
- Abdullah shahbaz khan,Ram panth,Gagan Krishna P.R and suresh G.Patil,Structural performance of concrete by partial replacement of cement with hypo sludge(paper waste),IJETE,Vol.1,Issue 7,Aug 20114.