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Research on Effect of Magnetized Water on Performance Evaluation of Concrete

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Abstract - *In this research study, the effect of magnetized water on workability and compressive strength of concrete was studied, in order to obtain operative concrete with high resistance and at a lower cost. The water after passing through magnetic field is called magnetized water* ***(MW).*** *The magnetized water was prepared by using electromagnetic field* ***(EMF)*** *and permanent circular magnet. This is done by passing tap water through magnetic field for 180 minutes. Some properties of magnetized water such as conductivity, TDS, and pH were studied. This experiment was conducted at 25 gauss and 250 gauss magnetic field strength.*

Key Words: Magnetized water, Electromagnetic field, magnetic field, compressive strength.

1. INTRODUCTION

Concrete is a material one that widely used in the construction of buildings because of its properties unique as compared with the other materials. The concrete features, such as their resistance and their high ability to resist the surrounding conditions and their permanence, made many of researchers seek to develop the concrete materials through carrying experiments and researches with the aim of reaching to suitable buildings with high resistance and appropriate economic costs.

The quality of water which is used in the concrete mixture plays an important role in its impact on the concrete resistance, therefore for this reason the suitable water used for mixing must be taken into consideration. Because the importance of water impact on different properties of concrete, it was imperative that this material must be given an interesting in research and study, hence the idea of using magnetic water in concrete mixture to improve its resistance rather than using high-cost additives. The cost of treated water was considered very low as compared with the other methods. Therefore, the interest of researchers focused on the production economic concrete with high resistance by using new philosophies and modern technologies in design methods with no negative impact of the environment. Perhaps the most important of these methods using the magnetic field effect on water properties and thus affects the different properties of concrete.

The objective of the current study is to identify the effect of water exposed to the magnetic field on some properties of concrete. Also, this study includes the effect of different intensities of magnetic field on some water properties such as pH, TDS and electrical conductivity (EC) and the effect of changing of these properties on the concrete.

1.1 MAGNETIC WATER

Magnetically treated water is the water obtained after passing through a specific magnetic field, or placing that magnet in or near this water for a period, thereby changing many of its properties due to exposure to the effect of those magnetic fields. The water that we drink or use during our daily lives loses many of its properties due to desalination processes by and environmental

pollution by subjected to condensation high air pressure and the addition of many sterile substances. Therefore, the process of magnetic treatment of water works to revive many of the properties, which lost under the influence of desalination and environmental pollution and strengthen it. The process of magnetic treatment correctly reorganizes water ions while the form of these ions randomly in the tap water. Scientific research has shown that more than 14 properties change in water after passing through the magnetic field, including electrical conductivity, increase dissolved oxygen in water, increase the ability to dissolve salts and acids, crystallization, surface tension, change in the speed of reactions bye, increasing permeability, etc and the water retains its magnetic strength for 8-12 hours and then starts in slow gradual decline, although some properties of water do not change even if this water passes for a long time in this field. The magnetically treatment of water was done using magnetic devices of certain intensity, and for a certain period, there are many factors influence in the process of the magnetization of water:

1. The amount of exhibiting water to the magnetic field
2. Water velocity through the magnetic field.
3. The intensity of the magnetic field.

2. MAGNETIC DEVICE

Due to lots of advantages of magnetic water, a lot of company and researchers are trying to manufacture the magnetization devices. There are many types of magnetization devices, these devices may take many shapes, many intensities and many sizes, but all of them have the same concept of work, Fig. 1 illustrates some types of magnetized water devices.

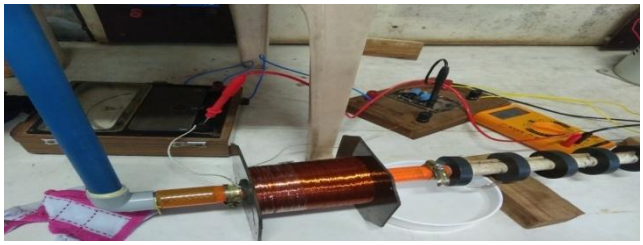


Fig. 1 Magnetic device

2.1 PREPARATION OF DEVICE

The magnetized water prepared by passing the tap water through the magnetization devices with different specific intensities. Water was supplied from a basin filled with water of about 10 liters to a plastic tube of 3-meter length, this tube was connected to magnetization device with the specific intensity and then the water returns to the basin again, Fig. 2 shows the magnetization system was used in this study. The circulation time of water through the system is 180 minutes, where the water would acquire the magnetization properties. The magnetic field intensity which was generated by using this magnetic system is 25 gauss and 270 gausses.

2.2 ELECTROMAGNET

An electromagnet is a magnet that runs on electricity. Unlike a permanent magnet, the strength of an electromagnet can easily be changed by changing the amount of electric current that flows through it. The poles of an electromagnet can even be reversed by reversing the flow of electricity. An electromagnet works because an electric current produces a magnetic field.

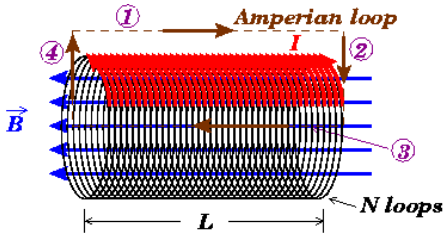


Fig 4: Electromagnet

For performing this experiment, we were required to find out the magnetic field intensity

produced through this electromagnetic concept. Magnetic field density is being calculated through the theoretical formula which was given by the amperes law.

Formula used: $\beta = \mu \frac{NXI}{L}$

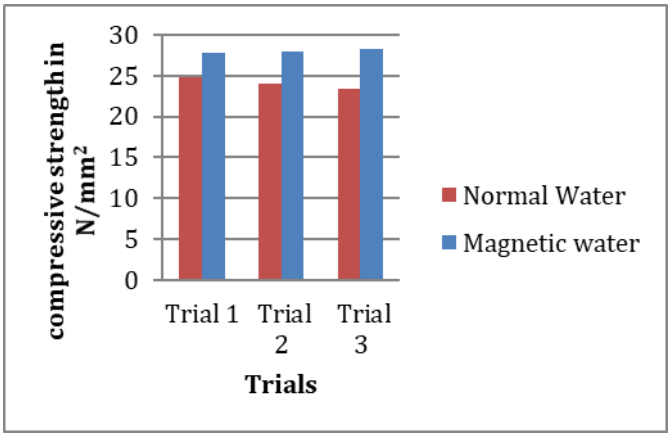
Where β is magnetic field strength, μ is permeability, N is number of turns of coils in closed loops, I is the electric current which is supplied, and L is the length of instrument. Before fixing the values of N and I we did a trial and error calculation. Then from our calculation, we fixed the value of I as 5 amperes, L as 15 cm, μ as $4\pi*10^{-7}$, and β as 0.8 tesla. After substituting all this values in the equation, we calculated the number of turns required by the coil.

3. RESULTS AND DISCUSSION

3.1 TEST CONDUCTED ON CONCRETE

3.1.1 COMPRESSIVE STRENGTH:

The compressive strength of concrete is given in terms of the characteristic compressive strength of 150 mm size cubes tested at 28 days (f_{ck}) - as per Indian Standards (ACI standards use cylinder of diameter 150 mm and height 300 mm). The characteristic strength is defined as the strength of the concrete below which not more than 5% of the test results are expected to fall.

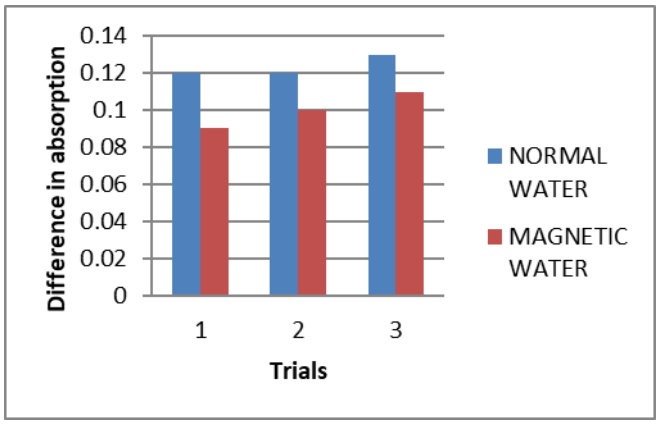


Compressive strength using normal water:

Compressive strength using magnetized water:

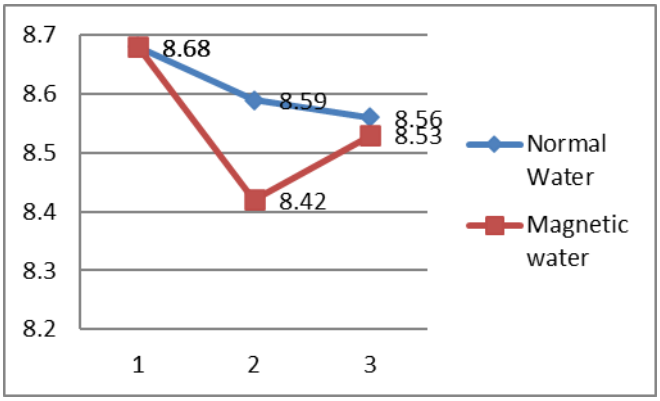
3.1.2 WATER ABSORPTION:

Water absorption is measured by measuring the increase in mass as a percentage of dry mass. It can be seen that surface water absorption is higher than internal water absorption for all the specimens. This is due to the rapid loss of water at the cover concrete during curing.



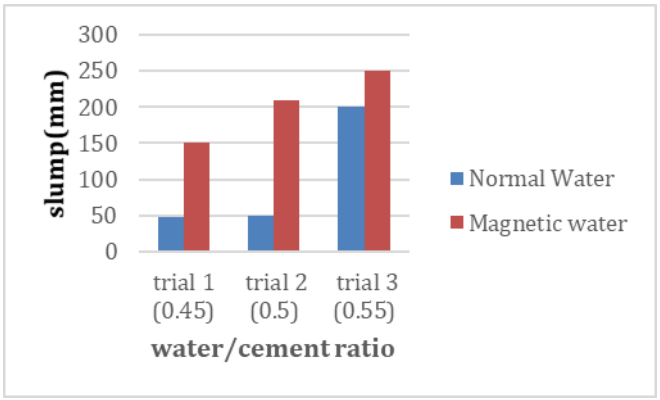
3.1.3 WEIGHT REDUCTION:

In this test the weights of concrete cubes are being compared which were made by magnetic water and non-magnetic water and it has been observed that weight of cube decreases when it is been made by magnetic water. This decrease in weight is given in terms of percentage.



3.1.4 SLUMP CONE TEST:

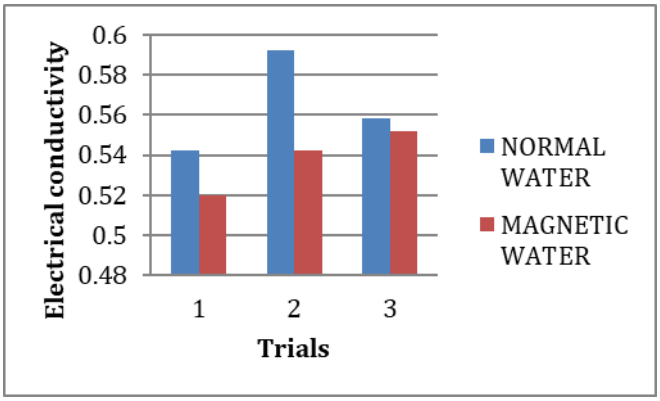
Concrete slump test or slump cone test is to determine the workability or consistency of concrete mix prepared at the laboratory or the construction site during the progress of the work. And it is been observed that workability of concrete increases when magnetic water is used.



3.2 TEST CONDUCTED ON WATER

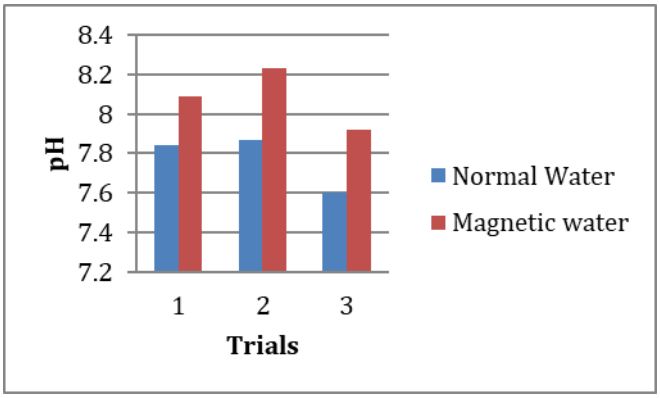
3.2.1 ELECTRICAL CONDUCTIVITY:

It has been observed that electrical conductivity of water decreases. As the conductivity of water decreases, the corrosion effect on RCC structure decreases.



3.2.2 PH OF WATER

It has been observed that pH of water increases. This shows that we can make acidic water into neutral water.



4. CONCLUSIONS

(From this experimental study following points can be drawn)

i) Magnetic field creates a structural change in water molecule.
ii) Magnetism effect makes water molecule smaller in size and increases the binding property of water with concrete.
iii) When magnetic water is used in concrete mixture, the workability of concrete mix increases.
iv) Magnetic water concrete cubes have 16 % more compressive strength as compared with normal water concrete cubes
v) These changes are observed at magnetic field of 270 gauss, if we go on increasing the magnetic field, definitely the results will be better.

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