

Comparative Study on Strength Enhancement of Concrete using Magnetic and Normal Water

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ABSTRACT

Water performs an essential function in concrete preparation and additionally in workability and power of the concrete. The big quantity of salt and mineral content is existing in regular water. It leads to affect the sturdiness of concrete shape and also life spans of shape are reduced. One of the recent technologies used to enhance the compressive strength and workability of concrete is using magnetized water as a substitute of ordinary water in concrete mixes. This new technological know-how has increased the compressive strength. Using magnetized water in concrete is fantastic in terms of decrease porosity and higher. In this technology, by using passing water through a magnetic field, the range of molecules in the water cluster is breakdown into small from 13 to 5 or 6, which reasons a decrease in the surface tension of water and also expand the pH and reduces the hardness in the water with an improvement in the workability and power of concrete. Due to the smaller measurement of molecules, the water layer surrounding the cement is thinner than normal water molecules. These initiatives are examined to compare the power of normal water and magnetized water in concrete. The discount of the quantity of salt and mineral content in water will improve resistance to corrosion excessively. In this study, the effect of magnetic water and regular water on workability and power of M30 grade concrete was studied and comparative observation for NWC and MWC by means of compression strength and spit tensile strength.

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1. INTRODUCTION

The preliminary lookup and scientific trying out concerning the utility of a magnetic area to concrete manufacturing were commenced in Russia in 1962 for military constructions such as airports and jetties. This research used to be endured step with the aid of step in other institutes, such as the VNLL Jelezobeton Research and Scientific Institute in Russia, and some wonderful consequences had been discovered in this regard. Magnetic units consist of one or greater permanent magnets, which set off adjustments and consequences on ions and molecules. A magnetic subject has a considerable impact on clusters of water molecules and motives the minimize of such a mass. Such a decrease of molecules motives extra participation of water molecules in the cement hydration reaction. Also, when water is blended with cement, cement particles are surrounded with the aid of water molecule. Concrete is the most broadly the use of material for construction, one of the principal problems noted in the manufacturing of concrete is that preparing of cement that motives lot of pollution for the surroundings and great of water performs a vital function in presentation of concrete. Impurities of water may also have an effect on the putting of concrete and it may leads to have an effect on the energy and sturdiness of the concrete. This chemical constituent actively participated in chemical response and impacts the setting, hardening, sturdiness and strength development of concrete. For this alternative solution magnetic water is placed. Magnetic water doesn't imply water has obtained magnetic strength however that it has

been subjected to a magnetic subject which is located positive adjustments in the homes of water.

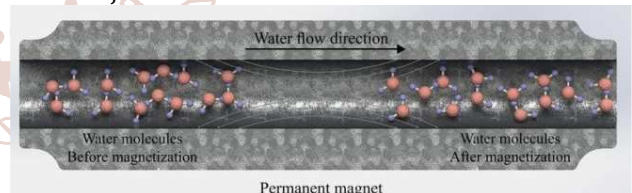


Fig1.1 Effect of a magnetic device with permanent ions passing through its magnetic field

Many researchers examined that the scaling property and corrosion development, in magnetic water is significantly decreased if the water is passed through an excessive magnetic flux which in turn changes the bodily shape of the water molecules and softens the challenging water. This softening depth is anticipated on the magnitude of flux induced. To attain higher depth and magnetized, water is made to recirculate by designing a setup with motor and auto transformer.

1.1. MAGNETIC WATER

The water which was subjected to excessive severe and targeted magnetic field is referred to as magnetic water. More than one hundred applicable articles and reviews are available in the open literature, so honestly magnetic water treatment has acquired some interest from the scientific community. The suggested outcomes of magnetic water cure

are diverse and often contradictory. The Australian Fluid Energy mentions that the molecule organizations of magnetic water fluctuate from molecule corporations of ordinary water in having decrease diploma of consolidation, and the molecules extent is greater uniform. Joshi et al proposed magnetic discipline impact on hydrogen bonds between water molecules and discovered some exchange which came about in the homes of water such as mild absorption, floor tension and pH. The activation of magnetic area on water depends on the following three conditions according to Huchler et al,

- A. Magnetic flux density.
- B. Duration of exposing water to magnetized field (velocity of water current).
- C. The quantity of exposing water to the subject.

1.2. EFFECT OF MAGNETIC WATER:

According to this literature study, a substance is stated to be magnetized when its constituent molecules or structural factors can be aligned in a definite direction via the have an impact on of an exterior magnetic field. In a liquid or in a gas, this can solely happen to molecules that possess an peculiar range of electrons. Water, H two O, incorporates 10 electrons, so it is now not attracted to or oriented through a magnet. In fact, water, like most molecules, is diamagnetic; it is actually repelled via a magnet, even though so weakly that touchy units are wished to observe this effect. Fig.1.2 suggests structural crew of water molecules. Water molecules which consists of one oxygen molecule and two hydrogen molecules bonded as an remoted triangle with its upper perspective is 105°. When water is subjected to a magnetic field, the water molecules will arrange in one route This mode of association is caused by means of rest bonds, then the bond angle decreases to much less than 105°, main to a decrease in the consolidation diploma between water molecules, and make bigger in measurement of molecules. For these reasons, the viscosity of magnetic water is less than viscosity of ordinary water. This change in water molecules composite motives a trade in permeability pressure, floor tension, pH and electric conduction.

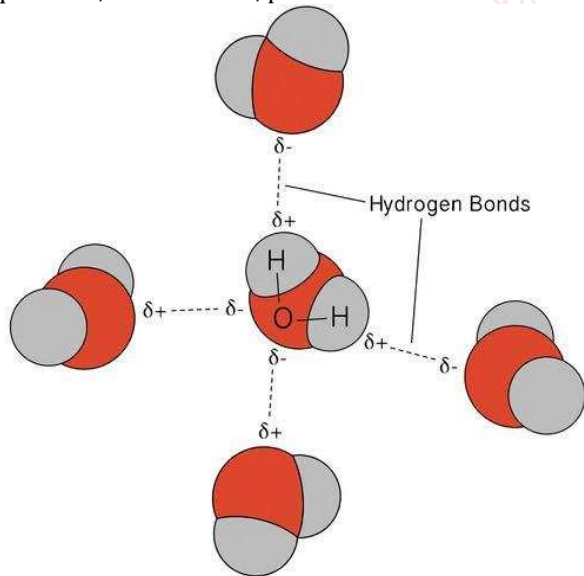


Fig 1.2 Structural group of water

2. MATERIALS COLLECTION

2.1. Permagan N406:

Permagan Neodimium 406 Magnetic fields are shaped via the action of charged particles. For example, electrons flowing in

a wire will make a magnetic subject surrounding the wire. The desirable fields generated by moving electrons are used in many domestic appliance, automobiles, and industrial machines. One primary instance is that the magnet, which is made from countless coils of wire wrapped around a central iron core. The magnetic subject is present only whilst electrical modern-day is handed thru the wire coils. Permanent magnets don't use an applied electrical current. Instead, the magnetic area of a permanent magnet consequences from the mutual position of the very small magnetic fields mcreated by every of the atoms inside the magnet. These atomic-level magnetic fields outcomes from the spin and orbital actions of electrons. While several resources endure alignment of the atomic-level fields in response to an applied magnetic field, solely ferromagnetic materials retain the atomic-level alignment when the applied area is removed. As a result, all permanent magnets are composed of ferromagnetic materials. Here these paper to use PERMAG (N406) for manufacturing of magnetized water. PERMAG is absolutely made up of strong rare earth magnets referred to as atomic number 60 (N406). The magnetic discipline intensity is 10,000 gauss energy and ten thousand gauss power= 1 Tesla, therefore magnetic flux density of PERMAG N406 is 1 Tesla.



Fig 2.1 Permagan N406

2.2. CONCRETE INGREDIENTS

2.2.1. CEMENT

The cement used at some stage in this work used to be Ordinary Portland cement of fifty three – 53 grade was used as it comfy the necessities of IS and results have been Table no 2.1

2.2.2. COARSE AGGREGATE

The coarse mixture of 20mm dimension used to be used in the find out about the aggregates were examined as per IS specifications. Locally available coarse combination (basalt commonly known as blue metal) holding on 4.75mm sieve is used. The bodily homes of coarse aggregate are listed beneath in Table no 2.2

S. no	Physical properties	Values	As per IS:8112-1989
1.	Specific gravity	3.15	3.10-3.15
2.	Standard consistency	28%	30-35
3.	Initial setting (min)	35	30 min
4.	Final setting (hr,min)	178	600 max

Table 2.1 Physical Properties Of Cement

S. No	Physical Properties	Values
1.	Specific gravity	2.80
2.	Absorption	0.8%
3.	Nominal size of aggregate	12.5mm

Table 2.2 Physical properties of coarse aggregate

2.2.3. FINE AGGREGATE

M sand passing thru IS 4.75 mm sieve was once used as quality aggregate. The sand used having Water absorption of 1% and unique gravity of 2.70. The sieve evaluation consequences are proven in Table No. 2.3

S. No	Physical properties	Values
1.	Fineness modulus	3.24
2.	Specific gravity	2.70
3.	Size	4.75mm
4.	Water absorption ratio	1%

Table 2.3 Physical properties of fine aggregate

3. MIX DESIGN

In general, most of the building areas use M30 grade concrete except including any admixture. So, right here M30 grade of concrete is used to extend the compressive power the usage of magnetic water. The diagram of M30 concrete has been carried out as per IS:10262-2009.

Water cement ratio	Cement	Fine aggregate	Coarse aggregate
0.50	1	0.68	1.3

Table 3.1 Mix design for M30 grade

4. EXPERIMENTAL SETUP

In this technique the water is recirculated for one hour to result in magnetic flux in the water through the motion of utilized magnetic field. This recirculated water is used for the casting of concrete specimens. The setup to gain the above cited method consists of Autotransformer, 0.5HP General reason Motor, Permagn N406. The autotransformer is used to decrease the furnish voltage of the motor, this controls the waft of water in the setup. By this manner the hardness in the water is reduced, this enhances the resistance to corrosion of metal reinforcement.

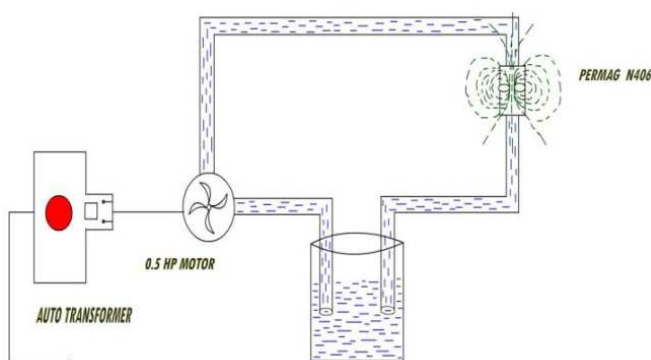


Fig 4.1 magnetically treated and recirculation water

4.1. PH

In chemistry, pH is a scale used to specify how acidic or primary a water-based solution. Acidic answer has a decrease pH, whilst fundamental answer has a greater pH. At room temperature (250C or 770F), pure water is neither acidic nor simple and has a pH of 7. The pH check is carried out for each and every fifteen minutes of recirculation. pH take a look at is carried out for magnetically dealt with -

recycled water and everyday faucet water, the outcomes are proven under.

S. No	Recirculation 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 4.1 Effect of pH value on recirculation time

4.2. HARDNESS

Hardness was once in the beginning described as the ability of water to precipitate soap. Hard water types scale, generally calcium carbonate, which reasons a range of problems. . Left to dry on the floor of glassware, silverware, and plumbing fixtures (shower doors, taps and sink tops), challenging water leaves ugly scale, called water spots. Scale that types on the internal of water pipes sooner or later reduces the water pipes' carrying capacity. Scale that types within appliances, pumps, valves, and water meters causes wear on shifting parts. The most commonly used gadgets consist of grains per gallon (gpg), components per million (ppm), and milligrams per liter (mg/L) The beneath desk indicates variant of hardness (in mg/lit) with exchange in recirculation time. As the recirculating time will increase hardness decreases, which suggests that induction of magnetic flux in water adjustments the property of hardness.

S.No	Recirculation time	Value
1.	0	530
2.	15	470
3.	30	430
4.	45	360
5.	60	325

Table 4.2 Effect of hardness on recirculation time

5. CASTING AND COMPARATIVE RESULT OF MAGNETIC AND NORMAL WATER

5.1. COMPRESSIVE STRENGTH



Fig 5.1 Casting of cubes 150mm*150mm*150mm

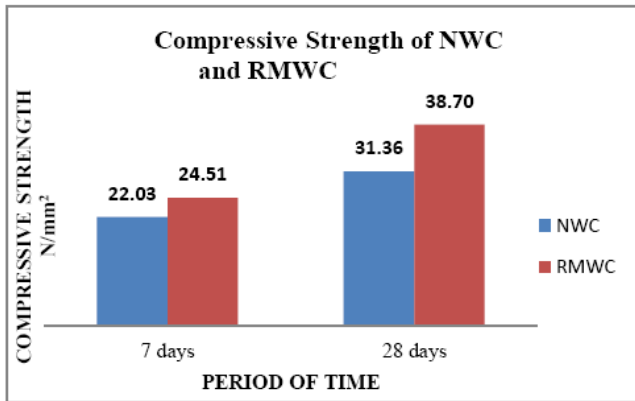
5.1.1. Test result of cubes prepared using normal, non-recirculation and recirculated magnetic water

Curing Days	Compressive Strength (N/mm ²)			
	Sample 1	Sample 2	Sample 3	Average
7 Days	21.3	22.3	22.5	22.03
28 Days	32.3	30.5	31.3	31.36

Table 5.1 Compressive Strength of Nmc

Curing Days	Compressive Strength (N/mm ²)			
	Sample 1	Sample 2	Sample 3	Average
7 Days	26.3	25.32	26	25.87
28 Days	41.65	40.55	40.32	40.84

Table 5.2 Compressive Strength Of Recirculation Magnetic Water



Graph 5.1 Comparative strength of normal water and recirculation magnetic water

5.2. SPLIT TENSILE STRENGTH



Fig 5.2 Testing of Cylinder, size 150mm*300mm

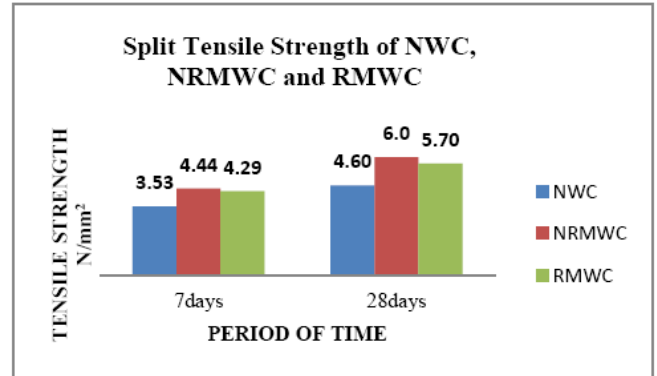
5.2.1. Test result of cylinder prepared using normal and recirculated magnetic water

Curing Days	Compressive Strength (N/mm ²)			
	Sample 1	Sample 2	Sample 3	Average
7 Days	3.33	3.78	3.43	3.53
28 Days	4.50	4.85	4.55	4.60

Table 5.3 Split tensile strength of NMC

Curing Days	Compressive Strength (N/mm ²)			
	Sample 1	Sample 2	Sample 3	Average
7 Days	4.26	4.45	4.16	4.29
28 Days	5.35	5.80	6.00	5.70

Table 5.4 Split tensile strength of recirculation magnetic water



Graph 5.2 Comparative strength of normal water and recirculation magnetic water

6. CONCLUSION

In this magnetic water science the power of concrete receives make bigger barring including any admixture or additives. As the recirculation time is accelerated the pH price of magnetic water additionally will increase from 6.6 to 7.8 concurrently the hardness decreased from 530mg/lit to 325mg/lit. This will additionally provide higher answer for corrosion of reinforcement in RCC buildings which appears to be a large hassle in building industry latest days. Compressive electricity of concrete at the cease of 28 days for ordinary and recirculated magnetic water are 31.36 N/mm² and 40.84 N/mm². The common make bigger in the compressive power is 36.1%. With in contrast to the regular water the recirculated magnetic water concrete is greater in compressive strength. In cut up tensile check the electricity is higher in recirculated magnetic water compared to regular water.

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