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EFFECT OF ADMIXTURE ON THE STRENGTH PROPERTIES OF CONCRETE USING TREATEDWASTE WATER WITH VARIABLE SIZE OF AGGREGATES

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Abstract— In this research work effect of admixture on strength properties of concrete with 100% treated waste water using variable size of aggregates was studied. The M30 grade of concrete was tested. Variable size of aggregates such as 40 mm graded, 20 mm graded and 10 mm were used .A water reducing admixture namely. Fosroc SP430 G8 was used. Proper aggregate gradation not only ensure a workable concrete mixture that can be compacted easily but also helps to reduce problems such as segregation, bleeding and loss of entrained air and plastic shrinkage cracking. For M30 grade of concrete the compressive strength was achieved easily using 40 mm graded aggregates,20 mm graded aggregates and 10 mm aggregates. The compressive strength achieved highest was using 40 mm aggregates. For flexural strength the results achieved were also appreciable. The flexural strength results using 20 mm graded aggregates were most suitable. For split tensile strength the results which were highest were using 40mm graded aggregates. Lastly for the results of abrasion, the preferred size of aggregates were 40mm graded aggregates. Hence results are satisfactory using treated waste water with variable size of aggregates.

Keywords— Treated waste water, Admixture, Variable size of aggregates, Compressive strength, and Flexural strength.

I. INTRODUCTION

Concrete may be defined as the substance which is composed from a combination of raw materials like cement, coarse aggregates, fine aggregates & water which hardens to makes a very strong building material. The solidity of concrete depends on the quality of ingredients used and conditions on which they are used. By proper regulating & modifying the ingredients, concrete can achieve a great compressive strength which can be useful for various works. . As it possess high strength it is useful in number of ways in construction purpose. About 12 billion tons of concrete is fabricated every year. As we know concrete is composed of different ingredients and each component drag the characteristics of the concrete which must be controlled within acceptable limits so that desired workability and strength should be achieved in a systematic way. Concrete has many qualities that make it most extensively used construction material. The correct use of ingredients, placement, and curing are done to remain these properties to be in favourable conditions. The superior quality concrete possesses multiple benefits which make it more reputed. First, it is cost effective & money saving as ingredients is available without difficulty. Concrete's lengthy existence and fantastically low maintenance makes it valuable and profitable. Concrete is no longer as likelihood to crumble, decline, and disintegrate as other constructing materials doing. Concrete has the potential to be configure, create and construct into any favoured shape. Construction of the moulds and casting can occur on the work-site which is totally economical. The strength of concrete is mostly dependent on hydration. The hardening is caused by chemical reaction between water & cement. The strength of concrete will increase when .much less extent of water is preferred. The hydration reaction itself really dominates a unique amount of water. Concrete is desired to be blended with extra water than it is required for the hydration reactions. The cause of adding extra water is to achieve favoured workability. Therefore it is feasible to adjust the properties of concrete to meet the demand of any particular situation. The quality process of composing a powerful, effective, long lasting, indestructible, hard wearing concrete lies in the cautious control of its basic and process components.

II. EXPERIMENTAL PROGRAM

This section gives a detail of materials utilized as a part of experimentation program and test utilized as a part of this study .The experimentation program focuses on concrete of grade M30 designed by BIS method with variable size of aggregate using treated waste water. The various tests performed on concrete were compressive, flexural, split tensile & abrasion. A set of samples were prepared which consists of cubes, beams, cylinders which were cured for7, 14 &28 days respectively. The combination of variable size of aggregate using treated waste water are listed as follows

i) 40 mm Graded aggregate
ii) 20 mm Graded aggregate

iii) 10 mm
iv) 100% treated waste water
v) water reducing admixture

III. DETAILS OF MATERIAL

A. Water

The treated waste water samples used in this investigation was collected from the municipal sewage treatment plant near 3BRD, Chandigarh. The capacity of this treatment plant is 15MGD and employs a sequencing batch reactor process for treating waste water. The laboratory test on the treated waste water were carried out as per BIS: 3025.

Table I: - Test result on both Potable and Treated Waste Water.

S.no	Parameters	Potable Water (mg/l)	Treated Waste Water (mg/l)	Permissible limits(mg/l) as per BIS: 456-2000
1	pH	7.49	7.24	< 6
2	DO	7.38	6.83	-
3	COD	10	196	3000
4	BOD	6	140	200
5	TDS	225	532	2000
6	Sulphate Content	24.72	3603	400
7	Chloride Content	18.5	140	2000
8	Acidity	-	3.5	5
9	Alkalinity	11.5	-	25

B. Cement

The cement used in this project was Ordinary Portland cement of Ultra Tech. Cement test were performed for important parameters of BIS code and results are given below in table.

Table II: - Properties of cement

PROPERTY	VALUES	IS:8112-1989 LIMITS
Standard consistency	29	----------
Initial setting time	216	>30 minutes
Final setting time	517	<600 minutes
Specific Gravity	3.15	3-3.15

Coarse aggregate

Natural occurring aggregates having size of 40 mm, 20mm and 10mm were used during the research. Their various physical properties were tested as per BIS 383-1970. The specific gravity of coarse aggregate determined was 2.71

C. Fine aggregate

The accessible fine aggregate was provided for this experimentation. Fine aggregate generally consist of natural sand. The IS specifications categorized the fine aggregate into four different types according to its suitable grading. Aggregate which are fine contribute the maximum to the covering up of surface area in concrete. The fine aggregate are also classified according to size and may be known as coarse sand, medium sand, and fine sand. Sand which is used for investigation was conforming to zone II. The specific gravity determined was 2.65 and the silt content was 5.12 %.

IV.MIX DESIGN

A number of trial mixes were performed as per BIS method for M30 grade of concrete with variable size of aggregate and after that design was finalized. The quantity of material for M30 grade per meter cube of concrete with variable aggregate size are represented in the table below

Table III:- Quantities of mixing material per m^3

Size of Aggregate →	40mm Graded	20mm Graded	10mm
Cement(kg)	390	390	390
w/c ratio	0.42	0.43	0.44
Water (liter.)	164	168	172
F.A.(kg)	521	694.59	911.71
C.A.(kg)	1395.91	1212.14	991.30

V. MIXING, CASTING AND CURING

Pan mixer was preferred in mixing concrete. Cubes, beams & cylinder were cast using standard metallic forms and were vibrated by table vibrator to get a smooth surface. Cubes were cast with 15 cm mould , beams were cast with 10x10x50 cm moulds and cylinder were used having dimension of 20 cm length and 10 cm DIA . The mould was tightened and oil was applied on the inner side for ease of de-moulding before casting of specimen. Mixed concrete was filled in three equal layers and were vibrated using vibrator table with each layer. The specimen faces were flushed using trowels to obtain a smooth surface.

VI. TESTING OF CONCRETE

A. Compressive Strength

Cubes were casted to determine 7^{th}, 14^{th}, 28^{th}, day's compressive strength of concrete. A set of three cubes for each mix shall be tested on the 1^{st} day after specified curing period. For most of the works cubical moulds of size 15cm x 15cm x15cm were commonly preferred.

B. Split Tensile Strength

Cylinders were casted to determine 7^{th}, 14^{th} and 28 days tensile strength for M30 grade of concrete. The size of cylinders used was 150X300 mm. Treated waste water was used for mixing and casting of cylinders and tested according to BIS: 5816-1999.

C. Flexural Strength of Concrete

Beams of size 150X150X700 mm were casted for 7^{th}, $14^{th,}$ &28 days curing to check the flexural strength of concrete. The test was conducted on universal testing machine as per guideline of BIS: 516-1979.

D. Abrasion Test

Abrasion test was done as per IS: 9284 method of test for abrasion resistance of concrete.

VII. RESULTS

The test were done at different stages on each sample and the results are listed below

A. Compressive strength (M30)

The cubes of concrete were prepared for M30 grade by using variable sizes of aggregates with 100% treated waste water. The compressive strength tests at different stages were carried out on each sample and the results are listed below.

Figure I:-Compressive Strength Trends of M30

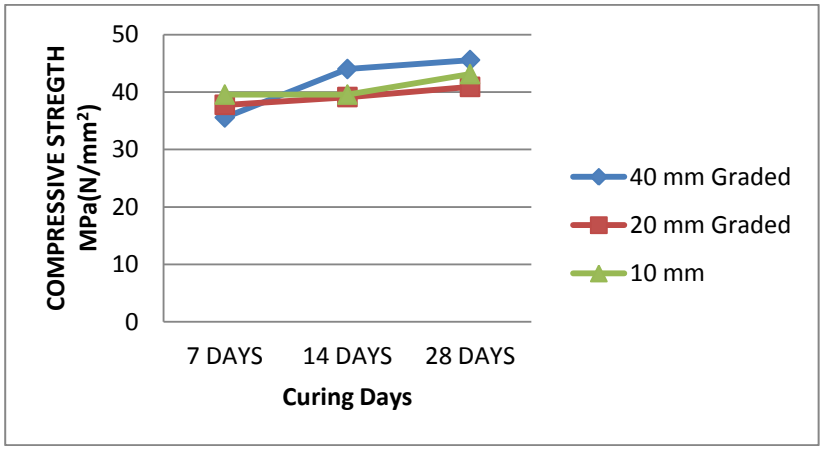


Table IV: - Compressive Strength Test Results of M30 (Mpa)

Size of Aggregate → / Curing Days ↓	40 mm Graded	20 mm graded	10 mm
7 Days	35.56	37.76	39.55
14 Days	43.99	39.11	39.55
28 Days	45.55	40.88	43.11

B. Flexural Strength

The concrete beams of M30 grade were prepared by using 100% treated waste water with variable size of aggregate. The flexural strength tests in different ages were carried out on each specimen and the results are depicted below.

Figure II: - Flexural Strength of M30 using variable size of aggregates

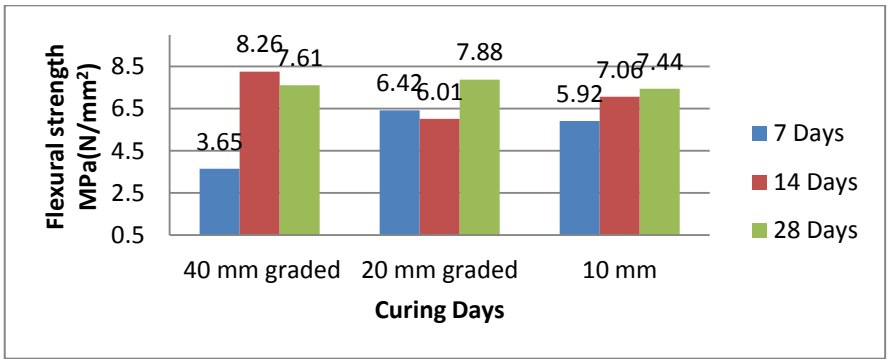


Table V: - Flexural strength test result of M30

Size of Aggregate → / Curing Days ↓	40 mm Graded	20 mm graded	10 mm
7 Days	3.65	6.42	5.92
14 Days	8.26	6.01	7.06
28 Days	7.61	7.88	7.44

C. **Split Tensile Strength**

The concrete cylinder of M30 grade were prepared by using treated waste water with variable size of aggregate using admixture The split tensile strength tests at different ages were carried out on each specimen and the result are depicted below.

Figure III:-Split Tensile Strength of M30 using variable size of aggregate

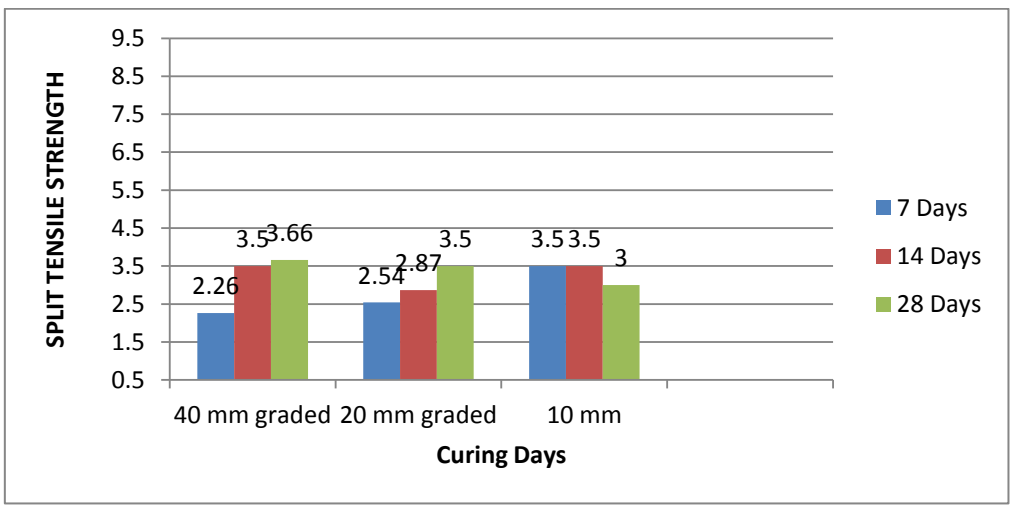


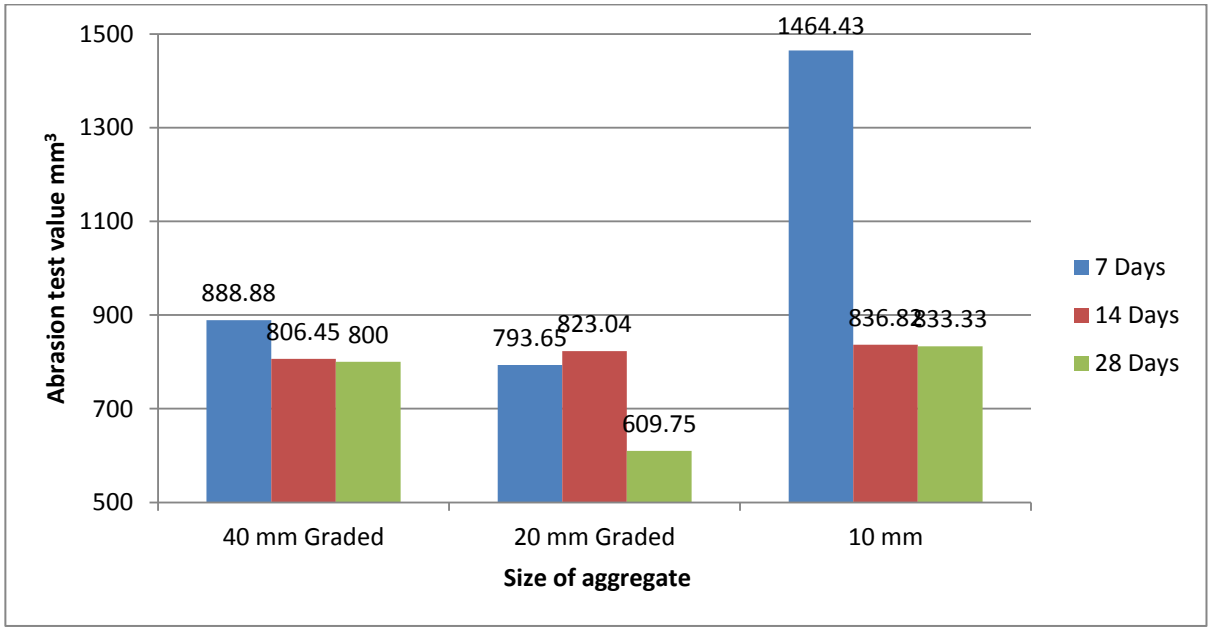
Table VI: - Split tensile strength test result of M30

Size of Aggregate → / Curing Days ↓	40 mm Graded	20 mm graded	10 mm
7 Days	2.26	2.54	3.5
14 Days	3.5	2.87	3.5
28 Days	3.66	3.50	2.87

D. Abrasion Test

As specified in IS 1237-2012 the test was done with the help of abrasion testing machine which runs at 30 RPM and a cycle of 22 revolutions were done before the stoppage of disc.

Figure VII: - Abrasion test result for M30 using variable size of aggregate



VIII. CONCLUSIONS & RECOMMENDATIONS

Grade (M30)	Variable size of aggregates		
	40mm graded	20mm graded	10mm
Compressive strength	Recommend	Recommend	Recommend
Flexural strength	…….	Recommend	Recommend
Split tensile strength	Recommend	Recommend	……
Abrasion	Recommend	……..	Recommend

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