

Effect of Magnetized Water on the Properties of Concrete

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Abstract— Concrete is the majority of widely used man-made building material. As water is one of the major ingredients of concrete which leads to more consumption of water. In this research study, the effect of magnetized water on properties of concrete was studied, in order to obtain operative concrete at a lower cost. The magnetized water was prepared using the magnetic treatment system. Five concrete mixes were prepared, one without magnetized water and four with. The Compressive strength of M25 concrete cubes and split tensile strength of concrete cylinders are tested. From the results it is concluded that the compressive strength increased up to 25% for magnetized water of 48 hours for curing of 28 days. The split tensile strength for magnetized water for 48 hours also increased to 25 % than conventional concrete. It is also concluded that water consumption also reduces when water is magnetized compared to normal water.

Key words: Concrete, Magnetized Water

I. INTRODUCTION

Concrete is the majority of widely used man-made building material on the universe and cement is used to produce around 2.5 t (over one cubic meter) of concrete per person per year. One essential thing for the word concrete to acquire 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 made with OPC. Water consumption is rising as the population and human needs grow. Industrial sector comes in the second place with 20 % water consumption after the agricultural sector which accounts for 70 % of water use. In concrete production practice there is more than one billion tonnes of water consumed each year. Water used in concrete production plays a vital role in the concrete mix, starting from governing the hydration process of cement, along with proper curing in order to reach the desired strength, not to mention managing workability and durability of the concrete structure. Drinking water or tap water is usually used in concrete production to avoid the appearance of impurities. This constraint along with the limited availability of drinking water across the planet raised the important issue of optimizing the use of water in concrete constructions. Using magnetized water has promising potentials in saving water amount used in concrete construction.

A. Magnetized Water:

When water passes through a magnetic flux it is known as magnetized water. The structure of water is aligned in one direction after magnetization, and the molecule sizes change after the bond angle changes, therefore viscosity and surface area increases by magnetization, hence the hydration rate increases. The level of magnetization is controlled by the method used and water purity. Fig. 1.1 illustrates water

molecules arrangement in normal temperature. Due to the smaller size of magnetized water molecules, the water layer surrounding the cement is thinner than normal water molecules, therefore less water demand which has positive effect of hardened concrete properties.

Matter is made up of atoms & that atoms are made up of a main core of matter called the nucleus. Small particles are known as electrons which rotate on their axis and orbit all-around the nucleus and these electrons convey electric currents when they go by means of materials and metals, so electrons might be called as tiny particles of electric power. In the 19th century, researchers concluded that the heading electricity makes magnetism and in the 20th century, it switched out to be clear that magnetism was induced by electrons moving inside atoms and generating the magnetic fields surrounding them. Domains are actually groups of atoms in which spinning electrons develop an overall magnetic field. Magnetism is generated by electrons spinning and orbiting inside the atoms. A big portion of an atom is void inside and the electrons are really much farther from the nucleus and majority of the electrons in an atom is available in pairs that spin in opposite directions matches that turn in inverse bearings, so the magnetic impact of one electron in a pair counteracts the impact of its accomplice. Yet, in the event that an atom has a few unpaired electrons, these produce net magnetic fields that line up with each other and transform the entire atom into a tiny magnet. The atoms have practically no magnetism and are less affected by outside magnetic fields due to lack of unpaired electrons in case of diamagnetic materials. When water is exposed to the magnetic field the water clusters breaks and the size of water cluster reduces by which the surface area of water per unit volume increases compared to non-magnetic water. The magnetized structured water is noticed to have better bioavailability and is due to the reason that the clusters formed in magnetized water are of smaller size.

Thus water when subjected to magnetic field has better distribution or in simpler terms improves specific area. Hydration process depends on the surface areas of water and cement, when cement come and get in touch with water, the hydration process begins as more water is obtainable for hydration more number of cement particles are hydrated and this results in better quality and density of hydration products of cement.

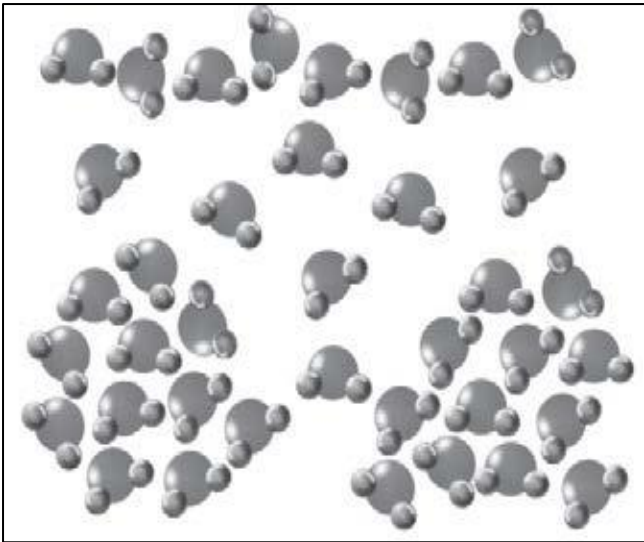


Fig. 1.1: Water molecules before magnetic treatment and after magnetic treatment

This improve in hydration may lead to enhance in the compressive strength of the concrete. This results in increase in efficiency of cement used in concrete. Therefore, improve in surface area substantially influences physical properties of the C-S-H hydrate. Improve in the specific area implies better hold of all properties of concrete and may thus result in strength generation. As amount of C-S-H gel obtained is directly proportional to the amount of C-S-H gel formed and thus increases in specific area resulting in increased strength.

II. OBJECTIVE

The objective of the present research work is to find the influence of the Magnetic water on various strength properties Concrete. Concrete is obtained by replacing water with magnetized water. The water is prepared by magnetizing potable for 24, 48, 56 and 72 hours. Compressive strength, split tensile strength with the addition of magnetized water of different magnetizing periods are calculated and then the results are to be compared with the controlled concrete.

III. PROPERTIES OF MATERIALS

A. Cement:

In the present investigation Ordinary Portland cement (OPC) of 53 Grade confirming to IS specifications was used. The properties of cement is mentioned in Table I

S.No.	Property	Results
1.	Fineness	1.66%
2.	Specific gravity	3.12
3.	Normal Consistency	31%
4.	Setting time(min)	90 min 350 min
	Initial	
	Final	

Table 1: Physical Properties of 53 Grade Ordinary Portland cement

B. Fine Aggregate

Locally available river sand confirming to IS specifications was used as the fine aggregate in the concrete preparation. The properties of fine aggregate are shown in Table II.

S.No.	Property	Values
1	Specific Gravity	2.15
2	Fineness Modulus	2.60
3	Grading of Sand	Zone – II

Table 2: Properties of Fine Aggregate

C. Coarse Aggregate

Coarse aggregate of nominal size 20 mm and 12.5 mm, obtained from the local quarry confirming to IS pacifications was used. The properties of coarse aggregate are shown in Table III. The coarse aggregate used for the reparation of concrete is a mixture of 60% 20 mm and 40% of 12.5 mm size aggregates.

S.No.	Property	Values
1	Specific Gravity	2.74
2	Water Absorption	0.4%
3	Fineness Modulus	6.53

Table 3: Properties of Coarse Aggregate

D. Water

Potable water magnetized for 24hrs, 48hrs, 72hrs and 96hrs is used for this work. Comparison of Properties of Magnetized water with potable water is shown in Table IV.

Parameter	Potable Water	Magnetized Water	Limits as per IS456-2000
PH	7.84	7.32	6.5-8.5
TDS	495	565	-
Total Hardness	288	252.5	400

Table 4: Properties of Magnetized Water

E. Concrete Mix Proportion

M25 grade of concrete mix was designed as per the Indian Standard code of practice. The mix proportions were mentioned in Table V

Cement	Fine Aggregate	Coarse Aggregate	Water
1	2.28	4.09	0.5

Table 5: Concrete Mix Proportions

F. Test Specimens

Concrete test specimens consist of 150 mm × 150 mm × 150 mm cubes, cylinders of 150 mm diameter × 300 mm height are used. Concrete cubes were tested at different curing periods (3, 7 and 28 days) of curing to get the compressive strength. Cylindrical specimens were also tested at the age of 28 days to obtain the split tensile strength of concrete. The rate of loading is as per the Indian Standard specifications.

IV. RESULTS AND DISCUSSION

A. Compressive Strength

The compressive strength of concrete cubes of grade M25 with potable water is compared with that of concrete cubes prepared with magnetized water. It is inferred that the compressive strength of concrete cubes with magnetized water is around 25% more than potable water concrete cubes at 28 days and 48hrs of magnetized water. The results of compressive strength of potable water and magnetized water of cubes are presented in Table VI and Fig 4.1.

Type of mix		Compressive Strength (N/mm ²)		
		3 days	7 days	28 days
Conventional mix		19.51	25.31	33.8
Magnetized Water mix	24 hrs	20.20	23.77	41
	48 hrs	23.16	26.11	42.03
	72 hrs	20.01	24	40.97
	96 hrs	18.49	26.38	36.24

Table 6: Compressive Strength (N/Mm2) of Cubes at Different Periods of Curing

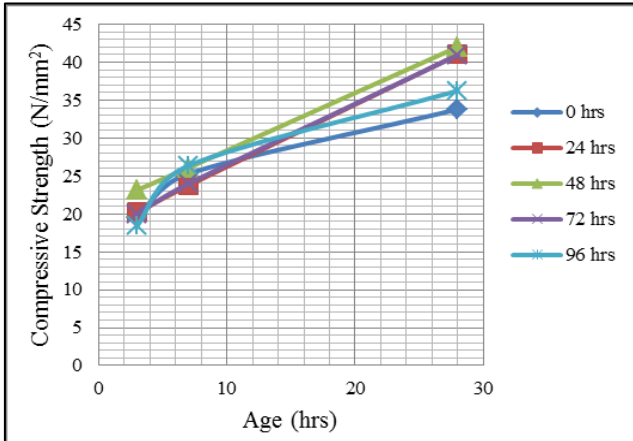


Fig. 4.1 Variation of Cube Compressive Strength of M 25 grade of Concrete with Age

B. Split Tensile Strength

The results of Split Tensile strength of potable water and magnetized water of cylinders are presented in Table VII and Fig 4.2. It is inferred that the Split tensile strength of concrete cylinders with magnetized water is around 25% more than potable water concrete cubes at 28 days and 48hrs of magnetized water.

Type of mix	Split Tensile Strength(N/mm ²) 28 days	
Conventional mix	2.52	
Magnetized water mix	24hrs	3.03
	48hrs	3.185
	72hrs	2.785
	96hrs	2.63

Table 7: Split Tensile Strength (N/Mm2) of Cylinders at Different Periods of Curing

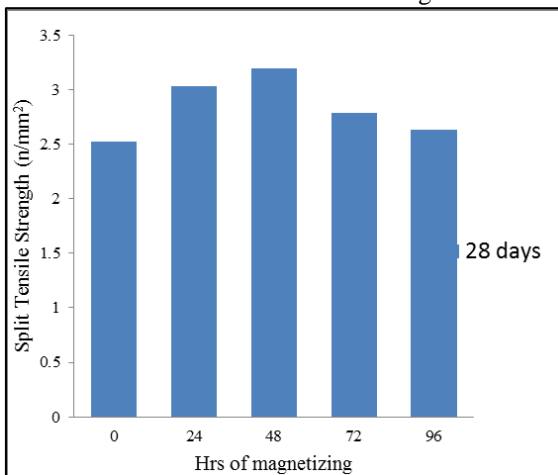


Fig. 4.2: Variation of split tensile Strength of M 25 grade of Concrete with Magnetization

V. CONCLUSIONS

Based on the test results of the present investigation, the following conclusions are drawn.

- Compressive Strength of Concrete has increased around 25% more than conventional water Concrete at 28 days of curing and Mixed with 48hrs of magnetized water.
- Split Tensile Strength of Concrete has increased around 25% more cube compressive strength than conventional water Concrete at 28 days of curing and Mixed with 48hrs of magnetized water.
- Decrease the amount of water required as there is break down of clusters of water.
- Magnetized water has less water consumption compared to conventional water.

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