International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 05 | May 2019 www.irjet.net p-ISSN: 2395-0072

EFFECT OF MAGNETIC WATER ON SPLIT TENSILE STRENGTH AND FLEXURAL STRENGTH OF M25 CONCRETE

Honey Salim[1], Beema Noushad[2], Joshua Varghese Cheriyan[3], Megul Jose[4], Adila Abdulla Kunju[5]

[1,2,3,4] U.G Students, Department of Civil Engineering, Ilahia College of Engineering and Technology, Mulavoor P.O., Muvattupuzha, Kerala, India

[5] Assisstant Professor, Department of Civil Engineering, Ilahia College of Engineering and Technology, Mulavoor P.O., Muvattupuzha, Kerala, India

---

Abstract - *Water plays an important role in the concrete preparation. It plays an important role in strength of concrete. A new technology known as magnetic water in which when added to concrete improves the strength of concrete. In this project work, we check the effects of magnetic water on properties of concrete such as split tensile strength and flexural strength of M25 grade concrete. Magnetic water is prepared by using an Inductor of capacity 10A and 415 V. Basically, it uses a conductor that is wound into a coil, and when electricity flows into the coil from the left to the right, this will generate a magnetic field in the clockwise direction. It also acts as a magnet. When the current passes to the coil a magnetic field of 500-1000 gauss is generates on the surroundings of the inductor. Then water placed on the both sides of the inductor. When water placed on the inductor, some of the physical properties of water changes. The water clusters are broken due to magnetic field and which will increase the water activity. In this study magnetized water is used for mixing of concrete. When magnetic water was used there was an increase in split tensile strength by 44% after 7 days of curing and 67% after 28 days of curing and flexural strength is increased by 20% after 7 days of curing and 19% after 28 days of curing.*

Key Words: Magnetic water(MW), Magnetic water concrete(MWC), Normal water(NW), Normal water concrete(NWC), Inductor

1.INTRODUCTION

Water is the key ingredient in concrete for the different process including hydration process, proper curing etc. When water mixed with cement which forms a paste which binds the aggregate. Water causes the hardening of concrete by the process known as hydration. Water consumption is increasing as the population and human needs increases. Water consumption in agricultural sector is around 70% and in industrial sector it is 20%. In concrete production there is more than one billion tonnes of water consumed each year. One of the recent technologies used to enhance the split tensile strength and flexural strength of concrete is using magnetized water instead of normal water in concrete mixes. Water after placed in the surroundings of a magnetic field of certain strength is called magnetic field treated water (MFTW) or magnetic water. Similar researches were also conducted in Japan, Taiwan confirming that MFTW could improve concrete strength increased 10-19% more than those mixed with tap water .Hence, it can save 5% of cement dosage, bleeding of concrete and improve resistance to freezing. Using magnetized water in concrete is best in terms of lower porosity and higher density. There is a rapid increase in the implementation of magnetized water technology on the eighties and nineties decades. This is due to the development of magnetic devices and their influences in concrete properties.

Importance of the mechanical properties of magnetized water concrete have been used in many fields of civil, military construction, like airports and jetties. Most researchers concentrate to produce economical concrete with higher strength by using new philosophies of design methods, like using water which is magnetically treated. When normal water flows through magnetic field, some of the physical properties of water are changed. Also the number of molecules in the water clusters will decreased to 6 or 5 molecules which will cause decrease in surface tension and an increase in the percentage of molecules contribute for the hydration process. In magnetic treated water, molecules will lose their attractive and repulsive forces and then oriented on a magnetic pole or electric charge. Neutralized molecules of water are more easily attracted to numerous electrostatic fields which naturally contained by cement grains. Hydration of cement is faster and more complete with magnetically treated water.

1.1 Literature Survey

B. Siva Konda Reddy, Vaishali G. Ghorpade and H. Sudarsana Rao (2014) investigated the use of magnetic water for mixing and curing of concrete. Concrete is the most widely used man-made building material on the planet. The reaction of OPC with water results in hydration products, which glue the reacting cement particles together to form a hardened cement paste. When

cement & water are mixed with sand and coarse aggregate the resulting product is called concrete. This paper finds new method of using this potable water by magnetizing which can be used in mixing and curing of concrete. Strength tests conducted on this magnetic water concrete (MWC) showed encouraging results and one can easily replace normal water with magnetic water for mixing and curing of concrete. [3] V Srinivasa Reddy, A Kranthi Kumar and A Sumanth (2017) studied the effect of magnetic field treated water on fresh and hardened properties of Concrete. According to the magnet vendors, magnets can be used to improve blood pressure, circulation, cure and prevent diseases, tooth decay and hair damage, increase vehicles mileage, reduce fuel consumption, control pollution, improve plant growth, soften water, prevent scale deposition and even increase the strength of concrete by 23 % . Generally water is transparent and treated to be homogenous consisting of just two hydrogen atoms bonded to a single oxygen atom. But at nano-level, water is not homogeneous, water exists in clusters of molecules and this cluster size depends on the temperature, pressure and forces existing around the water. These clusters of molecules are held by hydrogen bond and vanderwaal's forces . When water is exposed to the magnetic or electric fields these clusters break down changing certain properties of water. Usually water in the living system normally exists as cluster system of 12,14,17,21or more molecules and these clusters changes when there are variations in temperature and pressure of surrounding environments. [6]

Pradnya Ubale, Asst.Prof. Rahul D. Pandit, Prof. Dr. Abhijeet P. Wadekar (2016**)** studied the performance evaluation of magnetic field treated water on conventional concrete containing flyash**.** when water is magnetised, it exhibits structural changes which increases the specific surface area of water. When this magnetised water is used in concrete instead of normal water, it is found that the compressive strength increases considerably. The additional strength attained by the use of magnetized water is used to address the need for reducing cement usage in concrete. In this attempt to reduce the usage of cement, fly ash which has immense potential to be used in construction industry, can be used to replace cement in concrete to a considerable extent. Based on the experimental results obtained by conducting tests on workability and compressive strength, optimum fly ash content for various grades of concrete are achieved. [5]

1.2 Objectives

1. To establish the procedure for producing the magnetic water (MW).
2. To understand the concept of magnetic water concrete (MWC) and its characteristics in terms of strength aspects for M25 grade concrete.
3. To compare the split tensile strength and flexural strength of NWC and MWC of M25 grade concrete.

1.3 Scope Of The Study

The strength properties are found higher in concrete with magnetic water. The percentage efficiency of concrete sample prepared with magnetic water is more than the conventional one. Flexural strength and split tensile strength of M25 grade magnetic water concrete has not been studied. So the scope of this project is to compare the split tensile strength and flexural strength of normal water concrete (NWC) and magnetic water concrete (MWC) of grade M25**.**

1.4 Methodology

1. Literature Review.
2. Select suitable mix proportion.
3. Material testing.
4. Choosing dimensions for the specimens (cylinders, beams).
5. Preparation of magnetic water
6. Preparation of test specimens.
7. Testing for engineering properties to find out the 7day and 28 day split tensile strength and flexural strength of NWC and MWC.
8. Interpretation and comparison of the results.

2. EXPERIMENTAL INVESTIGATION

2.1 Raw Materials

1. Ordinary Portland Cement(OPC) of 53 grade.
2. River Sand passing through 4.75mm sieve is used as fine aggregate.
3. Coarse aggregate of 20mm size is used.
4. Normal Water(NW).
5. Magnetic Water(MW)

2.2 Test Data For Materials

1. Specific gravity of cement : 3.1
2. Specific gravity of:

Coarse aggregate : 2.5
Fine aggregate : 2.5

2.3 Mix Proportion

1. Grade of concrete is M25
2. Mix proportion is 1:1:2

2.4 Preparation Of Magnetic Water

Fig-1: Inductor

Fig-2: Magnetic water equipment system

Magnetic water is prepared by using an Inductor. Fig-1 shows an inductor. An inductor, also called a coil, choke, or reactor, is a passive electronic component which is capable of storing electrical energy in the form of magnetic energy. Basically, it uses a conductor that is wound into a coil, and when electricity flows into the coil from the left to the right, this will generate a magnetic field in the clockwise direction. It also acts as a magnet. The inductor used for producing magnetic field is of capacity 10A and 415 V. First AC of maximum 5A is given to the inductor coil. Here current is provided to the 3 phase of the inductor. Current can be adjusted by using a rotating handle. When the current passes to the coil a magnetic field of 500-1000 gauss is generates on the surroundings of the inductor. Then a 10 litre of water placed on the both sides of the inductor. After 5 hours, the normal water will change to the magnetic water and the pH of the normal water also gets changed to a value of 8.2. Fig-2 shows the magnetic water equipment system.

2.4 Tests Under Normal Water And Magnetic Water

1. Splitting tensile strength test

3 Cylinders of diameter 150mm and length 300mm size specimens were cast. The split tensile strength of the NWC and MWC cylinders were conducted after 7 days and 28 days of curing.

Fig-3: Cylinder testing in compression testing machine

2. Flexural strength test

3 Beams of size 10cm*10cm*50cm specimens were cast. The flexural strength of the NWC and MWC beams were conducted after 7days and 28 days of curing.

Fig-4: Beam testing in flexure testing machine

3. TEST RESULTS

3.1 Test Results Of Concrete After 7 Days And 28 Days Of Curing Under Normal Water

Table-1: Split tensile strength of NWC cylinders after 7 days and 28 days of curing

Sl. No.	7days of curing		28 days of curing	
	Maximum load (kN)	Avg. split tensile strength (N/mm^2)	Maximum load (kN)	Avg. split tensile strength (N/mm^2)
1	174	2.45	200	3.00
2	175		205	
3	172		210	

Table-2: Flexural strength of NWC beams after 7 days and 28 days of curing

Sl. No.	7days of curing		28 days of curing	
	Maximum load (kN)	Avg. Flexural strength (N/mm^2)	Maximum load (kN)	Avg. Flexural strength (N/mm^2)
1	11.5	5.63	12.5	6.50
2	11.0		13.0	
3	11.4		13.5	

3.2 Test Results Of Concrete After 7 Days And 28 Days Of Curing Under Magnetic Water

Table-3: Split tensile strength of MWC cylinders after 7 days and 28 days of curing

Sl. No.	7days of curing		28 days of curing	
	Maximum load (kN)	Avg. split tensile strength (N/mm^2)	Maximum load (kN)	Avg. split tensile strength (N/mm^2)
1	250	3.54	350	5.02
2	255		355	
3	245		360	

Table-4: Flexural strength of MWC beams after 7 days and 28 days of curing

Sl. No.	7days of curing		28 days of curing	
	Maximum load (kN)	Avg. Flexural strength (N/mm^2)	Maximum load (kN)	Avg. Flexural strength (N/mm^2)
1	13.5	6.75	15.0	7.75
2	13.0		15.5	
3	14.0		16.0	

3.3 Comparison Of Split Tensile Strength Of NWC And MWC After 7 Days And 28 Days Of Curing

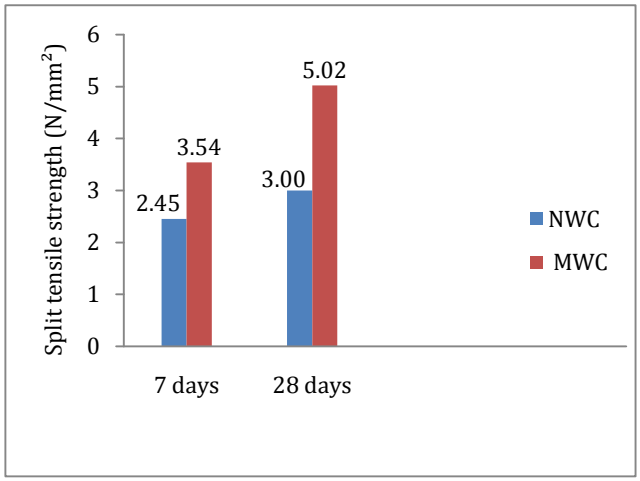

Fig-5: Comparison of split tensile strength of NWC and MWC after 7days and 28 days of curing

Fig-5 shows the comparison of split tensile strength of NWC and MWC after 7 days and 28 days of curing. The split tensile strength of NWC at 7 days of curing was found to be 2.45 N/mm^2 and the MWC was found to be 3.54 N/mm^2. There was an increase of 44% than NWC when MW was used. Also the split tensile strength of NWC at 28 days of curing was found to be 3.00 N/mm^2 and the MWC was found to be 5.02 N/mm^2. There was an increase of 67% than NWC when MW was used.

3.4 Comparison Of Flexural Strength Of NWC And MWC After 7 Days And 28 Days Of Curing

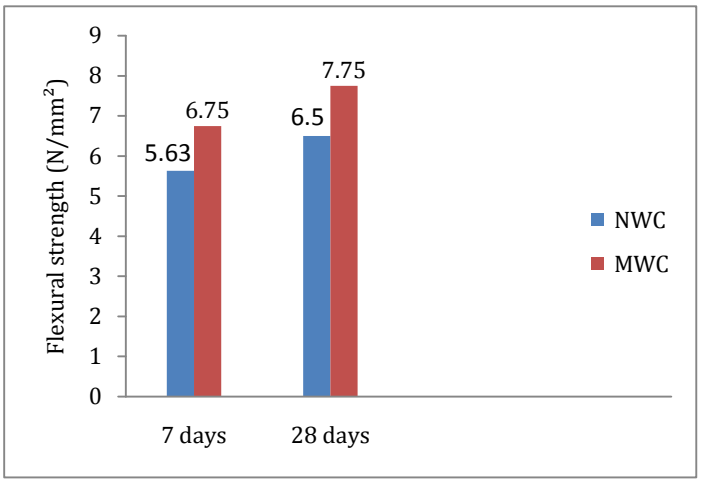

Fig-6: Comparison of flexural strength of NWC and MWC after 7days and 28 days of curing

Fig-6 shows the comparison of flexure strength of NWC and MWC after 7 days and 28 days of curing. The flexure strength of NWC at 7 days of curing was found to be 5.63 N/mm^2 and the MWC was found to be 6.75 N/mm^2. There was an increase of 20% than NWC when MW was used. Also the flexure strength of NWC at 28 days of curing was found to be 6.5 N/mm^2 and the MWC was found to be 7.75 N/mm^2. There was an increase of 19% than NWC when MW was used.

4. CONCLUSIONS

Based on the experimental studies conducted, the following conclusions can be drawn,

1. Using magnetic water for preparation of concrete can enhance the properties of concrete.
2. The magnetic water mix concrete show higher split tensile and flexural strength than the normal water concrete.
3. When magnetic water is used for concrete mixing, it increases the split tensile strength by 44% after 7 days of curing and 67% after 28 days of curing.

4. When magnetic water is used for concrete mixing, it increases the flexural strength by 20% after 7 days of curing and 19% after 28 days of curing.
5. The increase in the strength is due to more hydration of cement in the magnetized water concrete. Due to the increase in hydration it fills up the pores in the concrete.

REFERENCES

[1] Arihant Jain, AakashLaad, KirtiChitrarth Singh, Krishna Murari (2017): "Effect of magnetic water on properties of concrete", International Journal of Engineering Science and Computing. Research Article, Volume 7, Issue No.5.

[2] B. Siva Konda Reddy, Dr.Vaishali, G Ghorpade, Dr.H.Sudarsana Rao (2014): "Influence of magnetic water on strength properties of concrete *", Indian Journal of Science and Technology, Vol 7(1), 14–18.*

[3] B. Siva Konda Reddy, Dr.Vaishali, G Ghorpade, Dr.H.Sudarsana Rao (2014): "Use of magnetic water for mixing and curing of concrete", International Journal of Advanced Engineering Research and Studies, Volume 4 Issue 1, P 93-95.

[4] H.Afshin, M. Gholizadeh, N. Khorshidi (2010): "Improving mechanical properties of high strength concrete by magnetic water technology", Scientia Iranica, Vol. 17, No. 1.

[5] Pradnya Ubale, Asst.Prof. Rahul D. Pandit, Prof. Dr. Abhijeet P. Wadekar (2016): "Performance evaluation of magnetic field treated water on conventional concrete containing flyash", International Journal of Science Technology and Management.Vol. No.5, Issue No.02.

[6] V Srinivasa Reddy, A Kranthi Kumar and A Sumanth (2017): "Effect of magnetic field treated water on fresh and hardened properties of concrete". Journal of Civil Engineering and Environmental Technology.p-ISSN: 2349-8404; e-ISSN: 2349-879X; Volume 4, Issue 2; pp. 134-138. .

[7] Yasser R. Tawfic, Wael Abdelmoez (2013): *"*The influence of water magnetization on fresh and hardened concrete properties*".* International Journal of Civil Engineering and Technology (IJCIET), ISSN 0976 – 6308, ISSN 0976 – 6316 Volume 4, Issue 6.