

“EXPERIMENTAL INVESTIGATION ON EFFECT OF MAGNETIZED WATER ON PROPERTIES OF FRESH AND HARDENED CONCRETE”

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ABSTRACT:- This study involves the investigation of influence of magnetic water on the workability and compressive strength of concrete. The water is initially magnetized with the help of 3hp motor having a Bluemax Technology magnet at its inlet pipe. Both the Physical and chemical properties of water is Tested for PH, Alkalinity, Acidity, Hardness, Chloride tests are conducted for samples are then prepared and casted with magnetic water and ordinary water in four different cases. About 72 concrete cubes of size 150x150x150mm, 18 cylinders of size 300mm height, 150mm diameter and 18 Beams of size 500x100x100 mm are casted for M20, M30, M40 grade and tested for compressive strength, split tensile strength and flexural strength for 7, 14, 21 and 28 days respectively. This study is aimed to compare the strength of concrete in Magnetised and Normal water by performing tests like compressive strength, split tensile strength and flexural strength.

Key words: Magnetic Water, Workability, Compressive Strength, Curing Ages.

1. INTRODUCTION

When water is subjected to the magnetic field the water clusters breaks and the size of water cluster decreases by which the surface area of water per unit volume increases compared to non-magnetic water. Usually a water cluster consists of many water molecules of size 11-50 depending on the dominating force in the water molecule. But when water is exposed to magnetized field it is observed that the number of water molecules decreases to a smaller amount and is usually about the size 5-6. Thus, water when exposed to magnetic field has better dispersion or in simpler terms increased specific area. Hydration process depends on the surface areas of water and cement, when cement comes in contact with this water, the hydration process begins, as more water is available for hydration more number of cement particles are hydrated and this results in better quality and density of hydration products of cement. This increase in hydration may lead to increase in the compressive strength of the concrete.

1.1Magnetic Water

Magnetic fields are produced by the motion of charged particles. The magnetic field is present only, when electrical current is passed through the wire coils or by using permanent magnet along the flow of water. The mechanism of magnetic water as shown in figure.

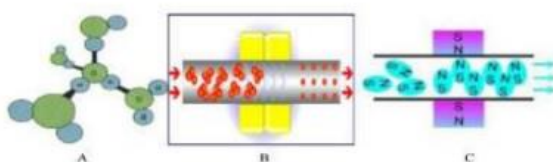


Figure 1. Mechanism of Magnetic Water

a) Water Cluster b) Breakage of Cluster c) Orientation

Due to the effect of magnetic field on the water, large water cluster are cut and broken down by external magnetic field to form smaller water cluster, which helps magnetic water to penetrate easily into cement particles and thereby hydration process will take place more effectively. Effect of hydration process as shown in figure.

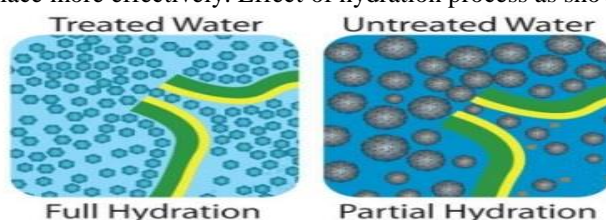


Figure 2. Hydration process for Magnetic and Non-Magnetic Water

2. LITERATURE REVIEW:

2.1 Seyitriza Tigrek & Frank Barnes (2010) investigated the behaviour of water structure under electric and magnetic fields and their effects on protein transportation in the human body they found that the water exposed to fields forms different structures which improves reaction between complex biological ions and molecules present in the proteins.

2.2 M.C. Yan et.al (2009) discussed the ability of magnetic water to dissolve oxygen and ionic salts and studied the effect of magnetization on the structure of water molecule. In his research he came with the exact reasons for improvement of properties in magnetic water that the bond angle in water decreases which breaks the water cluster.

2.3 Pang Xiao Fet.al (2008) studied the influences of magnetic field on thermodynamic, mechanical and electromagnetic properties of water including the specific heat, surface tension force, soaking effect or angle of contact, refraction index and electric conductivity. From these investigations he concluded that the magnetic fields reduce the specific heat of water, increase the soaking degree and hydrophobicity of water to materials, depress its surface tension force and increase refractive index and electric conductivity of water relative to those of pure water. He also concluded that one can predict that these changes are caused by the changes of microscopic structures and distribution of water molecules under the action of a magnetic field.

2.4 Pang Xiao Feng & Deng Bo (2008) Studied the effects of water before and after magnetization using spectrum techniques like infrared, Raman, visible, ultraviolet and X-ray lights and they examined the molecular and atomic structures of water. Experiments discovered that the size in contact angles of magnetized water on the surface of hydrophobic materials decreases and a change in the cluster structure of water molecule were observed.

2.5 Chaplin M. F. (2007) discusses the property of retention of properties imparted into the water and how they are used in the applications of homeopathy. He proposes that glass wares are to be used to make the effect more specific and effective. He also proposes the mechanisms by which water may have been retaining the properties imparted to water.

3.WATER

Water fit for drinking is generally considered fit for making concrete. Water should be free from acids, oils, alkalis, vegetables or other organic impurities. soft waters also produce weaker concrete. Water has two functions in a concrete mix. Firstly, it reacts chemically with the cement to form a cement paste in which the inert aggregates are held in suspension until the cement paste has hardened. Secondly, it serves as a vehicle or lubricant in the mixture of the aggregates and cement. In our project we have collected magnetised water sample from BPSC College hostel building with our project guide.

Table No 1. Chemical Properties of Water

Materials	Results		Allowable Limits
Sample	Normal water (Mg/ltr)	Magnetized water(Mg/ltr)	Normal water (Mg/ltr)
Determination of PH	8.63	7.89	6.5-8.5
Acidity			
Phenolphthalein	Absent	212	0
Methyl Orange	Absent	Absent	0
Alkalinity			
Phenolphthalein	93.2	Absent	600
Methyl Orange	314.4	6	
Total Hardness	130.4	577.2	600
Chlorides	79.43	563.10	1000

4.SAMPLE PREPARATION

4.1 Mix design

The process of selecting the ingredient's in relative proportion so as to achieve, strength, Durability and workability as economical as possible is termed as concrete mix design. In our project we have done concrete mix design as per IS 10262-2009

4.2 Mixing

Calculate the material required for 12 cubes, 3 cylinders, and 3 beams specimens using the mix proportion by mass as shown in table and water to W/C of 0.40 Mixing was done by hand, Cement and fine aggregate shall be mixed

dry to a uniform colour and then the coarse aggregate is added and mixed until the coarse aggregate is uniformly distributed

4.3 Casting:

The following procedure is adopted to casting of specimens.

- Place the moulds on the vibrating machine and put the wet concrete mix inside the moulds in three layers.
- Switch on the button of vibrating machine and then tamping has to be done using standard tamping rod.
- Vibration should not be more, otherwise segregation will take place.
- After filling the moulds with wet concrete, level the surface and give the designation to it.

4.4 Curing:

- After conducting the near surface characteristic tests, the specimens were kept for moist curing for the standard period of 7,14 & 28 days.

5.TESTS CONDUCTED FOR FRESH AND HARDENED CONCRETE

5.1 Workability Test

The workability tests are conducted on fresh concrete.

Table No 2. Slump Cone Values

Sl no	Grade	W/C Ratio	Type	Magnetized water(mm)	Normal Water(mm)
1	M20	0.5	Cube's	95	65
			Cylinder's and Beam's	70	28
2	M30	0.45	Cube's	62	57
			Cylinder's and Beam's	45	40
3	M40	0.4	Cube's	50	35
			Cylinder's and Beam's	95	90

5.2 Compressive Strength Test:

Table No 3. Compressive Strength for M20 grade Concrete

Sl No	No of Curing Days	Compressive strength(N/mm ²)	
		Normal Water	Magnetized water
1	7	15.49	18.49
2	14	17.23	19.74
3	21	18.56	23.78
4	28	21.89	26.78

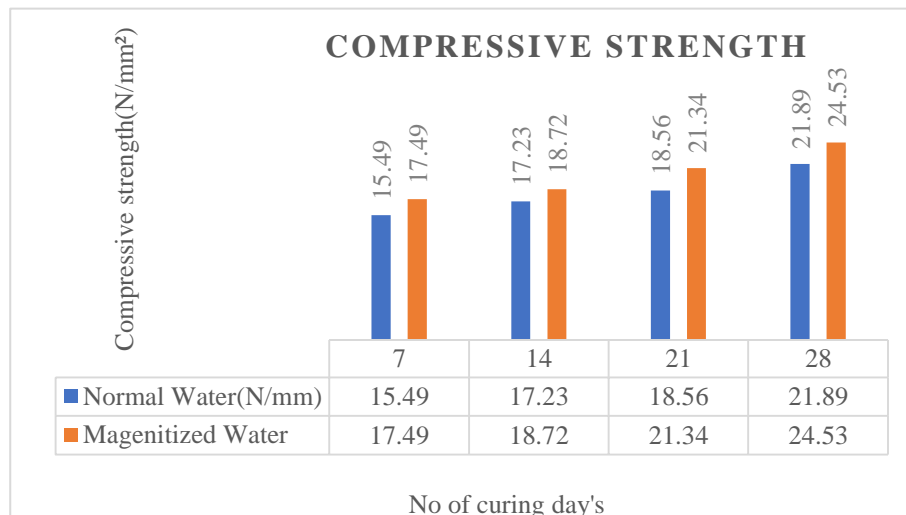


Chart I. Compressive Strength of Cubes for M20 grade Concrete

Table No 4. Compressive Strength for M30 grade Concrete

Sl No	No of Curing Days	Compressive strength(N/mm ²)	
		Normal Water	Magnetized water
1	7	20.62	24.6
2	14	24.83	28.22
3	21	28.72	32.31
4	28	31.3	36.5

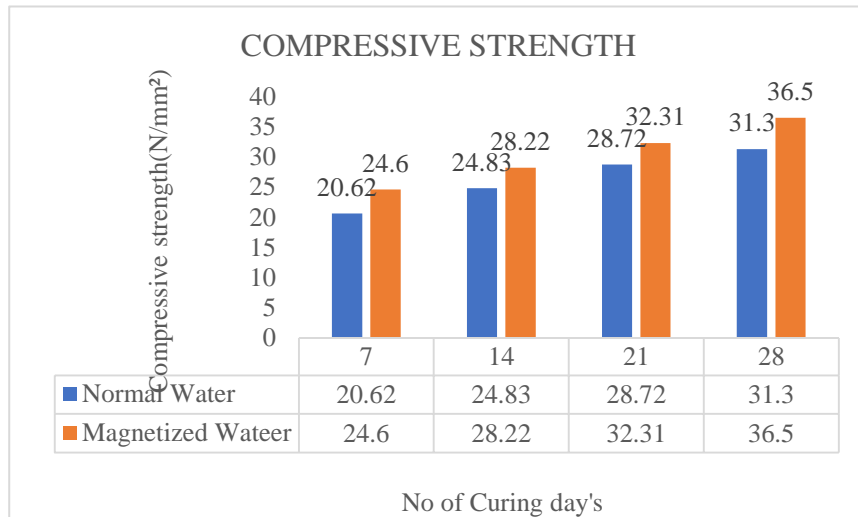


Chart II. Compressive Strength of Cubes for M30 grade Concrete

Table No 4. Compressive Strength for M40 grade Concrete

Sl No	No of Curing Days	Compressive strength(N/mm ²)	
		Normal Water	Magnetized water
1	7	29.11	32.29
2	14	33.5	38.62
3	21	38.41	43.74
4	28	41.03	45.25

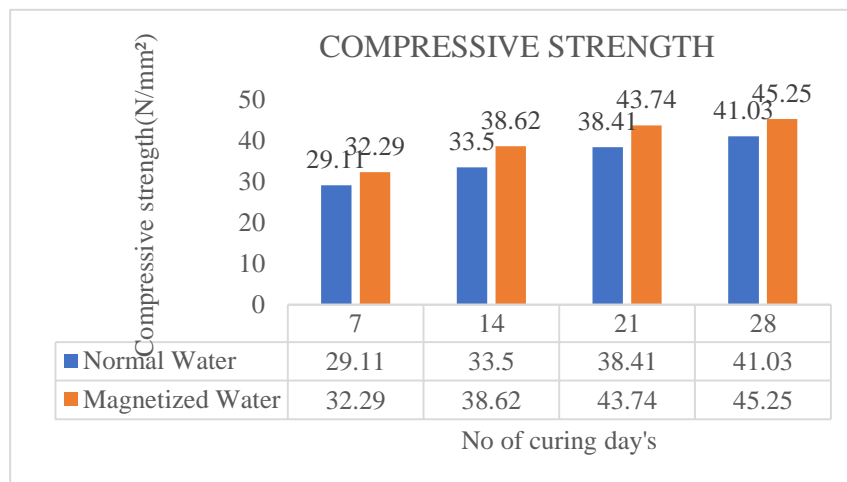


Chart III. Compressive Strength of Cubes for M40 grade Concrete

5.3 Split Tensile Test:

Table No 5. Split Tensile Strength for M20, M30, M40 grade Concrete

Sl No	Grade	No of Curing Days	Compressive Strength(N/mm ²)	
			Normal Water	Magnetized water
1	M20	28	2.05	2.46
2	M30	28	2.19	2.62
3	M40	28	2.32	2.69

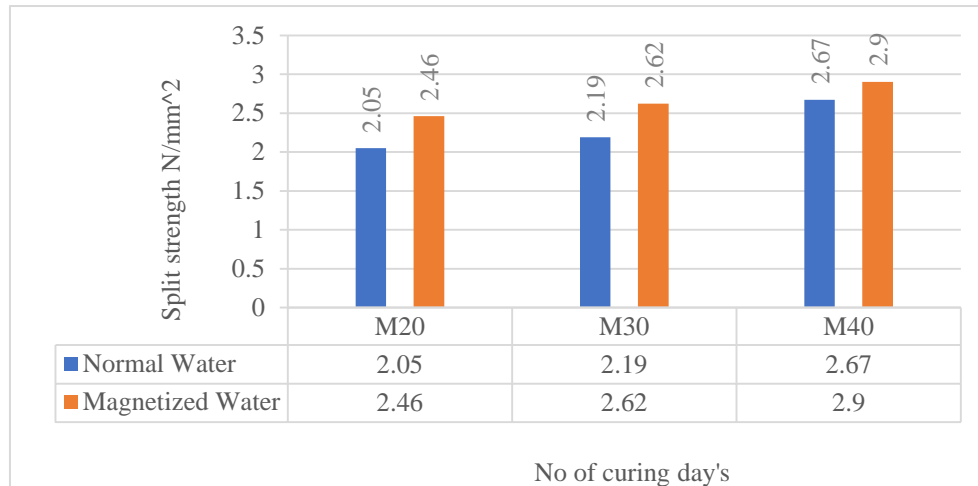


Chart IV. Split Tensile Strength of Cylinder's for M20, M30, M40 grade Concrete

5.4 Flexural Strength Test:

Table No 6. Flexural Strength for M20, M30, M40 grade Concrete

Sl No	Grade	No of Curing Days	Tensile Strength(N/mm ²)	
			Normal Water	Magnetized water
1	M20	28	3.21	3.46
2	M30	28	3.84	3.92
3	M40	28	4.52	4.62

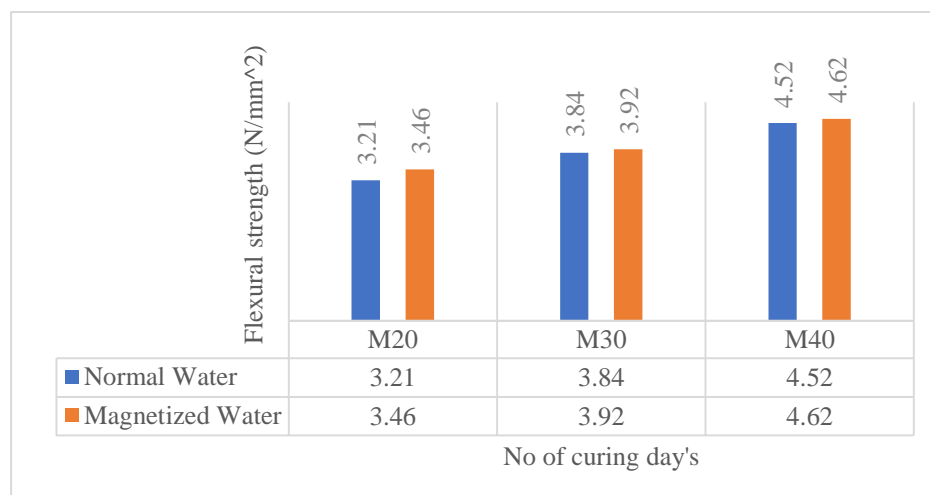


Chart V. Flexural Strength of Beam's for M20, M30, M40 grade Concrete

6. CONCLUSIONS

- 1.The strength properties are found higher in concrete with magnetized water and same in workability.
- 2.Studies conducted on water which is exposed to magnetic field indicates that the magnetic field exposure on water brings about internal molecular Changes in water and increases surface area of water in unit volume.
- 3.In this Magnetic water technology the strength of concrete gets increase without adding any admixtures or additives.
- 4.with compared to the normal tap water and magnetic water concrete is higher in split tensile strength of concrete.
- 5.with compared to the normal tap water and magnetic water concrete is higher in compressive strength of concrete.
- 6.with compared to the normal tap water and magnetic water concrete is higher in Flexural strength of concrete.
- 7.The average increase in compressive strength of magnetized is found to be 16.40 %
8. The average increase in split-tensile strength of magnetized is found to be 19.87 %
- 9.The average increase in Flexural strength of magnetized is found to be 4.02 %
- 10.The concrete prepared by using magnetised water will be cost effective, environmentally accepted and required low maintenance for the devices.

7.REFERENCES

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