INVESTIGATION OF STRENGTH OF CONCRETE USING REED BED TREATED WASTE WATER WITH PARTIAL REPLACEMENT OF CEMENT AND SAND

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Abstract

The most extensively used construction material in the world is concrete and the instant most consumed material by humans after water is cement. In this present experimental study fly ash is partially replaced for cement and foundry sand is partially replaced for fine aggregate. Water used for mixing and curing is reed bed treated waste water. In this present investigation comparison of strength of concrete using normal water and reed bed treated waste water is done. In the present study fly ash content is varied by 5%, 10%,15% and 20% and foundry sand content by 10%,20%,30% and 40%.Compressive strength and split tensile strength tests were conducted. The specimens were casted and tested for 7days and 28days.

Keywords*:* Fly ash, foundry sand, reed bed treated waste water, Compressive strength, Split tensile strength

I. INTRODUCTION

The most extensively used construction material in the world is concrete and the instant most consumed material by humans after water is cement. In worldwide about 5% of CO_2 emissions is produced by ordinary Portland cement. This is one of the major cause of global warming. To avoid this currently substitute materials are used as an alternative to ordinary Portland cement.

In the construction field, the water which is used for mixing and curing of concrete is normal portable water, which is used as per the provisions. In the design codes, it is acclaimed that the compressive strength of cubes made of portable water should not to be less than 90% of cubes made with tap water. Non-fresh waters from different sources are collected and tested formerly before using it to the concrete. The non fresh water include sea waters,mineral waters,sewage and industrial waste waters. Due to the presence of various types of impurities that exists in all water types, it is difficult to come to an conclusion regarding the use of non-fresh water in concrete blends.

From past few decades there is scarcity of natural sand. In present days good natural river sand is not willingly accessible, that one is to be carried from a lengthy distance. These are exhausting resources. So alternative to natural river sand is to be find. Instead of natural sand artificial sand are used in construction

II. SCOPE AND OBJECTIVES

- To determine the strength characteristics of concrete using reed bed treated waste water.
- To determine the strength of concrete by partially replacement of fly ash.
- To determine the optimum strength by adding foundry sand of varying percentages to optimum molarity concrete.
- Comparing the strength of concrete using fresh water and reed bed treated waste water.

III. EXPERIMENTAL WORK

This experimental work is mainly concern with the study of mechanical properties like compressive strength, split tensile strength and as well as flexural strength of concrete by partial

replacement of foundry sad as fine aggregate and fly ash as cement.

Tests over carried out on cubes, cylinders and beams to study the mechanical properties of concrete using foundries sand and fly ash and treating it using reed bed treated waste water. Foundry sand is replaced with five percentages (0%,10%,15%,20% & 30%) of natural Sand by weight and fly ash is replaced with five percentages (0%,5%,10%,15%& 20%) of cement . A total of five concrete mix proportions are made with and without foundry sand and fly ash. Compression test, splitting tensile strength test and flexural strength test will be carried out to evaluate the strength properties of concrete at the age of 7 &28 days. The reedbed treated waste water is collected from the water treatment plant in Nitte and it is used for mixing and curing of concrete cubes .

Cement: In this experimental study, Ordinary Portland cement (ACC Brand) is used.

Table1. Test results of cement

SL.NO	Properties	Results
1	Normal consistency	29.3%
2	Specific Gravity	3.10
3	Initial setting time	90 Min.
4	Final setting time	290 Min.

Fine Aggregates: For this study Fine Aggregates of 4.75mm down size is used.

Table2. Preliminary test results of Fine aggregates

SL.NO	Particulars	Test Results
1	Specific Gravity	2.65
2	Water absorption	1.28%
3	Fineness Modulus	2.806
4	Grading Zone	Zone-II

Coarse Aggregates: In this study coarse aggregate of 20mm down size is used.

Table3. Preliminary Test results of coarse aggregates

SL.NO	Particulars	Test Results
1	Type of aggregate	Crushed angular
2	Specific Gravity	2.71
3	Water absorption	0.64%
4	Fineness Modulus	7.03
5	Surface Moisture	Nil

Table 4.Test Results of Foundry Sand

SL.NO	Particulars	Test Results
1	Specific gravity	2.31
2	Fineness modulus	1.95
3	Water absorbtion	0.45
4	Moisture content	0.15

Mix Design: Grade of concrete : M30

Target Strength : $f_{ck}+1.65(s)$ = 38.25 N/mm^2

Cement content : 407 kg/m^3

Water/Cement ratio : 0.43

Water content : 175lit

Fine Aggregate : 649 kg/m^3

Coarse Aggregate : 975.66 kg/m^3

Table5. Mix Proportion

Cement	Fine Aggregate	Coarse Aggregate	Water
1	1.59	2.95	0.43

IV. RESULTS AND DISCUSSIONS

A. Compressive strength:

The strength of prepared molds were checked in Compressive strength machine. The capacity of machine is 200T.7 Days and 28 Days cured molds were tested. The experiment outcome disclosed compressive strength was optimum at 10% addition of fly ash and 20% addition of foundry sand. Advance adding of fly ash and foundry sand drops the strength. Experiment were directed as per IS 516- 1959[4].

Table 6 Compressive strength results of Normal water

SL.NO	Compressive strength N/mm^2	
	7 Days	28 Days
100% OPC	28.8	41.3
5% FA + 10%FS	26.7	40.98
10% FA+ 20%FS	27.9	41.8
15%FA+30%FS	26	40.3
20%FA+40%FS	24.3	39.5

Table 7. Compressive strength results of Reed bed water

SL.NO	Compressive strength N/mm^2	
	7 Days	28 Days
100% OPC	28	43.4
5% FA + 10%FS	26.3	41.8
10% FA+ 20%FS	27.2	42.6
15%FA+30%FS	25.56	41.3
20%FA+40%FS	24	40.15

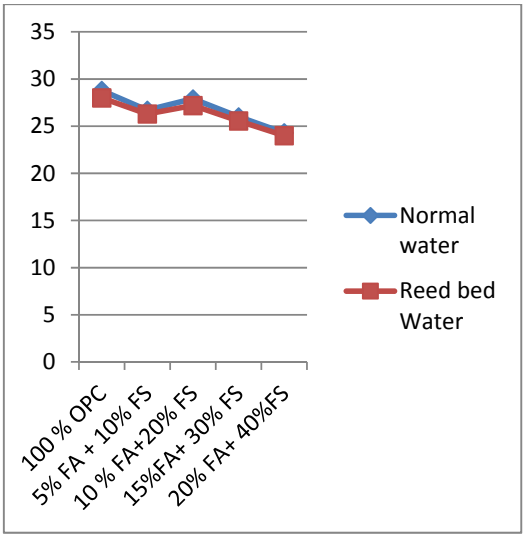

Figure1. Comparison of compressive strength of 7days

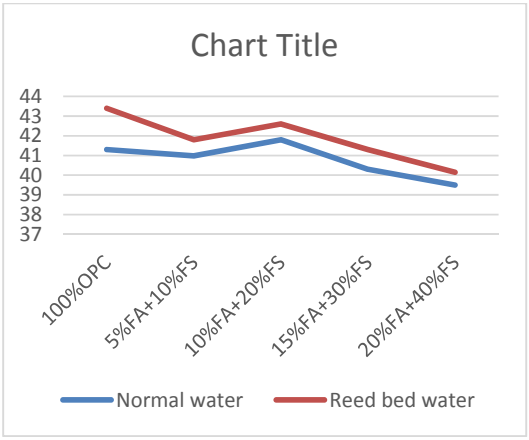

Figure2. Comparison of Compressive strength results of 28days

The compressive strength was optimal for 10% FA with 20% of FS addition for reed bed treated waste mix for 28 days. Advance adding of fly ash and foundry sand will reductions the strength.

Figure 3. Compression strength test

B. Split Tensile test:

Split tensile test is done to know the tensile property of concrete. As we know concrete is good in compression but week in tension so it is necessary to calculate the compressive strength of concrete. For this experimental study cylinders are done for the split tensile test and curing is done and testing is done for 7days and 28days cured cylinders.

Table8. Split Tensile strength results of Normal water

SL.NO	Split Tensile strength N/mm^2	
	7 Days	28 Days
100% OPC	2.5	3.25
5% FA + 10%FS	2	3.32
10% FA+ 20%FS	2.2	3.8
15%FA+30%FS	1.97	3.6
20%FA+40%FS	1.48	3.45

Table 9 .Split Tensile test results of Reed bed water

SL.NO	Split Tensile strength N/mm^2	
	7 Days	28 Days
100% OPC	2.4	3.42
5% FA +10%FS	1.92	3.59
10% FA+ 20%FS	2.18	3.95
15%FA+30%FS	1.6	3.66
20%FA+40%FS	1.4	3.53

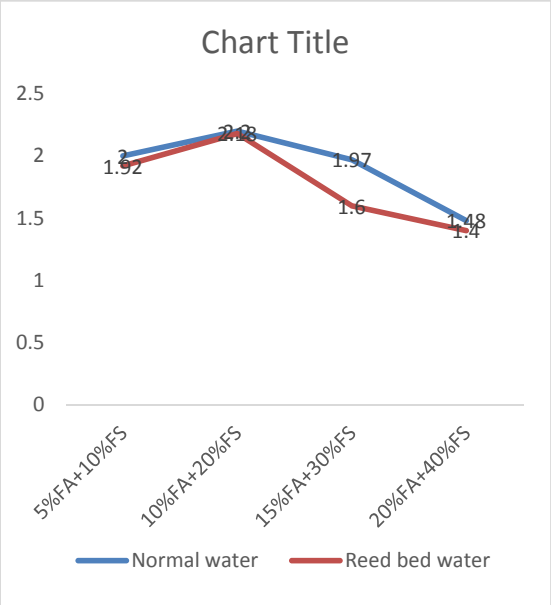

Figure 4. Comparison of Split Tensile strength results of 7days

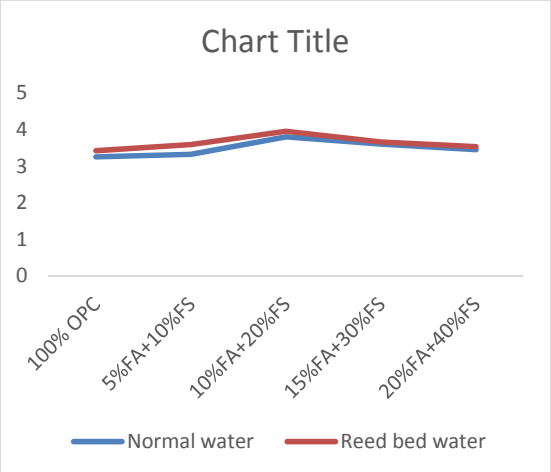

Figure5. Comparision of Split Tensile strength results of 28days

The Split Tensile strength was optimal for 10% FA with 20% of FS addition for reed bed treated waste mix for 28 days. Advance adding of fly ash and foundry sand will reductions the strength.

VI. CONCLUSIONS

- It is observed that for 7days test normal water mix gives higher strength than reed bed treated water, But for 28days reed bed treated water gives more strength than normal water.
- The optimum value obtained at 10%flyash and 20% foundry sand. Further addition of fly ash and foundry sand decreases the strength.
- The high compressive strength value obtained for 7days is 28.8 N/ mm^2
- The high compressive strength value obtained for 28days is 43.8 N/ mm^2.
- The high split tensile strength value for 7days is 2.2 N/ mm^2.
- The high split tensile strength value for 28days is 3.68 N/ mm^2

VII. REFERENCES

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