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Effect of Magnetic Water on Properties of Concrete

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Abstract:

This research investigates the effect of magnetic water also known as magnetic field treated water (MFTW) on compressive strength, water absorption, porosity and sorptivity on samples prepared with magnetic water. MFTW was obtained by passing through a magnetic field. Test variables included the magnetic strength of water and curing age. Results show that the compressive strength of concrete samples mixed with magnetic water is higher than those prepared with normal tap water. The compressive strength increase of concrete prepared with magnetic water is more significant at early age. The best result achieved for water absorption and porosity were obtained at magnetic strength of treated water is of 1T. The best result for sorptivity was obtained at magnetic strength of treated water is of 0.9T.

Keywords: Magnetic field treated water, Compressive strength, Sorptivity, Water absorption, Porosity

I. INTRODUCTION

Water after passing through a magnetic field of certain strength is called magnetic field treated water (MFTW) or magnetic water. Similar researches were also conducted in Japan, Taiwan confirming that MFTW could improve concrete strength increased 10-19% more than those mixed with tapwater [1, 2]. Hence, it can save 5% of cement dosage, bleeding of concrete and improve resistance to freezing [3,4]. We all know that water is a polar substance which tends to be attracted to each other by hydrogen bonds and forms clusters. In magnetic field, magnetic force can break apart water clusters into single molecules or smaller ones, therefore activity of water is improved. While hydration of cement particles, the MFTW can penetrate the core region of cement particles more easily. Firstly, hydration takes on surface of cement particles. A thin layer of hydration products is thus formed on cement particles, allowing a more complete hydration process to occur. Hence, hydration can be done more efficiently which in turn improves concrete strength. Besides the increase in compressive strength, there are also other advantages of preparing concrete with magnetic water. Firstly, it improves durability properties such as reduction in water absorption and porosity at magnetic strength of treated water at 1T. Moreover, it does not require addition of chemical admixtures to increase compressive strength thus it avoid environment pollution. The magnetized water can be kept in a reservoir for 0-12 h, over its advantage may be lost [2, 5] Once it leaves the magnetic field, it returns to its original state. This study also investigates the sorptivity characteristics on samples compared with magnetic water and prepared with normal tap water.

by different magnetic strength of treated water of 0.8T, 0.9T and 1T while 0T represent plain normal tap water.

B. MATERIAL

The cement used is Ordinary Portland cement of 43 grade manufactured by ACC Cement Company. Crushed granite stone of maximum size 20mm confirming to IS 383-1970 used as coarse aggregates. The fine aggregate used in this investigation was passing through 4.75mm sieve. The grading zone of fine aggregate was zone II as per Indian standard specification. Water is used for preparation of magnetic water is free from suspended particles and chemical substances.

C. PREPARATION OF MAGNETIC WATER (MFTW)

Magnetic water was prepared by passing normal tap water through magnetic field generated by electromagnets in physics lab. Water was rotating in electromagnetic field for 120 minutes for 3 litres water. The materials were used in preparation of MFTW electromagnets, gauss meter, 9V toy motor, propeller, plastic straws.

D. MIX PROPORTION

For this investigation, the concrete Grade M30 for the samples was used. The detailed mix design procedure of M30 Grade of concrete is given Table 1.

Table.I. Trial mix proportion for 1m³ of concrete

MATERIAL	QUANTITY IN KG
Cement	413.33
Fine Aggregates	664.67
20mm Aggregates	684.15
10mm Aggregates	456.1
Water	186

E. PREPARATION OF TEST SPECIMEN

To investigate the effect of magnetic water on the compressive strength of the concrete cubes of size 150x150x150 mm was used. For Water Absorption, Porosity and Sorptivity of the concrete cubes size of 100x100x100 mm was used.

II. EXPERIMENTAL WORK

A. OVERVIEW

For the investigation of magnetic water on concrete mix mechanical & durability properties of concrete samples are determined (like Water absorption, porosity and sorptivity) as representative parameter for the unconventional concrete. Now

F. EXPERIMENT VARIABLES

The magnetic strength of treated water is 0.8 T, 0.9 T and 1T. The age of curing of samples were 7 days and 28 days, for compressive strength test. The age of curing was 28 days for Water Absorption, Porosity and Sorptivity Test.

III. RESULT AND DISCUSSIONS

A. Compressive Strength

Table.2. Compressive strength of concrete

Magnetic Strength of Treated water	Compressive Strength (MPa)	
	7 Days	28 Days
0 Tesla	18.67	33.16
0.8 Tesla	20.1	34.20
0.9 Tesla	22.05	34.43
1.0 Tesla	22.23	35.91

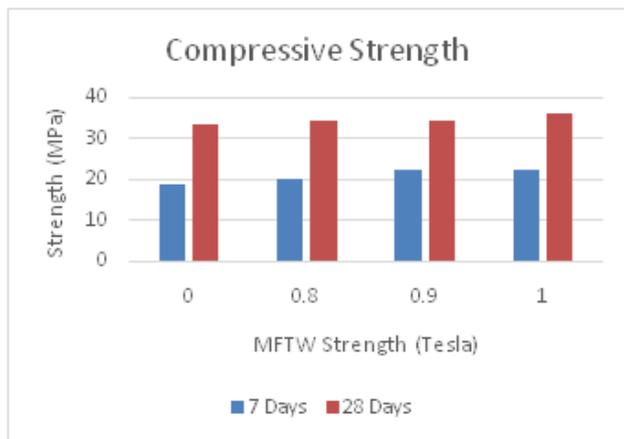


Figure.1. Strength variation of samples with strength of MFTW

B. Water absorption

Table.3. Water Absorption of Sample

Magnetic Strength of Treated Water	Water Absorption (%)
0 Tesla	5.618
0.8 Tesla	6.344
0.9 Tesla	6.914
1.0 Tesla	5.519

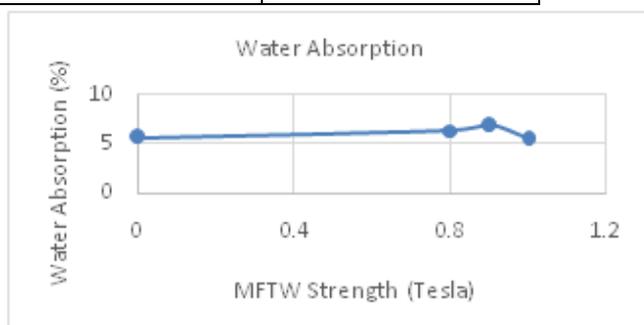


Figure.2. Water Absorption at different strength of MFTW

C. Porosity

Table.4. Porosity of Concrete Sample

Magnetic Strength of Treated Water	Porosity (%)
0 Tesla	13.4
0.8 Tesla	15.32
0.9 Tesla	16.21
1.0 Tesla	13.11

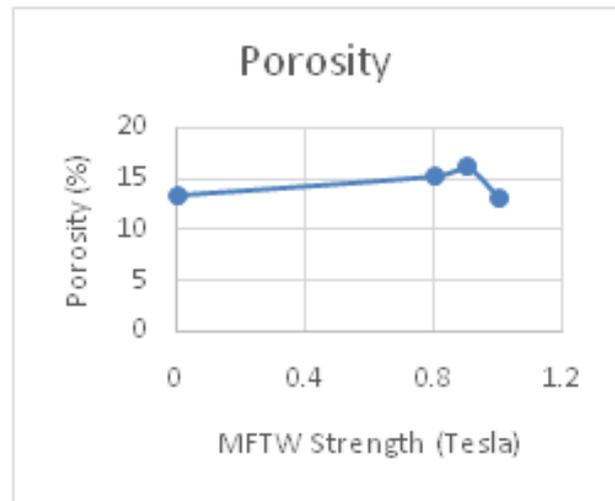


Figure.3. Porosity at different strength of MFTW

D. Sorptivity

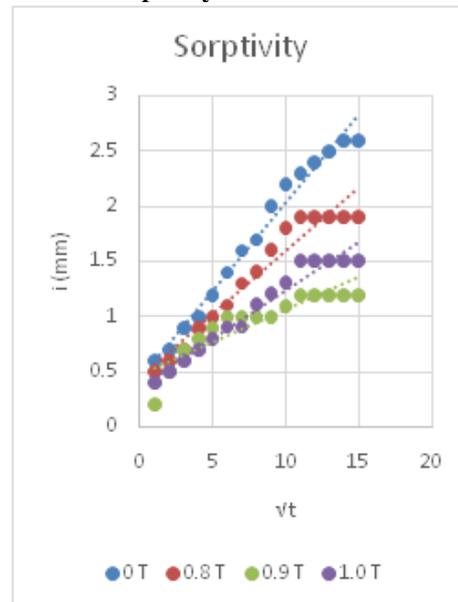


Figure.4. Comparison Graph of Sorptivity of Concrete Samples

IV. CONCLUSION

The compressive strength of concrete increases with the usage of MFTW and this increase in the strength is due to cluster concept. As more water is available for the hydration, the more number of cement particles are hydrated and this results in increase in hydration that may lead to increase in compressive strength of concrete. This phenomena increases the efficiency of cement used in concrete. The results from water absorption and porosity shows increasing trend in 0.8 Tesla and 0.9 Tesla but finally decrease in 1 Tesla which comes out less than 0 Tesla. The best result of sorptivity shows increasing trend upto 0.9 Tesla which is less than 0 Tesla sorptivity results. The process of magnetizing water thus changes the mechanical and durability properties of concrete.

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