

# Review on Effect of Foundry Sand And Magnetic Water on Strength of Concrete

Vishwa Nikam<sup>1</sup>, Abhishek Patil<sup>1</sup>, Girisha Pawar<sup>1</sup>, Sainath Patil<sup>1</sup>, Mrs. Smita .V. Pataskar<sup>2</sup>

<sup>1</sup>Students, Department of Civil Engineering, DYPCOE, Akurdi, Pune

<sup>2</sup>Professor, Department of Civil Engineering, DYPCOE, Akurdi, Pune

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## Abstract

Foundry sand is used in metal industries for casting and moulding purposes. There comes a time when this sand cannot be reused and is dumped. Due to uncontrolled dumping of foundry sand, the environment is getting affected negatively. When it comes to foundry sand, India is the second largest producer in the world. As an alternative to dumping, foundry sand can be used in concrete to increase its compressive strength, split tensile strength and flexural strength, foundry sand partially replaces the sand used in concrete which also proves to be economic.

Using foundry sand may enhance these properties but as per previous studies, it can also reduce the workability to some extent.

Magnetized water not only increases the workability but also alters the hydration process and breaks down the water clusters into smaller one or a single molecule. Some studies have also come up with the fact that, the cement content is also reduced.

**Key Words:** Foundry Sand, Magnetized Water, Workability, Strength, etc.

## 1. INTRODUCTION

Foundry sand is the waste that is generated by casting industries. Basically, metal industries use natural sand for the preparation of their products. During production, ferrous and non-ferrous particles get mixed with the sand. That sand is used several times for production purposes and then a time comes when it cannot be used again, so the industries simply dump it. This final waste product or by-product is known as Foundry Sand.

As per previous studies conducted on this topic, foundry sand consists mostly of silica sand that is clean, uniformly sized, and of high quality. Industries generate almost 95 percent of foundry sand and it consumes a large percentage of landfill space every year. The disposal techniques include spreading on cropland and running off into lakes and streams due to which the water resources dry and turn unfit for use and it can also cause harm to cattle. India produces about 3 million tons of foundry sand annually and is the second-largest

producer of foundry sand in the world.

The foundry sand can be used in concrete by replacing a certain percentage of sand as it is cheaper and also increases the strength of concrete. The foundry sand is of two types; green sand and chemically bonded sand.

Potable water, another important ingredient of concrete, plays a major role in the concrete mix, starting from the hydration process of cement, proper curing, and also managing the workability and durability of concrete. As per previous data obtained, to enhance the hydrogen bond of water can be passed through a magnetic field which will break the clusters of water into single molecules or smaller molecules. Thus, the magnetic water will actively participate in the hydration process and therefore the compressive strength of concrete will increase and workability will also be good. Reduction in cement content can also be achieved.

## 2. PROBLEM STATEMENT

- Construction field is the second largest user of potable water next to agriculture. Water consumption is raising as the population and human needs grows. In construction field the potable water is used in concrete for mixing, curing and highly helpful in the hydration process.
- To reduce the use of potable water, magnetized water is used which enhances the mechanical properties of water and also preserves the quality. Water is termed as homogenous but it is not the case in nano scale. When water is passed through a magnetic field, changes take place at nano scale.

## 3. AIM

- To study the strength behavior and economic impact on concrete after addition of Magnetized Water.

## 4. OBJECTIVES

- To study the change in compressive strength, split tensile strength and flexural strength.
- To determine the economic impact after using magnetic water.

## 5. LITERATURE REVIEW

### **“Use Of Magnetic Water For Mixing And Curing Of Concrete” by B Siva Konda Reddy, Dr. Vaishali G Ghorpade, Dr H Sudarsana Rao-2014**

Studied use of magnetic water for mixing and curing of concrete. They used circular magnet of 985 gauss for preparing MW. Using of magnetic water in concrete mixing showed an increasing short-term strength of concrete at 28 days by 12.62%, 21.5%, 45% in the split tensile strength, flexural strength and impact strength respectively. Concrete cubes casted with NW and cured with MW showed very small increase compressive strength compare to MW casted cubes cured in MW at very early age of hydration.

### **“The Experimental Study on Strength Behavior of Concrete Using Foundry Sand as A Fine Aggregate”, 2017, by S Hari Hara Sudan and Dr M Neelamegam.**

They replaced the foundry sand in the range of 0% to 60% by the weight of M25 grade concrete. Two types of foundry sand were used such as green sand and chemically bonded sand. Concrete mixtures are tested for 7,14- and 28-days strength are found out in terms of compressive (cube specimen size 150mm\* 150mm\* 150mm), split tensile (cylindrical specimen size 150mm\* 300mm) and flexural strength (beam specimen size 700mm\* 150mm\* 150mm). From the results it is concluded that the optimum percentage of replacing fine aggregate with green sand is 40% and the optimum percentage of replacing fine aggregate by chemically bonded sand is 30%.

### **“Performance Evaluation of Magnetic Field Treated Water on Conventional Concrete” by Pradnya S Ubhale And Prof. Dr. Abhijeet P Wadekar - 2018**

An experimental program was undertaken which consist of concrete grades of M15, M20, M25, M30, M40 and also on water sample. Improvement has been noticed in workability as well as compressive strength. Study shows increased compressive strength of concrete prepared by purified water is 12% to 14%. But in case of ground water magnetic treatment improves characteristic strength of concrete by about 30 to 49%.

### **“Strength Permeation and Nano Studies on Fly Ash Based Magnetic Water Concrete” by Y. Kiranmai And K. Naga Sreenivasa Rao- 2018**

Study has shown that the compressive strength of magnetized water concrete is more than normal water concrete by 38.1%, 12.7%, 10.8%, 18.3% and 18.1% of M30 Grade at 7,14, 21, 28 and 60 Days respectively. The compressive strength of magnetized water concrete is

more than normal water concrete by 7.5%, 15.3%, 13.8%, 22.03% and 11.3% of M40 grade at 7,14, 21, 28 and 60 Days respectively. Thermo gravimetric analysis of MWFC samples improved by 2% and 6% for M30 grade and by 3% and 4% for M40 grade when magnetic water is used instead of normal water for preparing concrete at 28 and 60 Days respectively.

### **“Strength Behaviour of Concrete Produced With Foundry Sand As Fine Aggregate Replacement”.Shaik Ahamed Mynuddin, M Mohan, T Indeasena Reddy, Nomula Pratik Reddy, 8 April 2018**

Their study demonstrates the use of waste foundry sand as partial replacement of fine aggregate like 10%, 20%, and 30%. They tested specimens for 7 days and 28 days of curing were results shows 30% replacement of sand gives maximum compressive as well as flexural strength for 28 days of curing period. The studies mention the it helps in preparing green concrete.

### **“An Experimental Study on the Use of Magnetized Water in Concrete with M Sand as Fine Aggregate” by Harsha Ramachandran, Sruthi Das K - 2018**

Four mixes are used in the study they are, NMNC- Normal water Mixing and Normal water Curing, NMMC- Normal water Mixing and Magnetized water curing, MMNC- Magnetized water Mixing and Normal water Curing, MMMC- Magnetized water Mixing and Magnetized water Curing. From the observations it is found that the magnetized water concrete is highly workable than normal water concrete. The compressive strength test is conducted on samples at 7 and 28 days of curing. There is a slight increase in strength for 7 days of curing but for 28 days curing a noticeable increase has been seen. As per their results the increase of 58.72% was observed in the compressive strengths of concrete cubes made and cured in magnetic water when compared with the conventional concrete. There is a 30% increase in 28 days split tensile strength for specimen with both mixing and curing is done by magnetized water.

### **“Effect of Magnetic Water in Strength of Concrete” by N. Muthu Prakash, S Aravindhyan, G. Dinesh, P. Sachithananthan, R. Kalaimani - 2019**

To study the effect of magnetic water on concrete strength, M30 concrete is casted. The water cement ratio is taken as 0.45. The main focus is on the compressive strength of concrete when magnetized water and magnetized industrial treated waste water is used. The cement used is Portland pozzolana cement. Crushed locally available hard basalt stone of maximum size of 20mm is utilized. The fine aggregate used is manufactured sand which passes through the 4.75mm. Based on the experimental work the compressive

strength of concrete is 32.860%, 23.32%, 12.940% for 7, 14, 28 days respectively as compared to TW.

**“Effect of waste foundry sand and fly ash on mechanical and fresh properties of concrete”, Dec 2020, by T. V. Reshma, M. Manjunatha, S. Shankalparsi, H. M. Tanu.**

30% fly ash is used as a partial replacement of cement and Natural river sand is replaced with waste foundry sand in varying percentages for M40 grade concrete. There is a improvement in slump value with an addition up to 30% replacement of WFS. It is observed that the compaction factor value improves marginally with increase in WFS and has reached maximum at 20% replacement of WFS. Thereafter compactor factor is decreasing gradually from 0.965 to 0.94 and then to 0.91. In concrete mix combination, 10% and 20% replacement of WFS shows better compaction than other mix percentages. The full strength of 47.25 MPa is obtained for 30% replacement after 90 days of curing.

**“Influence of Magnetized Water on Fibre Reinforced Concrete” by Aishwarya Kharde, Vijaykumar Rathi, Pramod Kolase- 2020**

4500 gauss strong magnet is used. From result they concluded that magnetized water is more workable than that of normal concrete. The specimens casted with magnetic water show an average increase of 14.93 % in compressive strength as compare to normal water. It is concluded that the magnetic water concrete is durable as compared to normal concrete. The decrease in compressive strength of MWC is 1.71% less than NWC after acid attack.

**“Employment of Magnetic Water In Construction” by Rawa A Al-Safy- 2021**

Study shows the influence of magnetic water on cement paste and mortar, concrete with adhesives for self-compaction. Both tap water and magnetized water was used to mix cement mortar of 1:3 mixing ratio. Sulphate resistance Portland cement type V and fine aggregate of grading zone 2 with different water cement ratios of 0.4, 0.45, 0.5, 0.55, 0.6. Higher enhancement in compressive strength was reported for magnetic water samples that tested after 7 days of curing. This improvement was (22.73%, 18.52%, 20%, 18.37% and 20%) for w/c of (0.4, 0.45, 0.5, 0.55 and 0.6) respectively. Study shows the enhancement of strength of concrete with changing water cement ratio.

**“Influence of Magnetic Water on Concrete Properties with Different Magnetic Field Exposure Times.”,2022, by Malathy Ramalingam, Karuppasamy Narayanan, Arivoli Masilamani,**

**Parthiban Kathirvel, Gunasekaran Murali and Nikolai Ivanovich Vatin.**

To prepare the magnetic water, the magnet with 0.9 tesla intensity were used by them for different exposure period of 60 mins, 45 mins, 30 mins, 15 mins, and instant exposure. The mix ratio of M20 concrete leading to a ratio of 1:1.82:3.10 with a w/c of 0.5. Thermogravimetric analysis was used to investigate the development of hydration process. It is observed that the use of MW at 28 days improves the compressive strength by 24.1% more than ordinary water. From the outcome of results, it was found that water exposure for 60 mins is optimum for mix.

**“Review On Effects Of Magnetic Water On Concrete” by Sagar R. Raul, Pratik H. Rathod and Vikas R. Bankar – 2022**

They studied work done by some researchers on use of magnetic water in concrete after studying on multiple work the they get result The addition of MW the compressive strength of concrete showed very significant increase in early stages of hydration and at 28 days this increase is around 55% and at 360 the final increase in the compressive strength is around 52%.The increase in compressive strength attributes to the enhanced hydration process in MWC due to availability of more surface area of water for hydration process. The split tensile strength increase is about 12.5% in MWC at 28 days and 365 days. Similarly, the flexural strength increase is about 21% at 28 days of curing, this further increased to 29% at 365 days in MWC.

**“Improvement of Hydration Products for Self-Compacting Concrete by Using Magnetized Water”, 2022, by A. A. ELShami, Noura Essam, El-Shikh M. Yousrythe.**

In this they study improve the fresh, mechanical, and microstructural properties of SCC using MW. For this purpose, a total of 12 mixes were produced with silica fume (SF) content (5% and 10% by weight of cement), and the mixing water passed through a permanent magnetic field (with a strength of 1.4 T) for 50, 100, and 150 cycles.

Magnetized water significantly improved the workability where an increase of 11% was recorded compared to tap Water. The mixes containing magnetized water in all ages have higher compressive, splitting, and flexural strengths than Their control mix. The best results in the increase in tensile and flexural strength reached 22% and 40%, respectively, at 90 days.

**“Effect of Magnetic Water on Concrete Parameters” studied by Vaibhav Arun Kamble, Gaurav**

**Someshwar Budge, Prasad Madhukar Tumade, Ajinkya Sanjay Wagh, Jayashree Dhake in April 2022.**

The study was conducted on the concrete grade of M30 with the testing specimen. Magnetic water was prepared by passing normal tap water through magnetic field generated by electromagnets in physics lab. Water was rotating in electromagnetic field for 120 minutes for 3 liters water. It was found that the percentage of concrete samples cast and cured with magnetized water is 20% higher than the conventional samples.

**6. OBSERVATIONS AND GAP ANALYSIS**

1. Foundry sand is compatible to replace normal sand by percentage only.
2. Foundry sand can replace normal sand by 0%-60%.
3. Foundry sand increases the compressive strength, split tensile strength and flexural strength.
4. Use of foundry sand has an impact on the economy of the project.
5. Almost every study is carried out on concrete of grade above M30.
6. Magnetic water breaks the clusters in water into smaller ones or a single molecule when used for mixing purpose.
7. Magnetic water increases the workability of concrete and can also be used for curing.
8. Foundry sand and Magnetized water have never been used together in a single project.

**Table -1: Gap Analysis**

Paper No	Parameters Studied			Testing Details
	Magnetic Water	Foundry Sand	MW+FS	
1.	Used	Not Used	-	Compressive Strength, Flexural Strength and Split Tensile Strength
2.	Not Used	Used	-	
3.	Used	Not Used	-	Compressive Strength
4.	Used	Not Used	-	
5.	Not Used	Used	-	Compressive Strength, Flexural Strength
6.	Used	Not Used	-	Compressive Strength, Split Tensile Strength

7.	Used	Not Used	-	Compressive Strength
8.	Not Used	Used	-	Slump Value
9.	Used	Not Used	-	Compressive Strength
10.	Used	Not Used	-	
11.	Used	Not Used	-	Compressive Strength, Flexural Strength
12.	Used	Not Used	-	
13.	Used	Not Used	-	Compressive Strength, Flexural Strength and Split Tensile Strength
14.	Used	Not Used	-	Compressive Strength

**7. METHODOLOGY**



**Chart -1: Methodology**

**8. CONCLUSION**

Expected results are as follows:

1. Satisfactory results in terms of compressive strength, split tensile strength and flexural strength



are partially replacing fine aggregate with waste foundry sand.

- Increase in compressive strength as well as workability after using magnetized water.

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## BIOGRAPHIES



Mr. Vishwa Nikam, “Final Year Student of DYPCOE, Akurdi, Pune (Department of Civil Engineering)”



Mr. Abhishek Patil, “Final Year Student of DYPCOE, Akurdi, Pune (Department of Civil Engineering)”



Ms. Girisha Pawar, “Final Year Student of DYPCOE, Akurdi, Pune (Department of Civil Engineering)”



Mr. Sainath Patil, “Final Year Student of DYPCOE, Akurdi, Pune (Department of Civil Engineering)”



Mrs. Smita .V. Pataskar, “Professor in DYPCOE, Akurdi, Pune (Department of Civil Engineering)”