

EXPERIMENTAL STUDIES ON DURABILITY OF MAGNETIC WATER CONCRETE

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ABSTRACT:- The magnetic water has been used in different fields like agriculture, health care, constructions, dairy production, and oil industries. Concrete mixes designed were prepared using tap water (TW) and another set of concrete mixes designed of the same proportions were also prepared using magnetized water (MW) in the laboratory to prepare the testing specimens. Assessment of the Concrete strength was performed to determine the effect of using magnetized water. The compression parameters included the mechanical properties and the consistency of fresh concrete. The change in water surface tension and the positive results of the concrete evaluation is evidence of the positive effect of using magnetized water in preparing concrete.

Durability of concrete can be defined as the ability to perform satisfactorily in the exposure condition to which it is subjected over an intended period of time with minimum of maintenance while maintaining its desired engineering properties. No material is inherently durable; as a result of environmental interactions the microstructure and, consequently, the properties of materials change with time. A material is assumed to reach the end of service life when its properties under given conditions of use have deteriorated to an extent that the continuing use of the material is ruled either unsafe or uneconomical. Concrete ingredients, their proportioning, interactions between them, placing and curing practices, and the service environment determine the ultimate durability and life of the concrete. The present work is carried out to investigate the effect of Magnetic Water on the Durability of magnetic water concrete (M30 grade and M40 grade). Effect of magnetic water on acid immersion and freezing & thawing of magnetic water concrete are studied. It is observed that, in most cases, concrete made with magnetic water has superior durability than those of normal water concrete although there is no significant difference in its composition.

I. INTRODUCTION

Concrete in construction industry:- Concrete is a composite material composed of aggregate bonded

together with a fluid cement which hardens over time. In Portland cement concrete (and other hydraulic cement concretes), when the aggregate is mixed together with the dry cement and water, they form a fluid mass that is easily molded into shape. The cement reacts chemically with the water and other ingredients to form a hard matrix which binds all the materials together into a durable stone-like material that has many uses. Construction industry is one of the major industries in all countries both in terms of economy and affecting environment. In construction industry, concrete and metal (mostly steel) are widely used materials. Concrete is primarily used building material. Approximately four tonnes of concrete is produced for every person on the planet. Concrete is the second most consumed entity after water.

Principle of magnet therapy:-All physical and mental functions are controlled by electromagnetic fields produced by the movement of electro chemicals (ions) within the body. When an injury occurs and tissue is damaged, positively charged ions move to the allocated area, causing pain and swelling. In order for healing to take place, the injured site must be restored to its natural negative electromagnetic charge. Pain and inflammatory related electro chemicals must be removed and oxygen and nutrients transferred to the area.

The application of a magnetic field to an injured area helps restore the normal electromagnetic balance. The magnetic field relaxes capillary walls as well as surrounding muscle and connective tissue, allowing for increased blood flow. More oxygen and nutrients are transferred to the injury site, while pain and inflammatory related electro chemicals are more efficiently removed. The overall process restores the normal electromagnetic balance of the area, relieving pain and inflammation, and promoting accelerated healing.



Figure 1 One litre Beakers placed over the Magnet

Magnetised water:-Magnetized water doesn't mean water has acquired magnetic strength but that it has been subjected to a magnetic field which has found to change certain properties of water. These anomalous properties of water are unique for water and may result in many variations of macroscopic properties. Magnetic water treatment has received some attention from the scientific community. The reported effects of magnetic water treatment are varied and often contradictory. In many cases, researchers report finding no significant magnetic treatment effect. In other cases, reasonable evidence for an effect is provided. The Australian Fluid Energy mentions that the molecule groups of magnetic water differ from molecule groups of ordinary water in having lower degree of consolidation and the molecules volume is more uniform.

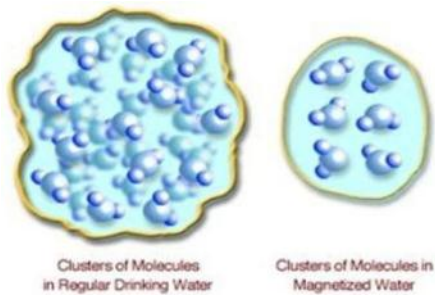


Figure 2 Differences in size of normal and magnetic water molecule clusters

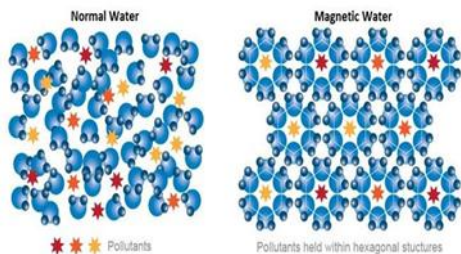


Figure 3 Change in water structure after magnetisation

Principles of magnetized water:- Natural water contains micro and macro particles of organic and inorganic nature along with different ions. Magnetic treatment of water is based on the principle of “magneto hydrodynamics”, where electrical energy is added to charged particles in water that contains ions and small solid particles with electrostatic charges by a magnetic field. The energy is produced by the momentum of the particles and remains attached to the particles as surface energy. Applying a magnetic field to natural water causes a redistribution of flow energy because of a momentum change of charged particles. All the particles and ions are electrically charged such that when magnetic fields are introduced convection and induced currents cause the liquid to spin. This movement then effects changes in gas content and the amount of salt crystallization centres in the water. The quick change of the magnetic field in a properly designed magnetic apparatus loosens hydrate layers and films in a moving liquid, thus enabling coagulation and coalescence.

Magnetised water in concrete:- In this magnetic water concrete the concrete is manufactured with magnetised water while mixing. The magnetised water is prepared by keeping the water on round magnets taken from scientific store. This phenomenon is based on magnetic therapy in the medical field.

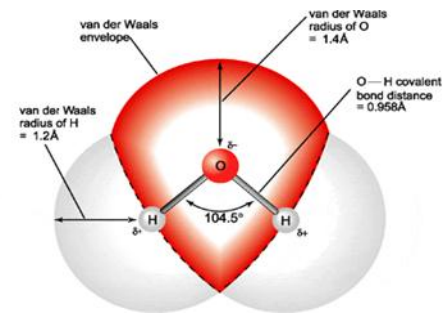


Figure 4 Structure of water

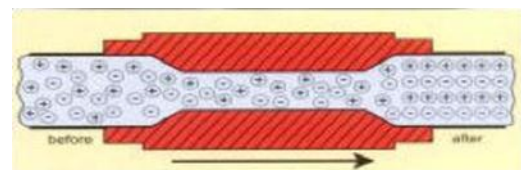


Figure 5 Movement of charged particles after magnetism

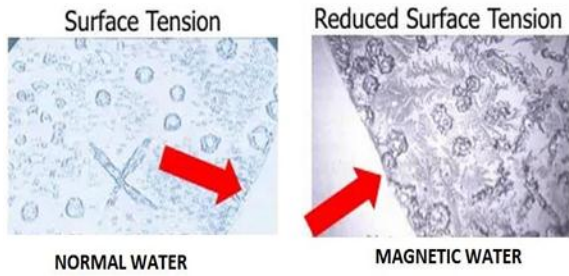


Figure 6 Change in Surface Tension of magnetised water

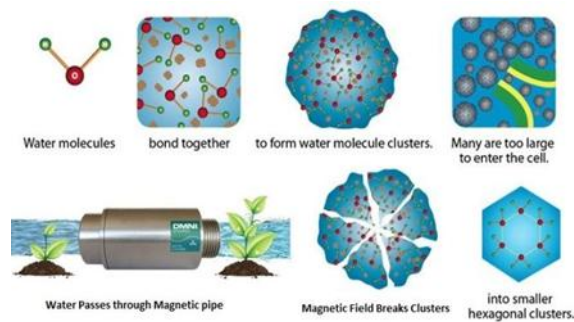


Figure 7 Change in water structure after magnetisation

MATERIALS AND METHODS MATERIALS USED

The following materials are used in the present investigation. A brief description is given below regarding the materials used.

- Cement
- Magnets
- fine aggregate
- coarse aggregate
- Magnetized water
- Normal water
- Hydrochloric acid

MAGNETS:- In the present investigation work, the Magnets were obtained from scientific store. The shapes of magnets are rounded. We found the strength of magnet by Gauss meter. Three types of strength magnets we used. The average magnetic strength of four magnets is 965gauss



Figure 8 Magnets used for magnetizing water

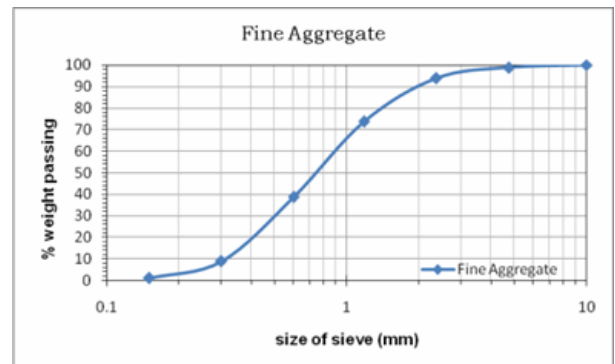


Figure 9 Sieve analysis chart for fine aggregate

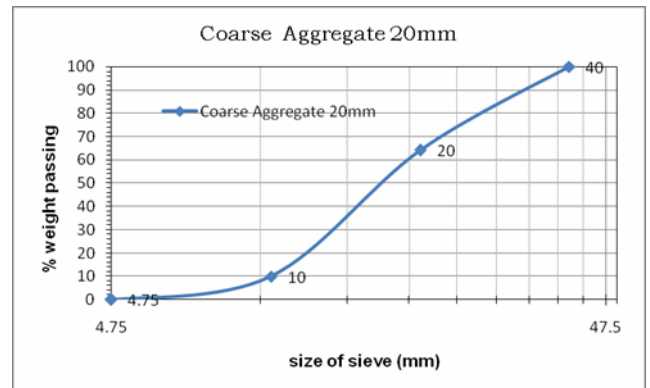


Figure 10 Sieve analysis chart for coarse aggregate (20mm)

MAGNETISED WATER: Magnetic water is obtained by placing water over the magnet. A beaker of water is placed over the magnets for a period of 24 hours to obtain magnetic water. During this time magnetic flux passes through the water changing the specific surface area of water which is called as magnetized water. Three different types of magnetic water can be prepared namely:

- 1) North pole water
- 2) South pole water

3) North south pole water or mixed pole magnetized water.

North Pole and South Pole water can be prepared using respective magnets. Whereas mixed pole water is prepared by mixing equal quantities of north and South Pole waters.



Figure 11 Water in 1 liter beaker placed on magnets

Table 1 Properties of water

Tests performed	Normal water	Magnetic Water
PH	7.2	7.9
Turbidity	7	7
Alkalinity	20	20
Chlorides	28	28
Hardness	112	84

Due to the magnetization of water various changes have been observed in different properties of cement. One such change observed is in the normal consistency of cement. A comparative study for normal consistency of cement using various waters has given the following results.

Table 2 Normal consistency of cement for different waters

Type of water	Normal consistency (%)
Normal water	30
North-South magnetized water	33

RESULTS AND DISCUSSION

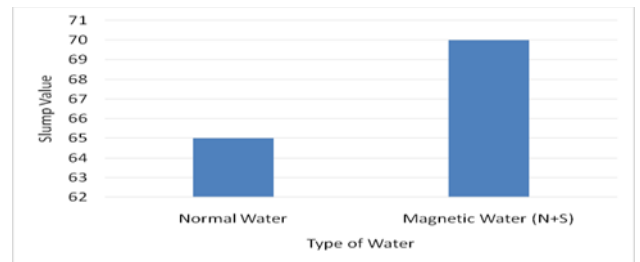


Figure 12 Workability of NWC and MWC of M30 grade concrete

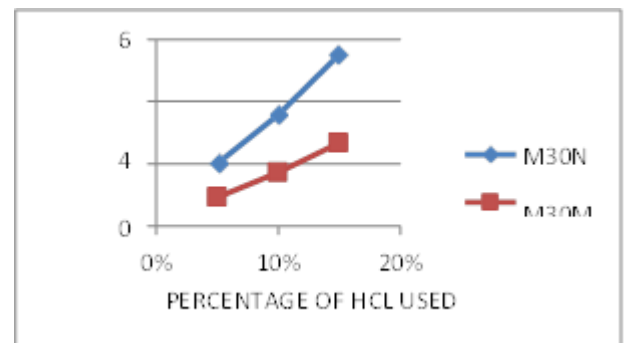


Figure 13 Percentage of weight loss for M30 grade NWC and MWC

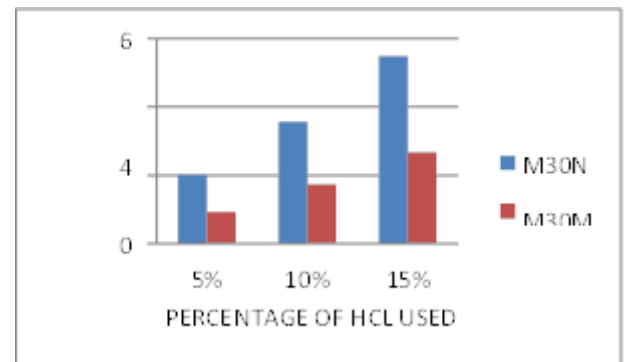


Figure-14 Comparison of % weight loss for M30 grade NWC and MWC

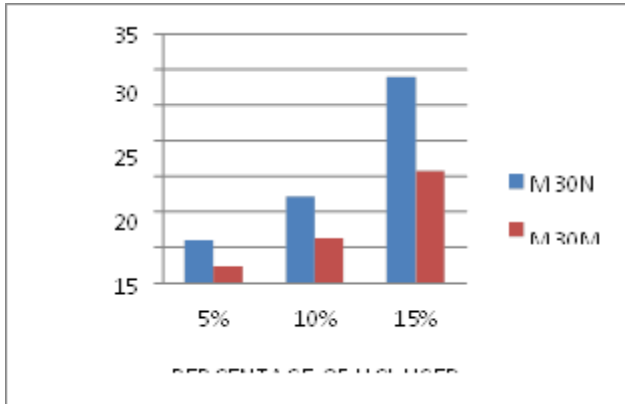


Figure 15 Comparison of % strength loss for M30 grade NWC and MWC

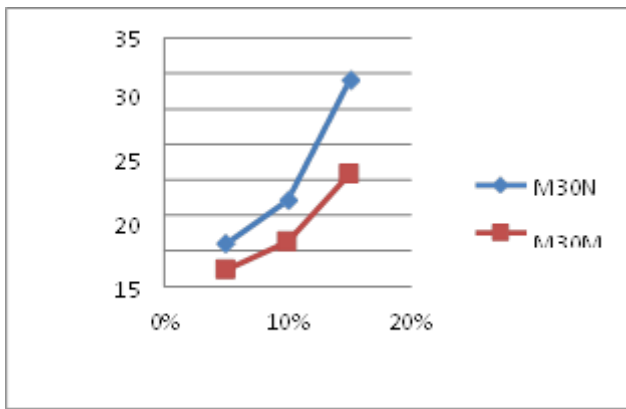


Figure 16 Percentage strength loss for M30 NWC and MWC

Tables 3 Effect of freeze-thaw cycle on properties of M30 grade NWC and MWC (28 DAYS OF CURING)

No. of Freeze-thaw cycles	NWC		MWC	
	Weight	% weight loss	Weight	% Weight loss
0	2.616	0.00	2.608	0.00
3	2.608	0.34	2.603	0.20
6	2.594	2.84	2.581	0.91
9	2.527	3.33	2.561	1.83
12	2.490	4.51	2.548	2.30
15	2.459	6.03	2.530	3.10

Table 4 Effect of Freeze-Thaw Cycles on properties of M30 grade NWC and MWC (60 DAYS CURING)

No. of Freeze-Thaw cycles	NWC		MWC	
	Weight	% weight loss	Weight	% weight loss
0	2.640	0.00	2.626	0.00
3	2.631	0.22	2.621	0.19
6	2.614	0.98	2.615	0.40
9	2.584	2.10	2.602	0.91
12	2.532	4.09	2.584	1.61
15	2.497	5.40	2.573	2.02

Table 5 Effect of Freeze-Thaw cycles on properties of M30 grade NWC and MWC (90 DAYS OF CURING)

No. of Freeze-Thaw cycles	NWC		MWC	
	Weight	% weight loss	Weight	% weight loss
0	2.524	0.00	2.629	0.00
3	2.515	0.33	2.625	0.23
6	2.501	0.91	2.6184	0.41
9	2.478	1.80	2.607	0.82
12	2.465	2.32	2.602	1.13
15	2.448	3.00	2.597	1.20

CONCLUSIONS:-

- The workability of magnetic water concrete is slightly more compared to normal water concrete.
- The percentage weight loss for M30 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage weight loss in NWC is 2.00%, 3.57% and 5.50% and in MWC is 0.92%, 1.73% and 2.67% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.
- The percentage strength loss for M30 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage strength loss in NWC is in between 6.00%, 12.13% and 29.00% and in MWC is 2.34%, 6.31% and 15.78% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.
- The percentage weight loss for M40 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage weight loss in NWC is in between 1.24%, 2.45% and 4.27% and in MWC is 0.43%, 0.95% and 2.27% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.

- The percentage strength loss for M40 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage strength loss in NWC is in between 5.71%, 8.37% and 21.70% and in MWC is 2.56%, 4.76% and 12.10% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.
- The percentage weight loss for M30 grade NWC is more as compared to MWC when specimens subjected to Freezing & thawing conditions. The Weight loss after 15 cycles of Freeze-Thaw in M30 grade NWC is in between 6.03%, 5.40%, 3.00% and in MWC specimens is 3.10%, 2.02%, 1.20% at 28, 60 and 90 days of curing respectively.
- The percentage weight loss for M40 grade NWC is more as compared to MWC when specimens subjected to Freezing & thawing conditions. The Weight loss in NWC normal is in between 5.60%, 4.20%, 2.80% and in MWC specimens is 2.40%, 1.90%, 0.50% at 28, 60 and 90 days of curing respectively.
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