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IMPLEMENTATION OF MAGNETIZED WATER IN CONCRETE WITH REPLACEMENT OF ORDINARY WATER

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Abstract: *Concrete is a fundamental construction material widely used in various infrastructure projects. The performance of concrete depends on the water-cement ratio and the quality of water used during the mixing process. In recent years, researchers have explored innovative methods to enhance concrete properties and sustainability. One such method involves the implementation of magnetized water as a replacement for ordinary water in concrete production. This study investigates the effects of using magnetized water in concrete and its potential benefits compared to ordinary water. Magnetized water, created by subjecting water to a magnetic field, is believed to alter water's physical properties, affecting the cement hydration process. The research aims to understand how the use of magnetized water influences critical concrete properties, including compressive strength, workability, and water-cement ratio. Experimental tests are conducted to compare concrete samples made with ordinary water and those with varying proportions of magnetized water. The mix designs are carefully controlled to ensure consistency and reliability in the results. Compressive strength tests are performed at different curing ages, and workability assessments are conducted using standard tests such as slump and flow tests. The results of this study will contribute to the growing body of knowledge on innovative construction practices and concrete technology. Engineers, construction professionals, and researchers can use this information to make informed decisions about incorporating magnetized water in concrete production. Furthermore, the investigation aligns with broader efforts to explore eco-friendly materials and reduce the construction industry's environmental impact.*

Index Terms - ***magnetized water, Ordinary water, Compressive strength, Workability, Water-cement ratio, Early-age strength development***

I. INTRODUCTION

The construction industry plays a vital role in shaping modern society, providing infrastructure for housing, transportation, and various other essential needs. One of theprimary components of construction is concrete, a versatile and durable material that forms the backbone of countless structures worldwide. Despite its widespread usage, traditional concrete production is known to have significant environmental impacts, including the depletion of natural resources and the emission of greenhouse gases. In light of the increasingglobal focus on sustainability and environmental responsibility, researchers and engineers have been exploring innovative techniques to reduce the environmental footprint of concrete production. Magnetized water, also known as "magnetic water" or "structured water," has gained attention due to its potential to enhance various properties of concrete while simultaneously reducing water consumption

The primary constituents of concrete are cement, aggregates (sand, gravel, or crushed stone), and water. Cement, in particular, is a major contributor to the environmental impact of concrete due to its high energy consumption during manufacturing and substantial carbon dioxide (CO_2) emissions. The cement production process involves heating limestone and other raw materials to high temperatures, resulting in the release of significant amounts of CO_2. Additionally, mining for aggregates can lead to ecosystem

degradation and habitat destruction. Furthermore, the large-scale water usage in concrete production exacerbates water scarcity in certain regions, especially in areas already facing water stress due to climate change.

Magnetized water is believed to influence the hydration process of cement particles, potentially leading to more efficient and uniform binding of the ingredients within theconcrete matrix. This could result in improved overall strength and durability of the concrete structure. As a consequence, the concrete's workability and cohesion could be positively impacted, making the pouring, placing, and shaping processes smoother and potentially reducing the need for excessive water content.

However, it's important to note that the implementation of magnetized water in concrete is a relatively novel concept and requires comprehensive research and testing to ascertain its efficacy and long-term effects. Factors such as the optimal degree of magnetization, potential changes in setting time, and any unforeseen interactions between magnetized water and concrete components need to be thoroughly investigated.

II. LITERATURE REVIEW

Rao T.M, Mahesh et al (2023) looked at the effects of magnetic water and fly ash on the mechanical and durability characteristics of concrete. To estimate the effect of magnetization on the properties of water, Numerous experiments on treated and untreated water, such as “pH, acidity, alkalinity, chlorides, and total solids”, have been carried out with the assistance of a neodymium rare earth magnet with a strength of 1.5 Tesla. Fly ash has been replaced with cement in weight amounts of 10, 20, 30, and 40%. Moreover, the present study investigated the “compressive strength, split tensile strength, water absorption, sorptivity and corrosion resistance tests” of concrete mixes after 28 days of curing. It was discovered that including magnetized water in the concrete mix has shown an increase of 38.46%in compressive strength and that the optimal proportion of fly ash is 30%. Similarly, the magnetized water in concrete has the potential to really boost the durability of concrete.

Ahmed M. Elkerany , Mostafa M. Keshta et al (2023) used as a partial replacement of cement weight by 5%, 10%, and 20%, and as an additive to cement by 5%, 10%, and 20% of cement weight. The MW was used to fully replace tap water (TW) in concrete mixes and wasprepared using two different magnetic fields of 1.4 tesla (T) and 1.6 T.

Microstructural and chemical analyses were carried out on selected materials and concrete mixes. The workability and compressive strength of the materials at 7, 28, and 365 days were measured, in addition to the splitting tensile strength at 28 days and the flexural strength at 28 days. The compressive strength at 365 days was conducted at 18 °Cand 100 °C to study the effect of the applied variables on the concrete durability at different elevated temperatures. Using MW instead of TW in MK concrete increased all the mechanical properties measured at 28 days by about 32–35%. The results of the microstructural and chemical analyses supported the compressive strength increase by showing indications of more C-S-H gel production and less CH when using MW in MK concrete.

Rawaa A. Al-Safy (2021) studied about the impact of using MW in the production of variousconstruction and building materials that based on cement is addressed to clarify the actual need in adopting such an

attractive technology to magnetize the water to be used in mixing and curing cement-based materials to construct sustainable concrete structures in construction sites. The literatures showed an incredible improvement in fresh and hardened properties of cement-based materials when MW was utilized in mixing or curing. As the nowadays is to reduce the waste in water in the construction industry with the improvement in the properties of cement-based materials using magnetic treated water, the need to adopt the MWT technology became an urgent and important demand to construct sustainable building structures. **Bafna, S.D., Pathak et al (2019)** studied that as the Magnetic water concrete, synthesized from the normal materials used for manufacturing of concrete which provides 10% to 20% extra strength to concrete, provides one route towards this objective. Good thing is normal water can easily replace with magnetic water and dispose waste plastic by which quantity of cement and sand used in any concrete mix reduces and we can made as new Eco-friendly material of construction for future.

III. METHODOLOGY

3.1 Selection of materials

Cement:

It is a high-strength variant of Ordinary Portland Cement (OPC), and boasts a minimum compressive strength of 53 MPa after 28 days of curing.

Coarse Aggregate:

The specific gravity of coarse aggregates like 20mm and 10mm aggregates can vary depending on the specific type of rock or material used for the aggregates. Generally, the specific gravity of typical coarse aggregates falls within a range of 2.6 to 2.9.

Fine Aggregate:

Fine aggregates are a foundational element in the world of construction. The specific gravity of fine aggregate, typically consisting of sand or similar materials, can vary depending on its source and composition. In general, the specific gravity of fine aggregate falls within the range of 2.5 to 2.8.

Water:

Water is a fundamental and multifaceted component in the world of concrete. Its presence in concrete mixtures has a profound impact on the material's workability, strength development,and durability.

Magnetized water:

Magnetized water, a concept that has garnered both intrigue and skepticism, refers to water that has been exposed to a magnetic field or treated with magnetic devices in an attempt to alter its properties.

3.2 Tests on Normal Water

1. pH of water: It is an important quantity that reflects the chemical conditions of a solution.
2. Turbidity: It is used to assess water quality prior to release into the environment
3. Alkalinity: It is a primarily measuring the acid neutralizing capacity of water.

4. Calcium ion concentration: It is a typically cell, the intracellular concertation of ionized calcium is roughly 100nM

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IV. RESULTS AND ANALYSIS

4.1 Normal water test results

One the most important element in the concrete is water. For mixing and curing of concrete water is essential. For this study tap water were used and the chemical properties. while normal water is widely accepted and understood, magnetized water remains a subject of debate and further research. While some claims suggest potential benefits, scientific evidence supporting these claims is currently limited, and more research is needed to fully understand the effects and applications of magnetized water.

Parameter	Units	Results	limits as per (IS 456:2000)
pH	-	7.14	6.5-8.5
Hardness	Mg/l	31	<600 for drinking water
Calcium-ion Concentration	Mg/l	3.13	-
Alkalinity	Mg/l	3.35	250
Turbidity	NTU	42	<10

4.2 Magnetized water test results

The two magnets are to be place below the glass beaker and replete with normal water for 24 hours magnetization. In the time of magnetization, the magnetic flux penetrates through the glass beaker into the water, thus water alters to magnetized water are shown in Table 3. Inthis study, the magnetized water was used to examining the strength properties of concrete.

Parameter	Units	Results (2T)	Results (0.986)	limits as per (IS 456:2000)
Ph	-	8.24	8.13	6.5-8.5
Haedness	Mg/l	755	800	<600 for drinking water
Calcium ion Concentration	Mg/l	93.35	90.83	-
Alkalinity	Mg/l	25	75	250 Rcc works
Turbidity	NTU	6	6.1	<10

4.3 Cement test results

The binding material of Ordinary Portland cement (OPC) of 53 grade were used in the present study for concrete mix. It was used in the examination for physical and chemical properties. The various tests results conducted on the cement are shown in Table

Cement	Units	Results	Requirements as per (IS:12269-2013)
Normal consistency	%	31	-
Specific gravity	%	3.13	-
Fineness of cement	-	3.35	Less than 10%
Initial Setting time	%	42	Minimum 30
Final setting time	Minutes	320	Maximum 600

4.4 Compressive Strength of Concrete

The concrete cubes of 150mm × 150mm × 150mm were casted with two different strengths of magnetized water. The compressive tests were done on this cube after 7, 14, 28 days. The test results are shown in table

Concrete mixes	3 days	14 days	28 days
NWC	19.86	30.86	42.63
MWC	22.36	35.10	48.75

V. CONCLUSION

The strength studies shows that MWC is showed strength development comparedwith NWC. The compressive, Split Tensile and Flexural strength of MWC enhanced as the maturity of the concrete increases by virtue of continues hydration mechanism which reduces the porosity of the concrete. The use of magnetized water instead of tap water in the concrete it exhibits significant increase in compressive strength by 30.07% for2T magnetized water in concretemagnetized water in concrete for 28 days curing. The split Tensile strength of concrete showed significant increase by 30.62% for 2T magnetized water in concrete Flexural strength of the concrete is also exhibits increment by 30.43% for 2T magnetized water

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