

Comparative Study of Conventional and Magnetic Water on M30 Grade of Concrete

Monali. G. Mandaokar¹, Asst. Professor. I. B. Dahat²

¹PG.Student: G. H. Rasoni University, Civil Engineering Department, Structural Engineering, Amravati, India

²Asst. Professor: G. H. Rasoni University, Civil Engineering Department, Structural Engineering, Amravati, India

Submitted: 01-06-2021

Revised: 14-06-2021

Accepted: 16-06-2021

ABSTRACT:The most important challenge for the concrete construction is to improve the strength and durability of structure. Water plays an important role in concrete preparation which contains huge amount of minerals and salts which leads to reduce the life span of structure. To overcome this problem a new technology called as Magnetic Field Treated Water (MFTW) is used. MFTW was obtained by passing water through a magnetic field. Magnetic Field Treated Water technology was initiated in Russia and China for agricultural and different kinds of work but now it is also used in construction industry.

In this research study, effect of conventional (potable) and magnetised water on compressive strength, split tensile strength and flexural test are compared. Tests were conducted on M30 grade of concrete. We are going to cast total 12 cubes, 12 cylinders and 12 rectangular shaped blocks for 7th day and 28th day curing. Along with this the effect on physical properties of water is also checked due to recirculation of water. We are expecting the results that the compressive strength, split tensile strength and flexural strength of concrete prepared by the magnetised water is higher or similar than the concrete prepared by the conventional concrete.

KEYWORDS:Magnetised water, Magnetic Field, Compressive strength, Tensile strength, Flexural

strength.

I. INTRODUCTION:

[3] Concrete is the most important material for the construction purpose. The process of concrete preparation creates environmental pollution as it emits CO₂. It has been noticed one of the major problem and quality of water plays a vital role in preparation of concrete for this reason the suitable water used for mixing must be taken into consideration. Water causes hydration process when mixed with cement. The importance of water impact on different properties of concrete must be given an interesting topic in research and study.

[4], [5] Water passed through magnetic field with certain intensity forms magnetic field treated water (MFTW) or magnetic water. When water comes in contact with magnetic field its cluster molecules break down into smaller molecules which increases the surface area of the water, as the surface area of water molecule increase thenumber of hydrated cement molecules also increases. Hence the strength also increases.

II. MATERIALS:

1) **Cement:** 53 grade of ordinary Portland cement has been used in this experimental study taken from local market.

Sr.No.	Properties	Results	
		Conventional water	Magnetic water
1	Specific Gravity	3.10	
2	Standard Consistency	31%	29%
3	Initial Setting Time	30 min	45 min
4	Final Setting Time	510 min	570 min

Table 1: Physical properties of Cement.

2) **Aggregates:** Coarse aggregate of 20mm from local market and fine aggregate from local river sand has been collected for experimental study.

Sr.No.	Properties	Coarse Aggregate	Fine Aggregate
1	Specific Gravity	2.67	2.65
2	Water Absorption	0.5%	0.5%

Table 2: Physical properties of Aggregates

3) **Magnetic Water:**[16], [17] In the present investigation rounded magnets were obtained from scientific store. Magnetic water formed by keeping one-liter beaker on the round magnet for 24hrs.



Fig 1: Rounded Magnets



Fig 2: One lit beaker over magnets for 24hrs.

III. MIX-DESIGN:

In the present experimental investigation M30 grade of concrete mix trials were done on procured

materials. The Indian standard mix design procedure is adopted i.e. IS 10262:2009.

Target Strength F_{ck}	38.25 MPa
Volume of Concrete	1 m ³
Weight of Water	186 kg
Weight of Cement	413.33 kg
Weight of Coarse Aggregate	1039.46 kg
Weight of Fine Aggregate	778.28
Water-Cement Ratio	0.45
Mix-Proportion	1:1.88:2.51

Table 3: Quantities of materials per meter cube.

IV. TEST RESULTS AND DISCUSSION:

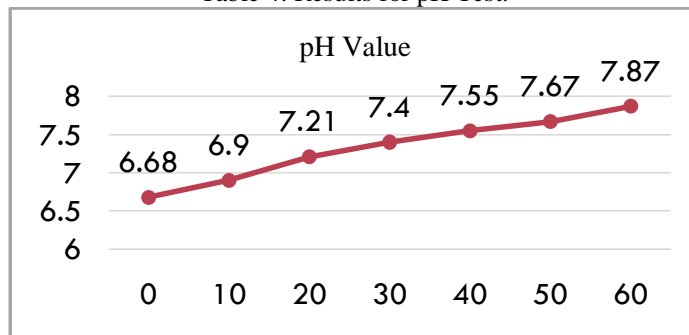
1. Test on physical properties of water:

Effect of magnetic field on the physical properties of water has been studied by following test.

1) **pH Test:** Following table shows the increasing value of pH as the recirculation time of magnetic water increases.

Sr.No.	Magnetic Recirculation (mins)	water time	pH Value
1	0		6.68
2	10		6.90
3	20		7.21
4	30		7.40
5	40		7.55
6	50		7.67
7	60		7.87

Table 4: Results for pH Test.

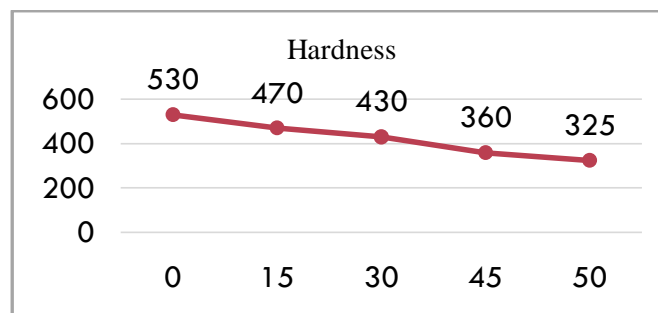


Graph1: Graphical representation of pH test.

2) **Hardness Test:** Following results shows that with increasing recirculation time of magnetic water hardness of water decreases.

Table 5: Results for Hardness of water.

Sr. No.	Recirculation Time (mins)	Hardness (mg/lit)
1	0	530
2	15	470
3	30	430
4	45	360
5	60	325



Graph2: Graphical representation of hardness of water

3) **Total Solids and Suspended Solids Test:** Following results shows that with increasing recirculation time, total solids and dissolved solids decreases.

Sr. No.	Time (mins)	Total Solids (mg/lit)	Dissolved Solids (mg/lit)
1	0	700	650
2	60	500	420

Table 6: Amount of total and dissolved solids.

2. Test on concrete:

1) Slump Cone Test: Following results shows that workability is higher for magnetic water than conventional water.

Sr. No.	Type of Water	Slump Value
1	Conventional Water	65
2	Magnetic Water	70

Table 7: Results for slump cone test.

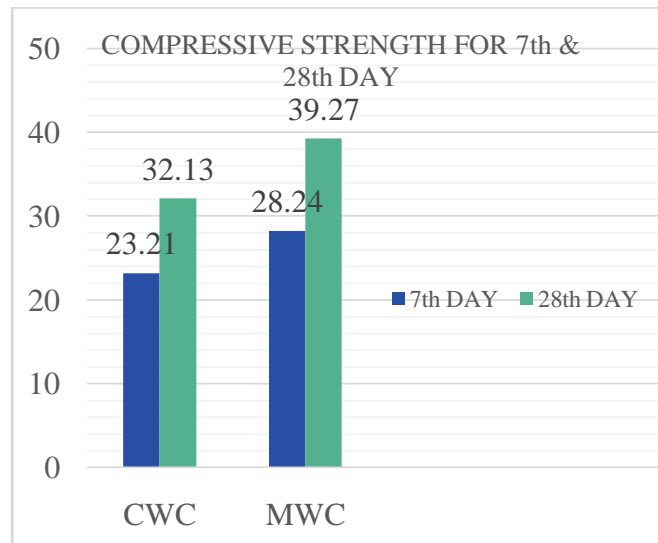
2) Compressive Strength Test: Following results shows that compressive strength for magnetic water concrete is 20-25% higher than the conventional water concrete.

Type of concrete	Compressive Strength in Mpa for 7 th Day			Avg Stresses in N/mm ²
	Spec. 1	Spec. 2	Spec. 3	
Conventional Water Concrete (CWC)	22.85	23.42	23.38	23.21
Magnetic Water Concrete (MWC)	27.64	28.33	28.75	28.24

Table 8: Results of Compressive Strength for 7th Day.

Type of concrete	Compressive Strength in Mpa for 7 th Day			Avg Stresses in N/mm ²
	Spec. 1	Spec. 2	Spec. 3	
Conventional Water Concrete (CWC)	32.30	31.83	32.72	32.13
Magnetic Water Concrete (MWC)	39.08	38.83	39.91	39.27

Table 9: Results of compressive strength for 28th Day.



Graph 3: Graphical representation of combined compressive strength for 7th and 28th day.

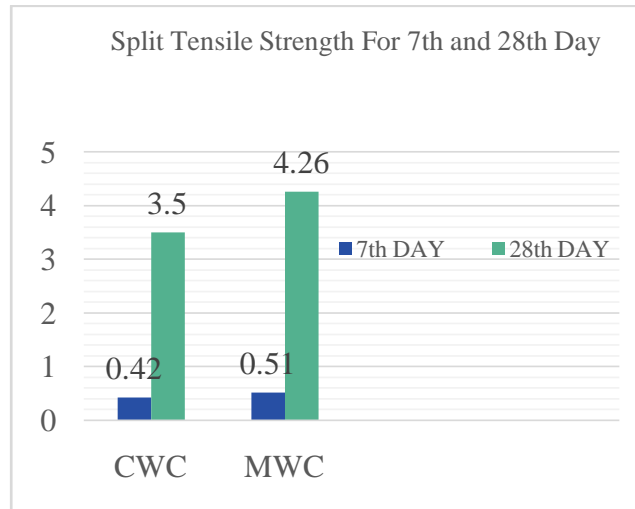
1) Split Tensile Strength of Concrete: Following results shows that split tensile strength for magnetic water concrete is 18-20% higher than conventional water concrete.

Type of concrete	Split Tensile Strength in Mpa for 7 th Day			Avg Stresses in N/mm ²
	Spec. 1	Spec. 2	Spec. 3	
Conventional Water Concrete (CWC)	0.43	0.40	0.42	0.42
Magnetic Water Concrete (MWC)	0.53	0.49	0.51	0.51

Table 10: Results for Split Tensile Strength for 7th Day.

Type of concrete	Split Tensile Strength in Mpa for 7 th Day			Avg Stresses in N/mm ²
	Spec. 1	Spec. 2	Spec. 3	
Conventional Water Concrete (CWC)	3.43	3.48	3.5	3.5
Magnetic Water Concrete (MWC)	4.18	4.28	4.34	4.3

Table 11: Results for Split Tensile Strength for 28th Day



Graph 4: Graphical representation of combined split tensile strength for 7th and 28th day.

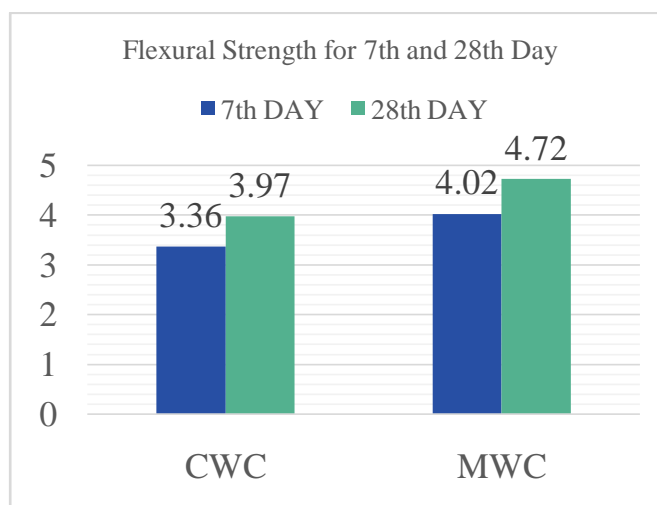
1) **Flexural Strength Test:** Following results shows that flexural strength for magnetic water concrete is 20-23% higher than conventional water concrete.

Type of concrete	Flexural Strength in Mpa for 7 th Day			Avg Stresses in N/mm ²
	Spec. 1	Spec. 2	Spec. 3	
Conventional Water Concrete (CWC)	3.34	3.36	3.38	3.36
Magnetic Water Concrete (MWC)	4.00	4.03	4.05	4.02

Table 12: Results of Flexural Strength for 7th Day.

Type of concrete	Flexural Strength in Mpa for 7 th Day			Avg Stresses in N/mm ²
	Spec. 1	Spec. 2	Spec. 3	
Conventional Water Concrete (CWC)	3.97	3.94	4.00	3.97
Magnetic Water Concrete (MWC)	4.72	4.68	4.76	4.72

Table 13: Results of Flexural Strength for 28th Day.



Graph 5: Graphical representation of combined Flexural Strength for 7th and 28th day.

CONCLUSION

In this experimental investigations results were obtained by comparing the physical properties of conventional water and magnetized water are mentioned below:

- 1) As the recirculation time is increases, the pH value of magnetized water also increases from 6.68 to 7.87 about 1 hour.
- 2) The hardness also reduced from 530 to 325 mg/lit due to recirculation of magnetic water. And also the total solids and dissolved solids content are reduced from 700 to 500 mg/lit and 650 to 420 mg/lit.
- 3) The workability of concrete is increases, when the slump value of magnetized water is 70mm with water/cement ratio 0.45.
- 4) Compressive strength of concrete of cube at 28 days for conventional water and magnetic water are 32.13 N/mm² and 39.27 N/mm² respectively.
- 5) Concrete prepared by magnetic water shows higher compressive strength about 20-25% than the concrete prepared by the conventional concrete.
- 6) Split tensile strength of concrete at 28 days for conventional water and magnetic water are 3.5 N/mm² and 4.3 N/mm² respectively.
- 7) Concrete prepared by magnetic water shows higher split tensile strength about 18-20% than the concrete prepared by the conventional concrete.
- 8) Flexural strength of concrete at 28 days for conventional water and magnetic water are 3.97 N/mm² and 4.72 N/mm² respectively.
- 9) Concrete prepared by magnetic water shows higher flexural strength about 20-23% than the concrete prepared by the conventional

concrete.

- 10) The recirculation period enhances the physical properties of water which helps to greatly achieve the strength of concrete without adding any chemicals. And it is one of the ecofriendly technologies.
- 11) It is advisable to use magnetic water for casting and curing of concrete in construction industry.

REFERENCES

- 1) IS 456:2000 (Reinforced Cement Concrete): IS 10262:2009 (Calculation of Mix Proportion Design)
- 2) "Magnetic water documentary" uploaded on September 24, 2011 by Fraha jf in you-tube (<https://www.youtube.com/watch?v=8nIaQWRBQ6E>Video, 33 min duration)
- 3) R. Malathy, N. Karuppasamy*, S.Baranidharan "Effect of Magnetic Water on Mixing and Curing of M25 Grade Concrete" International Journal of ChemTech Research CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555 Vol.10 No.11, pp 131-139, 2017.
- 4) Pradnya S. Ubale, Prof. Dr. Abhijeet P. Wadekar "Performance Evaluation of Magnetic Field Treated Water on Conventional Concrete" IJSRD - International Journal for Scientific Research & Development| Vol. 4, Issue 06, 2016 | ISSN (online): 2321-0613.
- 5) P. Srinidhi, K. S Navaneethan, G. Dheeran Amarapathi, S. Anandakumar "Comparitive Study On Concrete Materials Using Normal and Magnetized Water" International

- Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019
www.irjet.net p-ISSN: 2395-0072.
- 6) Ashish Dagadu Amate, Sanika Sanjay Bhosale, Utkarsha Nandkumar Banage, Preeti Ranjit Chavan, Rohit Pandit Biranje, V. G. Waskar “Effect of Magnetic Water on Performance Evaluation of Concrete” 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.
 - 7) Mr. Sagar C. Ashtekar “An Experimental Study On Effect of Magnetic Water On Compressive Strength Concrete” International Journal of Innovations In Engineering Research And Technology [IJIERT] ISSN: 2394-3696 VOLUME 5, ISSUE 8, Aug.-2018.
 - 8) Gone Naresh Kumar , Joel Shamil “Experimental Studies On Durability of Magnetic Water Concrete” International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2015): 6.391.
 - 9) Pang Xiao-Feng and Zhu Xing-Chun “The Magnetization of Water Arising From a Magnetic-Field and Its Applications in Concrete Industry” Pang Xiao-feng et al Int. Journal of Engineering Research and Applications www.ijera.com ISSN: 2248-9622, Vol. 3, Issue 5, Sep-Oct 2013, pp.1541-1552.
 - 10) Adnan Flayih Hassan, “Effect of magnetized water on the properties of cement mortars at the earlier ages”, Al-Qadisiya Journal for engineering sciences, 1, 1, (2008),95-108.
 - 11) Nan Su et al, “Effect of magnetic water on the engineering properties of concrete containing granulated blast-furnace slag”, Cement and Concrete Research, Pergamon,30,(2000),599-605.
 - 12) Ibrahim I.H, “Biophysical Properties of Magnetized Distilled Water”, Egypt. J. Sol., 29, 2, (2006), 363-369.
 - 13) Jacobe Bogatin et al, “Magnetic Treatment of Irrigation Water: Experimental Results and Application Conditions”, Environmental science & technology, 33,8, (1999),1280-1285.
 - 14) Maria Eugenia Garcia Harbour., “Changes of biological properties in physical-chemical water induced Magnetic field” Master’s thesis submitted at Department of Physical Chemistry, State University of Campinas, Brazil,(1998),1-112.
 - 15) H. Afshin, M. Gholizadeh and N. Khorshidi “Improving Mechanical Properties of High Strength Concrete by Magnetic Water Technology” Transaction A: Civil Engineering Vol. 17, No. 1, pp. 74{79 c Sharif University of Technology, February 2010 Research Note.
 - 16) Laxmikant reddy and V. Naveen kumar “Behaviour of magnetised water concrete under different curing conditions” CVR Journal of science and technology, volume 12, June 2017.
 - 17) Shuvkonda reddy, Dr. Vaishali Ghorpade and H. sudarsana rao “Use of magnetic water for mixing and curing of concrete.” International journal of advanced research and studies.E-ISSN2249-8974.