

# Experimental Investigation on Effect of Magnetized Water on Properties of Concrete

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**Abstract** - Increasing the compressive strength of concrete is an aim which most researchers are looking for, using various methods like fiber reinforcement in concrete mixture and usage of certain admixtures including super plasticizers to produce high strength concrete. The cost of these methods are not comparable with their advantages, thus most researchers concentrate their attention on producing economical concrete with higher strength using new philosophies in design methods and through modern techniques. One such technique is using magnetic water (MW) for manufacturing of concrete. In this research, the effects of magnetic water on mechanical and durability of concrete properties such as workability, strengths and porosity in concrete have been studied

**Key Words:** Fibre reinforcement, admixtures, magnetic water (MW), workability, porosity

## 1. INTRODUCTION

One essential thing for the word concrete to gain strength is hydration or some other reactions by usage of water for mixing the ingredients, so water is very essential for the hydration process to take place in the concrete. Magnetized water doesn't mean that the magnetic strength is acquired by water but when water is subjected /exposed to a magnetic field it exhibits changes in its certain properties. This study is to investigate the enhanced physical properties and the basic concepts of Magnets and Magnetism, basic structure of water molecule, effects of magnetic field on water structure and Magnetic water concrete.

### 1.1 Objectives

The aim of this study is to investigate the effect of usage of MW in mixing and curing of concrete. A comparative study of strength and durability being the main characteristics of M20 grade concrete with and without addition of MW are made to establish that the usage of MWC in the concrete. The main objectives of the work are to establish the procedure for producing the MW and to obtain specific experimental data, which helps to understand the MWC and its characteristics in terms of Strength and Durability aspects.

## 2. CONCEPT

The cement molecules undergo the process of hydration. When we use normal water the cement particles undergo

hydration with small clusters of molecules. But when we use magnetized water, the particles are directly hydrated with individual molecules of water, due to which complete hydration of cement particles takes place. Due to this complete hydration, strength is gained.

### 2.1 Normal Water

Normal water contains H<sub>2</sub>O molecules. These molecules are connected to each other via hydrogen bonds.

The molecular composition of a normal water is shown in the figure 1

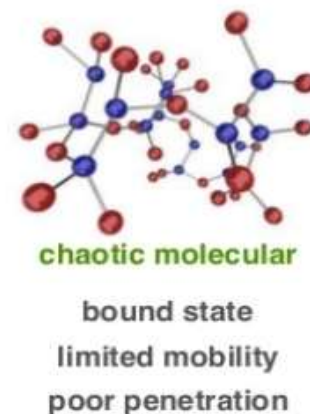


Fig -1: Molecular Structure of normal water

### 2.2 Magnetized Water

Water is passed through a magnetic field of high intensity ranging between 0.25T to 0.75T. Due to this the molecules are aligned in a certain direction.

The hydrogen bonding present in water breaks. Initially the water is present in cluster of molecules formed due to hydrogen bonding.

When passed through magnetic field the cluster breakdowns and single molecules are left as shown in figure 2 (a) & (b).

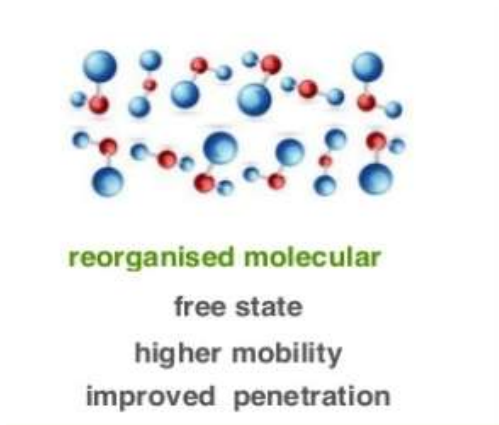


Fig -2 (a): Molecular Structure of Magnetized Water

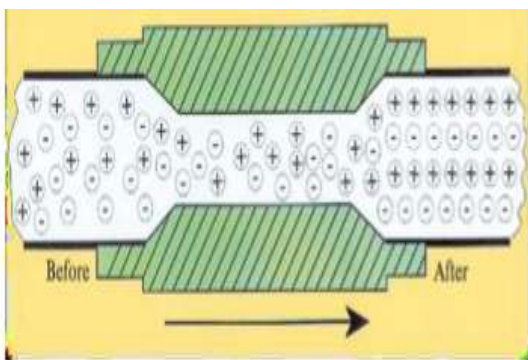


Fig -2 (b): Alignment of Ions after Passing through Magnetic Field

### 2.2.1 Preparation of Magnetized Water

The simplest and conventional method of Preparing the MW is to keep the normal water in the glass beaker and place the magnets above and below it, keeping the opposite poles facing each other and leaving the arrangement undisturbed for at least 25min as shown in fig 3 (a).



Fig - 3 (a): Conventional method

As the amount of water required was huge, hence, an apparatus was been made by attaching a GI Pipe with the normal bucket and placing the ring magnets of equal size at equal interval with a tap attached at the open end as shown in fig 3 (b). The normal water was filled in the bucket and arrangement was kept undisturbed for 1 day.



Fig -3: Apparatus Made

### 3. MATERIALS USED AND ITS PROPERTIES

- Cement: PPC
- Fineness of cement: 3%
- Fine Aggregate: Specific gravity = 2.65
- Coarse Aggregate: Specific gravity = 2.65
- Grade of concrete: M20
- Mix Proportion of 1 : 1.72 : 2.72
- Magnets

### 4. TESTS PERFORMED

#### 4.1 On Cement

The tests conducted to examine the properties of cement were:

- Fineness Test
- Consistency Test
- Initial and Final Setting Time Test

#### 4.2 On Concrete

The tests conducted to examine the mechanical properties of concrete were:

- Slump Cone Test
- Compressive Strength Test
- Split Tensile Test

These tests compare the result of the concrete made with normal water and magnetized water.

### 5. DESIGN MIX FOR M20

M20 concrete mix was designed for moderate conditions using IS 10262:2009. Mix Proportion calculated was - 1:1.72:2.72  
w/c = 0.32

Various samples of cubes of size (150 x 150x 150) mm were prepared for the above design mix using normal water and magnetized water. Quantity of materials used are mentioned in the table 1.

**Table 1-** Trial mix proportion for 1m3 of concrete

Materials	Quantities in kg
Cement	7.85
Fine aggregate	19.495
Coarse aggregate	30.739
Water	7.275

### 5. RESULTS

**Table 1-** Results on Cement

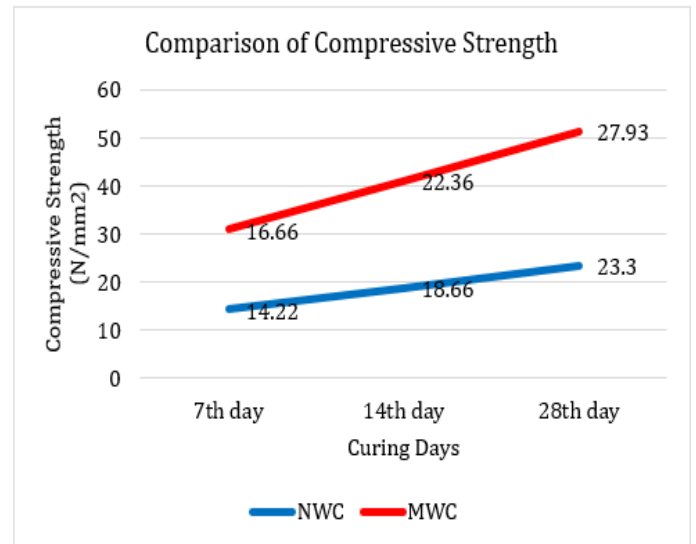
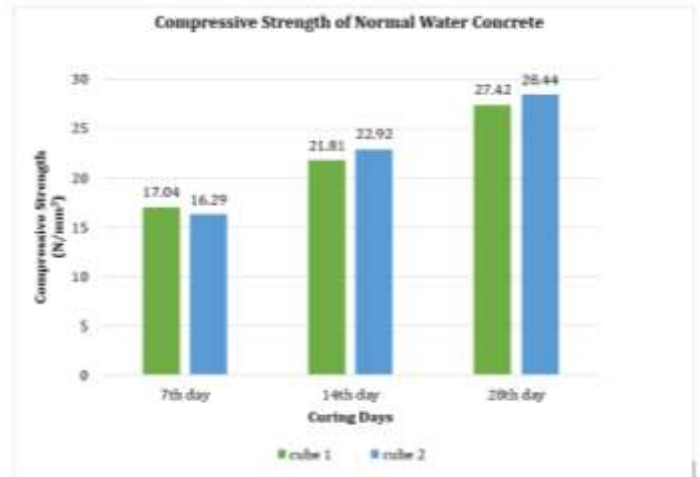
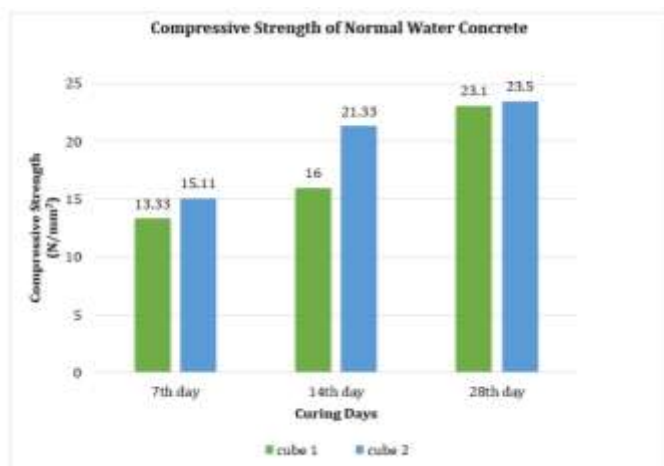
Properties	Normal water	Magnetised water
Consistency	31.44%	42%
Initial setting time	60 min	66 min
Final setting time	350 min	320 min

**Table 2-** Results on Concrete

Properties	Normal water	Magnetised water
Workability	Collapsible slump (very less workability) (10 cm)	True slump (good workability) (18 cm)
Compressive Strength 7 <sup>th</sup> day	14.22 N/mm <sup>2</sup>	16.66 N/mm <sup>2</sup>
14 <sup>th</sup> day	18.66 N/mm <sup>2</sup>	22.36 N/mm <sup>2</sup>
28 <sup>th</sup> day	23.3 N/mm <sup>2</sup>	27.93 N/mm <sup>2</sup>
Split tensile strength (28 <sup>th</sup> day)	2.72 N/mm <sup>2</sup>	3.08 N/mm <sup>2</sup>

### 7. GRAPHS

Compressive strength:



### 7. CONCLUSIONS

1. The consistency of cement has been increased by approximately 10.56% with the use of magnetised water.
2. Initial setting time of cement is found to be more for magnetised water than normal water.
3. Workability obtained by the use of magnetised water is of true slump i.e., with the good workability result.
4. Increase in compressive strength of concrete for the 7<sup>th</sup> day by 17%; for 14<sup>th</sup> day by 19.82% and for 28<sup>th</sup> day by 19.88.
5. Eco-friendly.
6. Cost reduction in production of concrete.

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