International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Effect of Magnetic 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.

2. LITERATURE REVIEW

Rabab Mohammed Hamdam, et al. (2017) studied 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. Data were collected from previous studies and researches. The magnetized water was prepared using magnetic treatment system. Four concrete mixes were prepared one without magnetized water and three with magnetized water. Cement reduction of 12.5% and 25% was imposed on the last two mixes with magnetized water. Slump and compressive strength tests were carried out on all four mixes and it was found out that concrete produced by the magnetic technology is easy to operate without affecting the compressive resistance of concrete.

Raad Hoobi Irzooki, et al. 7 (4.20) (2018) 194-199. investigated the magnetic field effect on the properties of tap water and the magnetic water effect on some properties of the concrete used for irrigation canal lining, so, for this purpose, the absorption and seepage features of concrete will be studied. The magnetic water was obtained by passing the tap water through magnetized devices with three different intensities (3000, 5000, and 7000) Gauss for 120 minutes. Some properties of magnetized water such as surface tension, viscosity, conductivity, TDS, and pH were studied.

Saddam M. Ahmed Volno-17 (2009) investigates the influence of magnetic water on compressive strength and workability (consistence) of concrete. Results show that the compressive strength of concrete samples prepared with magnetic water increases 10-20% more than that of the tap water samples. They have used electromagnetic effect for generation of magnetic field. The instrument consists of copper coils which are rolled one over the other. Magnetic field is generated around the coils.

Nan Su,Yeong-Hwa Wu, et al. (2000) studied the compressive strength and workability of mortar and concrete, which were mixed with magnetic water and

contained granulated blast-furnace slag (GBFS). The test variables included the magnetic strength of water, the content of GBFS in place of cement, and the water-to-binder ratio (W/B). Results show that the compressive strength of mortar samples mixed with magnetic water of 0.8±1.35 T increased 9±19% more than those mixed with tap water. Similarly, the compressive strength of concrete prepared with magnetic water increased 10±23% more than that of the tap water samples. In particular, the best increase in compressive strength of concrete is achieved when the magnetic strength of water is of 0.8 and 1.2 T. It is also found that magnetic water improved the fluidity of mortar, the slump, and the degree of hydration of concrete.

Arihant Jain, et al, (2017) investigates the effect of magnetic water also known as magnetic field treated water (MFTW) on compressive strength, water absorption, porosity and sorptivity on samples prepared with magnetic water. MFTW was obtained by passing through a magnetic field. Test variables included the magnetic strength of water and curing age.
Results show that the compressive strength of concrete samples mixed with magnetic water is higher than those prepared with normal tap water. The compressive strength increase of concrete prepared with magnetic water is more significant at early age. The best result achieved for water absorption and porosity were obtained at magnetic strength of treated water is of 1T. The best result for sorptivity was obtained at magnetic strength of treated water is of 0.9T.

B. Siva Konda Reddy, et al, (2013) studied the effect of magnetic field exposure time of water on workability and compressive strength of concrete mixed with magnetic water. Water used for mixing in concrete was exposed to North and South poles for different durations. The results indicate that the 24 hours of magnetic field exposure is optimum for usage of magnetic water in manufacturing of concrete.
In this study, magnetic water is prepared by retaining water in a glass beaker over a round magnet of 985 Gauss which was obtained from scientific store. The Magnetic water is obtained by placing the beaker filled with water over the magnets for a specific period.

M Gholizadeh, et al, (2011) examine the effect of magnetic water on concrete parameters. Strength parameters of concrete have been studied for more than 104 concrete samples, including the nonmagnetic samples (made by ordinary water) and magnetic samples (made by magnetic water), with slump and compressive strength experiments. Based on slump experiments, magnetic samples were 7 centimeters more than non-magnetic group and the average compressive strength of samples made by magnetic water was 23% more than that of samples made by ordinary water. The experimental results show the advantages of magnetic samples in concrete industry because of increase in plasticity, the efficiency and quality of concrete boosts in comparison with nonmagnetic samples.

Ali Yadollahpour, et al, (2014) studied that Electromagnetic fields (EMFs) for water and wastewater treatments show promising potentials. Safety, compatibility and simplicity, environmentally friendliness, low operating cost and not proven harmful effects are the main advantages of EMFs over conventional methods for wastewater treatment. In addition to the antimicrobial and antibacterial effects of EMFs on wastewater, these fields have special properties useful for wastewater treatment process: modifying the physical and chemical properties of water molecules and other elements, sludge precipitation, phosphorus and organic compounds removal from wastewater are some of these characteristics.

*Saeid Ghorbani, et al, (2018) s*tudied the effect of magnetized water on the mechanical and durability behavior of concrete block pavers. For this purpose, a total of five mixes were prepared with water that passed through a permanent magnetic field 10, 20, 40, and 80 times at a constant speed of 2.25 m/s. Compressive strength, splitting tensile strength, flexural strength, resistance to sulfuric acid attack, water absorption tests, and Scanning Electron Microscopy (SEM) analyses were conducted. The compressive strength, splitting tensile strength, and flexural strength test results showed a significant positive effect of using magnetized water. The remaining tests also revealed that using magnetized water increases the resistance of concrete block pavers to sulfuric acid attack and decreases their water absorption.

Chikoti Sateesh, (2017) studied the effect of magnetisation on the compressive strength of concrete mixed with different treated waste water. In this technology, by passing water through a magnetic field, some of its physical properties change and as a result of such changes, the number of molecules in the water cluster decrease from 13 to 5 or 6, which causes a decrease in the water surface tension. The nanostructure of water molecule changes due to Magnetisation which helps in the increase of strength of concrete.

3. CONCLUSION

Usage of the magnetic field for water treatment leads to change water properties, where the surface tension, viscosity, and electrical conductivity were decreased, and pH value was increased. The treatment of water by magnetization leads to improvement in the mechanical properties of concrete such as increasing the compressive strength and the workability of concrete and decreasing in the absorption and seepage of the concrete. The improvement of the properties of the concrete leads to the possibility of increasing he water- cement ratio and decreasing the cost of concrete at a specified value of compressive strength.

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