



REVIEW ON EFFECTS OF MAGNETIC WATER ON CONCRETE

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ABSTRACT: Most researchers are continuously looking for increasing the compressive strength of concrete by using various methods like use of mineral admixtures, chemical admixtures, Plasticizers, self curing agents, blending cement with pozolana, GGBS, silica fumes etc. The cost of these methods are not comparable with their advantages, thus most researchers concentrate their attention on producing economical concrete with higher strength using new philosophies in design methods and through modern techniques. It is experimentally proved that using magnetic water (MW) for manufacturing of concrete by passing water through a magnetic field, some of its physical properties change and as a result of such changes, the number of molecules in the water cluster decrease from 13 to 5 or 6, which causes a decrease in the bond angle in water molecular structure and increases the surface area of water in unit volume and which enhances the hydration of cement. Using magnetized water in concrete mix causes an improvement in the workability and compressive strength of concrete. Also, this processed water causes a reduction in the cement content required for the specified compressive strength value. The current study is review of work done by some researchers on use of magnetic water in concrete.

Key words: - Magnetic water, strength of concrete, properties of concrete, properties of water, magnetic field.

INTRODUCTION :

Concrete is the most widely used man-made building material on the planet. Concrete structures have been built since the discovery of Ordinary Portland cement (OPC) in the midst of the nineteenth century. The concrete gains its strength through hydration reaction in which cement and water are main compounds. It means that the properties of water is very much important in strength gain of concrete. Altering the properties of concrete and molecular structure of the concrete by passing it through the magnetic field shows great result in hydration of concrete due to increased surface area of water. As recommended by IS Code for the use of Potable water in a concrete mix, Potable water is becoming scarce day by day due to sudden increase in the urbanization and population. Surface water is polluted by allowing the untreated industrial wastes into flowing rivers and usage of high dosage of chemical fertilizers in agriculture.

Magnetized water doesn't mean that the magnetic strength is acquired by water but when water is exposed to a magnetic field it undergoes change in its certain properties. Since water has certain unique anomalous properties this may result in many variations of macroscopic properties. 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 some properties of water.

BENEFITS OF MAGNETIC WATER

These variations changes the structure of water and this structured water has many benefits and used in different applications as listed

below:

- i. Magnetic treatment of saline irrigation water is used as an effective method for soil desalinization.
- ii. The magnetic water is used to increase crop yield, this induced growth in is attributed to an increase in photosynthetic pigments, where the magnetic water increases the cell metabolism and mitosis.
- iii. The application of a magnetic water on seeds increases the germination and a percentage increase in the germinated seeds.
- iv. Dairy cows that drink magnetized water have shown an increase in milk production with the same quantity and quality of milk fat as present in cows drinking ordinary water.
- v. On consuming magnetic water poultry have showed an increase in egg production due to increase of improved digestion and nitrogen retention in them.
- vi. Use of Magnetic treated water changes the calcium carbonate (CaCO_3) equilibrium in water and tries to disperse carbonate precipitate in the solution, thus reducing the scale formation on pipe walls and other industrial equipment.
- vii. As this Magnetized structured water carries more oxygen and other essential minerals in to the human blood/organs alter rates of cellular, enzymatic or organic processes, thus magnetic water is used to cure/treat ill effects or diseases in human body.
- viii. Considering the above advantages of magnetic water some researchers used this water for manufacturing of concrete and get the significant results.

EFFECT OF MAGNETIZED WATER ON PROPERTIES OF CONCRETE

After studying some research works it is found that, when magnetized water was used in concrete certain properties of concrete were expected to be enhanced.

Concrete efficiency increases: As more hydration occurs the amount of unhydrated

cement is reduced and the strength is generated at a higher efficiency.

Volume of Water decreases: As the number of hydrated cement particles increases the desired amount of hydration requires lesser amount of water.

Cement content decreases: In concrete there is always a certain amount of cement remained as unhydrated. By using magnetized water the concrete can be made at reduced cement content.

Emission of Green House Gases decreases: Cement when hydrated releases greenhouse gases which have a major role in global warming and thus it is required to have environmental sustainability, concrete being the most utilized material on earth.

LITERATURE REVIEW:-

In this study some research papers are reviewed and summarise some important points of using magnetic water in concrete.

Setyowati E W et.al, (2012), studied the effect of high temperatures on the compressive strength of concrete. The study also included the degradation in micro structure of concrete using XRD and SEM techniques.

Xiao F.P and Xin Shui Zhu (2011), studied the influence of magnetic water on optic properties of concrete including cohesive force and internal friction angle as well as the infrared spectrum of absorption and fluorescence spectrum. The results obtained from these investigations indicate that the some new peaks in the infrared spectrum occur after magnetized water is joined into the concrete relative to those of pure water. These show clearly that the magnetized water enhances the combined force among the molecules, and lifts the optic properties of the concrete containing magnetized water. This enhancement in optic properties of concrete of concrete is due to the increase of hydrophilic feature of concrete after magnetized water is joined into it.

Florence Sanchez & Konstantin Sobolev (2010), presents the Nano science and Nano engineering applications in concrete technology. They describe about the impact of recent advances in instrumentation and computational materials science and their use in concrete research. Also the Recent progress in nano engineering and nano modification of cement-based materials are presented. The information provided in this paper is very crucial for predicting the pore structure of concrete and for providing new insights on how it can be improved.

Adnan Flayih Hassan (2008), investigated the influence of magnetized water on the initial and final setting time, consistency and compressive strength of cement mortars cubes at very ages of 1 and 7 day. The results indicated that the use of magnetized water in preparing cement mortars increases the compressive strength and the initial and final setting time of cement mortar decreased. Results also showed that the optimum water/cement ratio for obtaining the best compressive strength under the conditions of this study was 0.45.

Dale P.B and Paul E.S (2006), describes the effect of full and partial curing and hydration on the pore structure of the concrete. The connectivity of the pores in the structure are the results of improper curing which effects the durability of the concrete at later ages.

Neven Ukrainczyk et.al, (2006), investigated the degradation of Concrete from 30 years old hydro-electric power plant's pipeline using X-ray diffraction (XRD), and thermo gravimetric analysis (TGA/DTA). The study highlights the capabilities of the methods for the analysis of concrete towards the determination of hardened cement paste degradation. XRD results showed small quantity of ettringite, calcium carbo aluminate hydrate and Friedel's salt, and a complete leach of portlandite, while TGA results indicated small quantities of hydrates.

Nan Su, Chea-Fang Wu (2003), investigated on the compressive strength and workability of mortar, which is mixed with magnetic water and granulated blast-furnace slag (GBFS). The test variables included the magnetic strength of water, the content of GBFS in place of cement, and the water-to-binder ratio (W/B). Results showed that the compressive strength of mortar samples mixed with magnetic water increased by 9–19% more than those mixed with tap water. It is also found that magnetic water improved the fluidity of mortar and the degree of hydration of concrete.

Nan Su et.al, (2000), investigated on the workability and compressive strength of mortar which was mixed with magnetic field treated water (MFTW) containing fly ash. MFTW was obtained by passing tap water through a magnetic field. Test variable included the magnetic strength of water, fly ash content in place of cement, water to cementitious material ratio and curing age. Result shows that compressive strength of mortar samples mixed with MFTW is higher than those prepared with tap water.

INFLUENCE OF MAGNETIC FIELD ON WATER AND STRENGTH OF CONCRETE

Many researchers have studied the effect of electric and magnetic fields on the structure of water. All of them have noticed that there will be physical changes in water and some hardness will be removed by magnetizing the water. Experimental program we started with investigating production of magnetic water by exposing to north & south poles and investigate which pole water will be effective in mixing with concrete and for how much time this water is to be exposed to the magnetic fields.

CONCLUSIONS

- i. After studying the multiple works the following conclusions may be drawn;
- ii. The strength studies shows that MWC also behaves likes a NWC in strength development

i.e., developing very high strengths at early ages and less strength at later ages.

iii. 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 days 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.

iv. The split tensile strength increase is about 12.5% in MWC at 28 days and 365 days.

v. Similarly the flexural strength increase is about 21% at 28 days of curing, this further increased to 29% at 365 days in MWC.

vi. The Impact resistance increased in case of MWC, The impact strength increase is nearly 45%. In impact test it is observed that there is a significant improvement in first crack strength and ultimate strength in MWC because of more hydration and dense micro structure of MWC increases the resilience and strain relieving capacity MWC. This resilient character provides the excellent impact resistance and dissipates dynamic loading better than normal concrete. The increase in number of blows up to failure for MWC indicates its high energy absorption capacity which in turn enhances the increased impact resistance.

vii. Radiography test conducted on the concrete specimens with and without MW shows that the Pores/flaws are less in MW concrete specimens.

FUTURE SCOPE

i. The same investigation of influence of magnetic water on workability, strength and durability properties of concrete can be studied by varying the magnetic field strength.

ii. Methods and systems can be designed to produce magnetic water on large scale to use in in-situ concrete works.

iii. The present investigation can be extended to make concrete of higher grades and different

types of concrete.

iv. Further Nano studies can be carried out to examine the Nano structure of MWC.

v. Effects of treated magnetized waste water on durability of concrete can be carried out.

vi. Effects of treated magnetized salt water on durability of concrete can be carried out.

vii. Strength and durability of concrete can be studied by increasing the concentration of chlorides and sulphates in mixing water.

viii. This new Magnetic water technology can be applied to cement bricks/blocks to reduce the amount of cement to be used in them by replacing with fly ash or any material.

REFERENCES:

- Setyowati E W et al, "Micro Structure Effect of Concrete Degradation for Compressive Strength of Concrete Burned in High Temperature", International Journal of Emerging Technology and Advanced Engineering, 2, 12, (2012),1-6.
- Xiao Feng Pang and XinShui Zhu, "The Influences of Magnetized Water on Physical Properties of Concrete", Applied Superconductivity and Electromagnetic Devices Sydney, Australia, (2011),270-274.
- Florence S and Konstantin S, "Nanotechnology in concrete – A review", Construction and Building materials, Elsevier, 24, (2010),2060-2071.
- 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.
- Dale P.B and Paul E.stuzman, "Curing hydration and microstructure of cement paste" ACI material Journal, 103, M39, (2006), 348-356.
- Neven U et al "XRD and TGA investigation of hardened cement paste degradation", Conference on Materials, Processes,

Friction and Wear MATRIB'06, Vela Luka, (2006), 243-249.

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.

Nan Su and Chea-Fang Wu., "Effect of magnetic field treated water on mortar and concrete containing fly ash", Journal of Cement and Concrete Composites, 25, (2003), 681-688.

Fig. 1. Magnetization of water

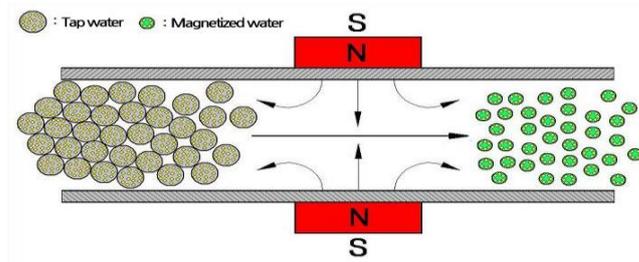


Fig. 2. Magnetization of water.

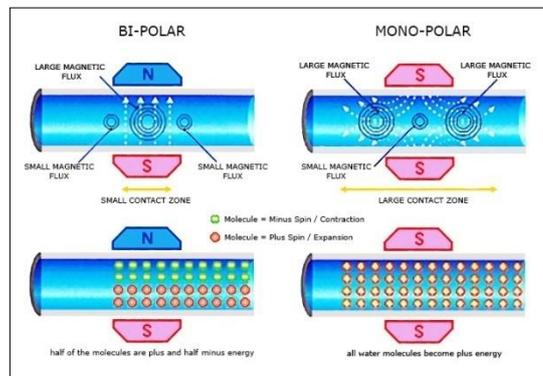


Fig. 3. Reduction in size of cluster

