RESEARCHERID
THOMSON REUTERS
[Raghu, 4(5): May 2017]
DOI- 10.5281/zenodo.572503
ISSN 2348 – 8034
Impact Factor- 4.022
GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

STRENGTH STUDIES ON FLY ASH BASED MAGNETIC WATER CONCRETE

Sabbani Raghu[*1] & Ch. Kireety[2]
[*1&2]Assistant Professor, Department Civil Engineering, Vardhaman College Of Engineering, Hyderabad, Telangana, India

ABSTRACT

The usage of concrete is growing with the exploding scope of construction industry. This called for the extensive production and usage of cement. Among all the ingredients of concrete, cement has deleterious effects on environment. As the usage of concrete is inevitable, pre-emptive measures should be taken to reduce the usage of cement in concrete while maintaining the same engineering properties. To address this cause, research has been carried out on various constituents and parameters of concrete which lead to the realization of new construction materials and practices. But the scope of effects on concrete caused by altering the properties of water has long been neglected. On account of this obscurity, this can be potential area of interest.

When water is magnetized, it exhibits structural changes which increases the specific surface area of water. When this magnetized water is used in concrete instead of normal water, it is found that the compressive strength increases considerably. This additional strength attained by the usage of magnetized water can be used to address the need to reduce cement usage. In this attempt to reduce the usage of cement, fly ash which has immense potential to be used in construction industry, can be used to replace cement in concrete to a considerable extent when magnetic water is used.

The present research work is carried out to investigate the effect of Magnetic Water on the Compressive strength studies on fly ash based magnetic water concrete (M30 & M40 grade). Examine the effect of magnetic water on compressive strength studies are also conducted to evaluate micro structure on fly ash based magnetic water concrete (M30 & M40 grade).

The results of tests showed that, in most cases, concrete made with magnetic water (magnetic water concrete), has higher compressive strength values, superior quality than those of normal water concrete

Keywords*: fly ash, compressive strength, super plasticizer, curing compounds.*

I. INTRODUCTION

Concrete in construction industry:
Construction industry is one of the major industries in all countries both in terms of economy and affecting environment. In construction industry, concrete and metal (mostly steel) are majorly used. Concrete is primarily used building material. Concrete is an artificial stone-like material used for various structural purposes. It is made by mixing a binding material (as cement) and various aggregates (inert materials), such as sand, stone chips, brick chips, pebbles, gravel, shale, etc., with water and allowing the mixture to harden by hydration. Approximately four tonnes of concrete is produced for every person on the planet. Concrete is the second most consumed entity after water. This extreme use of concrete is in regard to the various advantages provided by it. Few advantages are:

- Concrete is economical when ingredients are readily available.
- Concrete's long life and relatively low maintenance requirements increase its economic benefits.
- It is not as likely to rot, corrode, or decay as other building materials.
- Concrete has the ability to be moulded or cast into almost any desired shape.
- Concrete is a non-combustible material which makes it fire-safe and able to withstand high temperatures.
- It is resistant to wind, water, rodents, and insects.

ISSN 2348 – 8034
Impact Factor- 4.022

Everything about concrete is huge, it's usage, advantages and also disadvantages. One of the major disadvantages of concrete is its impact on environment. Concrete accounts for around 5% of the world's total CO2 emission. Cement manufacturing is high energy and emissions intensive because of the extreme heat required to produce it. Producing a ton of cement requires energy equivalent to about 400 pounds of coal, and generates nearly 0.9 ton of CO2. Given its high emissions and critical importance to society, cement is an obvious place to look, to reduce greenhouse gas emissions. Therefore there arises a need for the effective utilization of existing resources i.e., by maintaining the strength of concrete while reducing the quantity of cement usage in concrete.

Magnetic water concrete

In this magnetic water concrete the concrete is manufactured with magnetised water while mixing. The magnetised water is prepared by keeping the water on round magnets taken from scientific store. This phenomenon is based on magnetic therapy in the medical field.

Introduction For Mwc

Recently, magnetized water (MW) has been used in several applications including health, environment, agriculture, construction industry. The main target of this project is to study and evaluate concrete produced using MW. An experimental laboratory plan has been established to investigate the physical and mechanical properties of this concrete. Magnetized water is obtained by passing tap water through a magnetic field. Special apparatus to generate the magnetic field has been purchased and assembled with immerse-able water pump, for the laboratory study. The test variables include the magnetic strength of the water, the curing age of the concrete, the MW to cementations material ratio (w/c), and the constituents of the concrete mix usually used in Kuwait. The technology of using MW has been introduced in concrete production. A proposed program was developed to evaluate the feasibility of using MW in concrete by tune down the level of magnetizing to the optimum, and characterizing the concrete produced by MW in both fresh and hardened stages. Various mixes design produced by MW and compared with the control mixes produced by normal water.

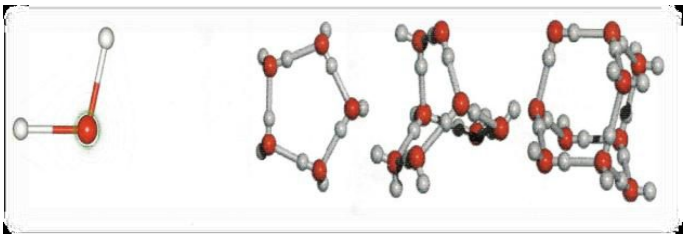

Figure 1.1 Structure of water

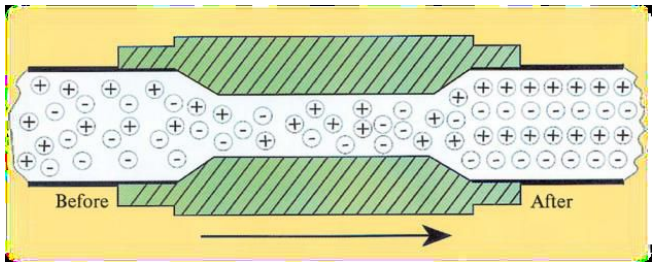

Figure 1.2 Movement of charged particles after magnetism

Workability plays an important role in the concrete quality in the short and long term. It is anticipated that the use of MW would have an effect on the fresh concrete quality that will lead to better quality of the hardened concrete, due to a change in the surface tension (viscosity) of the water used in the mix. Moreover, more water is required for the concrete to be mixed well. Adding more water in concrete will make it workable, but unfortunately adding water will scarify the concrete density. The reduction in water surface tension causes the water molecules to be more dynamic and fluid (Fig.1.3). This in turn allows much better bonding between the other materials added to the water.

[Raghu, 4(5): May 2017]
DOI- 10.5281/zenodo.572503
ISSN 2348 – 8034
Impact Factor- 4.022

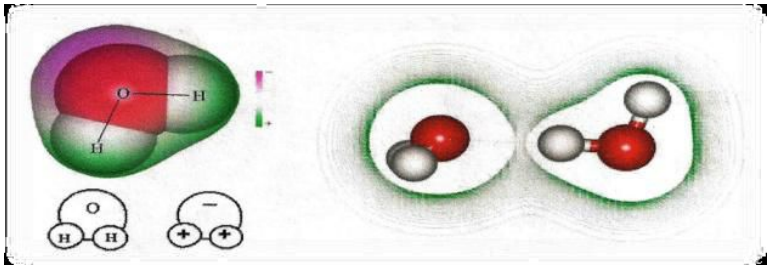

Figure 1.3 Change in Viscosity and Surface Tension of magnetised water

When water is magnetized, it becomes anti-magnetized and inhibits the mineral in concrete from bonding, which causes the minerals of the concrete and additive to repel each other. This fact plays a major role in of mixing, forming, and curing stages which all contribute in producing better concrete. All that will contribute in producing a high-quality concrete which can overcome its lack of ability to resist deterioration.

II. MATERIAL

The following materials are used in the present investigation. A brief description is given below regarding the materials used.

1. Cement
2. Magnets
3. fine aggregate
4. coarse aggregate
5. Magnetized water
6. Normal water
7. Fly ash

Cement

Locally available 53 grade ordinary Portland cement (OPC) of Ultratech brand has been used in the present investigation for all concrete mixes. The cement used was fresh and without any lumps. The cement thus procured was tested for physical and chemical requirements in accordance with IS 12269-1987(21).

Figure 2.1 Ultra Tech Ordinary Potland Cement 53 Grade

Magnets

In the present investigation work, the Magnets were obtained from scientific store. The shapes of magnets are rounded. We found the strength of magnet by Gauss meter. Three types of strength magnets we used. The average magnetic strength of four magnets is 985 gauss.

Figure 2.2 Magnets used for magnetizing water

ISSN 2348 – 8034
Impact Factor- 4.022

Fine Aggregates

In the present investigations, river sand available in the local market was used as fine aggregate. The physical property of fine aggregate such as gradation, specific gravity and bulk density were tested in accordance with IS: 2386-1963. The various properties of fine aggregate used in the present experimental investigation are given in a table which follows.

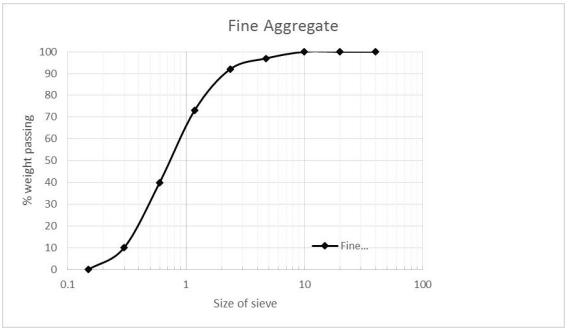

Figure 2.3 Gradation curve for fine aggregate

From fineness modulus it is clear that the fine aggregate confined to Zone-II in accordance with IS: 383-1970. The results of fineness modulus are given below:

Weight of sample taken = 1kg

Table 2.3 Fineness modulus results

IS Sieve Size	Weight retained gms	Cumulative weight retained gms	Cumulative % weight retained	Cumulative % weight passing	Grading Limits IS 383-1970 Zone II
10mm	0	0	0	100	100
4.75mm	30	30	3	97	90-100
2.36mm	50	80	8	92	75-100
1.18mm	190	270	27	73	55-90
600microns	330	600	60	40	35-59
300microns	300	900	90	10	8-30
150microns	100	1000	100	0	0-10
Total			288		

Figure 2.4 Fine aggregate used in Concrete mix

[Raghu, 4(5): May 2017] ISSN 2348 – 8034
DOI- 10.5281/zenodo.572503 Impact Factor- 4.022

Coarse Aggregate

Coarse aggregate used in the investigations was of two sizes viz. 20mm and 12mm. The crushed coarse aggregate was obtained from the local crushing plants. The physical properties of the coarse aggregate such as gradation, fineness modulus, specific gravity and bulk density are tested in accordance with IS:2386-1963 and IS:383-1970. The results for 20mm aggregate are tabulated below:

Table 2.4 Physical properties of coarse aggregate of size 20mm

S.NO	PROPERTIES	RESULT
1	Fineness modulus	7.228
2	Specific gravity	2.60
3	Bulk density in loose state	1361 kg/m^3

The data obtained from sieve analysis to determine fineness modulus of 20mm aggregate is tabulated.
Weight of sample taken = 5kgs

Figure 2.5 Gradation chart for coarse aggregate (20mm)

The various physical properties of 12mm aggregate are tested and the corresponding results are as follows

Figure 2.6 Coarse Aggregate Used in Concrete Mix

The data obtained from sieve analysis to determine fineness modulus of 12mm aggregate are tabulated below.
Weight of sample taken = 5kgs

ISSN 2348 – 8034
Impact Factor- 4.022

Table 2.7 Fineness modulus of coarse 12mm aggregate

S.NO	IS SIEVE SIZE	WEIGHT RETAINED IN gms	% WEIGHT RETAINED	CUMMILATIVE % WEIGHT RETAINED	% PASSING
1	40 mm	0	0	0	100
2	20 mm	0	0	0	100
3	10 mm	200	4	4	96
4	4.75 mm	1170	23.4	27.4	72.6
5	2.36 mm	3630	72.6	100	0
6	1.18 mm	0	0	100	0
7	600 µm	0	0	100	0
8	300 µm	0	0	100	0
9	150 µm	0	0	100	0

The gradation curve obtained by representing these values graphically is shown below

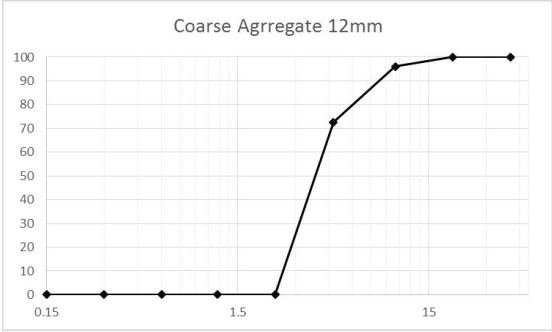

Figure 2.7 Gradation curve for 12mm aggregate

Magnetised Water

Magnetic water is obtained by placing water over the magnet. A beaker of water is placed over the magnets for a period of 24 hours to obtain magnetic water. During this time magnetic flux passes through the water changing the specific surface area of water which is called as magnetized water. Three different types of magnetic water can be prepared namely:

1) North pole water
2) South pole water
3) North south pole water or mixed pole magnetized water.

North Pole and South Pole water can be prepared using respective magnets. Whereas mixed pole water is prepared by mixing equal quantities of north and South Pole waters.

Figure 2.8 Water in 1 litre beakers placed on magnets

ISSN 2348 – 8034
Impact Factor- 4.022

Various physical tests have been conducted on different waters like North Pole water, South Pole water, north &South Pole water and normal water.
The results obtained are tabulated below.

Table 2.8 Properties of water

Tests performed	Normal water	Magnetic Water
pH	7.2	7.9
Turbidity	7	7
Alkalinity	20	20
Chlorides	28	28
Hardness	112	84

Due to the magnetization of water various changes have been observed in different properties of cement. One such change observed is in the normal consistency of cement. A comparative study for normal consistency of cement using various waters has given the following results.

Table 2.9 Normal consistency of cement for different waters

Type of water	Normal consistency
Normal water	30
North-South magnetized	33

III. RESULT & DISCUSSION

Effect of magnetic water on compressive strength:
The results of the compressive strength at 7,14,21,28 and 60 days M30 grades of Normal water concrete (NWFC) and Magnetic Water concrete (MWFC) are tabulated in Table 5.1.

Table 3.1 Compressive strength of NWFC and MWFC in N/mm2 (M30)

S. No.	Age in Days	NWFC	MWFC	% increase
1	7	16.11	22.25	38.1
2	14	22.62	25.5	12.73
3	21	28.97	32.1	10.8
4	28	38.8	45.9	18.3
5	60	43.8	51.74	18.13

Table 3.2 Compressive strength of NWFC and MWFC in N/mm2 (M40)

S. No.	Age in Days	NWFC	MWFC	% increase
1	7	26.33	28.3	7.5
2	14	32.11	37.01	15.3
3	21	37.7	42.9	13.8

ISSN 2348 – 8034
Impact Factor- 4.022

4	28	41.3	50.4	22.03
5	60	51.03	56.81	11.3

The cube compressive strengths of concrete with and without magnetic water at 7,14,21,28 and 60 days are given in Table 3.1 & Table3.2.

It is observed that with the addition of Magnetic water for mixing in concrete showed increase by 38.1% & 7.5 5 in cube specimens at 7 days, and at 28 days there was significant increase by 18.3% and 22.03 % in M30 & M40 respectively. The increase in strength of concrete is due to more hydration of cement in MWFC, which fills up the pores in the concrete making the concrete microstructure dense.

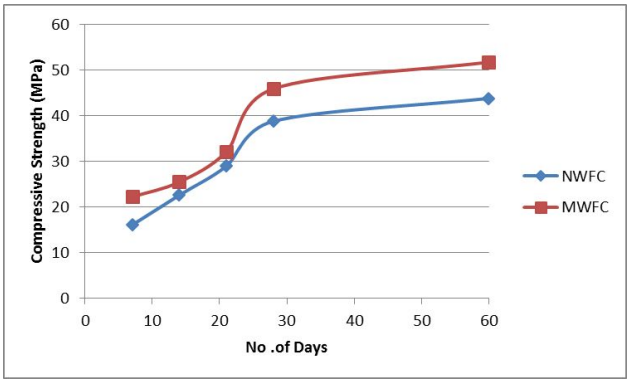

Figure 3.1 Compressive strengths for N.W.F.C and M.W.F.C for M30 grade concrete

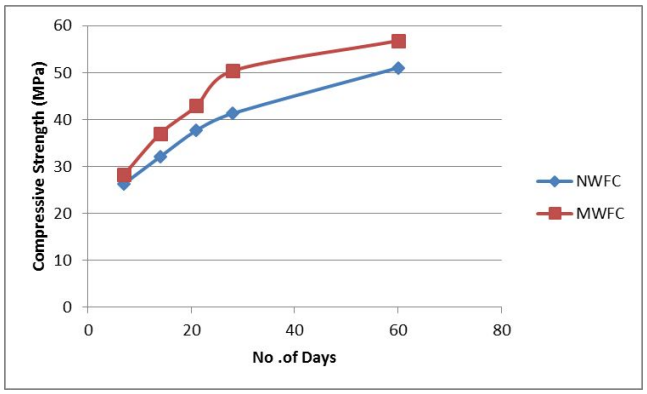

Figure 3.2 Compressive strengths for N.W.F.C and M.W.F.C for M40 grade concrete

IV. CONCLUSION

In this investigation the influence of magnetic water on Compressive strength studies on concrete. For this the magnetic water of 985 gauss strength is used. The conclusions obtained from this work are as follows:

- 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.

V. ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to Sri B.SIVA KONDA REDDY, Assistant Professor, Department of Civil Engineering, JNTUH College of Engineering. I was privileged to carry out my project under his

guidance. It was with his constant encouragement and lucid guidance that this work has seen the light of the day.
Finally, I thank all the unmentioned persons and invisible hands who helped me in completion of this thesis.

REFERENCES

"Properties of Concrete", by Neville. A. M. – Pearson Education Asia Pte.Ltd, Fourth Edition, First Indian reprint 2000.

1. *"Concrete – Microstructure, Properties and Materials", by P. K. Mehta and Paulo J. M. Monteiro, Tata McGraw Hill Education Private Limited,Fourth reprint 2011.*
2. *"Design of Concrete Mixes", 4e, by N. Krishna Raju, CBS Publishers & Distributors, Delhi, 2010.*
3. *Shetty M S, "Concrete technology (Theory and Practice)", 5th Edition, 2002, published by S. Chand and Company Ltd. Ram Nagar, New Delhi – 110055.*
4. *Advanced Concrete Technology, John Newman and Ban Seng Choo , Butterworth-Heinemann publication(Elsevier),UK,2003.*