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EFFECT OF MAGNETIC WATER AND MINERAL ADMIXTURES ON COMPRESSIVE STRENGTH OF CEMENT MORTARS

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ABSTRACT

This paper presents the experimental results on compressive strength of cement mortar cubes. The cement mortar cubes were prepared with magnetic water, cement, mineral admixtures and normal sand. The variables in this study are magnetic water, mineral admixtures and curing period. On observing experimental results, the increase in compressive strength of cement mortar cubes is more due to addition of magnetic water in the presence mineral admixtures

Keywords: magnetic water, mortar, compressive strength, mineral admixtures and curing period

I. INTRODUCTION

Concrete is a composite material, which made up of aggregates, cement and water. In this the aggregates will act as filler material and chemically inactive. The chemical and physical process between cement and water will take place which is called as hydration, to form cement paste. This cement paste will act as binding material for the aggregates. The compressive strength of concrete mainly depends upon formation of cement paste. The general practice to improve compressive strength of concrete the cement content will be replaced with mineral admixtures. And water content in traditional concrete has a significant influence on its engineering properties such as mechanical strength. But studies on water for concrete mixing have been scarce. With respect to concrete mixing, magnetization of water leads to reduced adsorption of active surface substances at the interface between water and cement. This in turn affects the hydration process and the hardening of cement. In the mixing of water and cement, hydration reaction will first take place on the surface of the cement particles. A thin layer of hydration products is thus formed on the cement particles, which hinders further hydration of the cement particles, thus preventing the development of mechanical strength of the concrete. However, if magnetic water is used instead, water molecules can easily penetrate into the cement particles, allowing a more complete hydration process to occur and enhancing the strength of cement mortar cube. The present experimental work is aimed to study the effect of magnetic water on compressive strength of cement mortar. So the experimental work is planned and executed as give below. The variables in this study are type water, curing period, duration of magnetism and mineral admixtures Silica Fume, GGBS.

II. EXPERIMENTAL WORK:

The materials used in the present experimental investigation are given below.

Cement: The cement for the whole work was procured in a single consignment and properly stored. The cement used is OPC, and the properties are, the specific gravity 3.10, Fineness modulus is 5%, initial setting time 35mins, standard consistency 32.5%.

Fine aggregates: Locally available River sand was used as Fine Aggregate. The Specific gravity of Fine Aggregate is 2.62.

Mineral Admixtures: Silica Fume (SF) and Ground Granulated Blast furnace Slag (GGBS) are procured from Fosroc Chemicals (India) Ltd. Bangalore.

Magnets: Round shape magnets used in this work are procured from Avishkar scientific & surgical store, Abids, Hyderabad. The average magnetic strength of each magnet is 985 gauss.

Preparation of magnetic water: Magnetised water (MW) is prepared by placing the water filled glass beakers over the magnets for the required period. During this period magnetic field penetrates into water through the glass beakers and the water in the beaker absorbs the magnetism. The period of time for which water magnetised is 24hrs, 48hrs and 72hrs. The water magnetized in this method is used for casting of cement mortar cubes. The Preparation of MW is shown in Fig-6. Some of the properties between normal and magnetised water are calculated and presented in Table-1.

S. NO	Property	Normal water	Magnetized Water Period		
			24 hr	48hrs	72 hr
1	pH	7.2	7.6	7.6	7.91
2	Electro Conductivity	200 micro Mhos/cm	250 micro Mhos/cm	300 micro Mhos/cm	500 micro Mhos/cm
3	Hardness	16ml	18ml	18ml	20ml

Preparation of test Specimen: In this investigation the mix proportion used for casting of cement mortar cubes is 1:3:0 with a water binder ratio of $p/3+0.48$. where p is standard consistency of cement. The cement was replaced with silica fume in (0%, 5%, 10% and 15%) and GGBS (0%, 5%, 10% and 15%) separately. All the test specimens were cast in twelve batches, in each batch the estimated quantities of cement, mineral admixture and Fine aggregates were first mixed in dry state to obtain uniform colour. Then predetermined amount of water is added, all the ingredients were mixed for five minutes in wet state. Thoroughly mixed cement mortar is filled into the mould and compacted by vibrating machine. The Standard mortar cube size is $70.6 \times 70.6 \times 70.6$ mm and used to cast the test specimens. After casting Specimens were removed from moulds after 24 hours of cast and immersed in a water pound, for 28days. The total number of specimens cast in this investigation was 252 to estimate effect of magnetic water on compressive strength of cement mortar in the presence of mineral admixtures. After completing the curing period the specimens were taken out from curing tank and allowed to surface dry, then tested using 200T capacity Compressive Testing Machine [10]. And while testing machine readings were noted.

Results and discussion: The compressive strength of mortar specimens is calculated using the experimental data and result is presented in Table-2. The effect of magnetic water and mineral admixtures used in this investigation is discussed as given below.

S. no	Magnetised water duration Hrs	Age of Testing Days	strength (N/mm ²)						
			Cement	Replacement of cement with SF			Replacement of cement with GGBS		
				100%	5%	10%	15%	5%	10%
1	0	7	24.60	21.64	21.64	20.66	25.58	26.57	26.57
2	0	14	31.50	33.45	31.40	29.33	32.46	33.45	34.44
3	0	28	45.33	42.31	41.33	41.33	43.29	43.29	45.26
4	24	7	26.89	25.91	26.23	25.90	29.19	28.20	31.16

5	24	14	32.80	34.44	33.78	32.8	31.22	33.78	34.76
6	24	28	47.23	46.26	45.26	44.28	47.23	48.24	48.24
7	48	7	31.48	31.81	32.80	30.82	32.14	32.14	32.14
8	48	14	35.72	37.06	34.76	35.09	34.76	37.05	37.99
9	48	28	47.33	47.33	45.26	46.25	47.23	48.26	48.26
10	72	7	35.42	33.45	35.42	34.44	37.39	37.39	39.36
11	72	14	42.31	44.28	40.34	43.29	43.29	41.33	44.22
12	72	28	48.21	48.21	47.23	46.25	49.20	46.25	47.23

Magnetised water: To visualise effect of MW and magnetised period on compressive strength, graphs are drawn and presented here. The variation of 7 days compressive strength of mortar cubes with varying MW is presented in Figure-4. The variation of 14 days compressive strength of mortar cubes with varying MW is presented in Figure-5. The variation of 28 days compressive strength of mortar cubes, with varying MW is presented in Figure-6. It is clear from the Figure-4 to Figure-6 that the compressive strength is increasing due to usage of MW. And also duration of magnetised duration increases strength increase.

Mineral admixtures: mortar strengths due to replacement of cement with silica fume and GGBS studied separately; in the both cases the compressive strength of mortar cubes is increasing up to optimum dosage of mineral admixtures and then decreasing. The mineral admixtures silica fume and GGBS are influencing strength in same way when they are used in normal water and magnetic water. To visualise effect mineral admixtures in the presence of magnetic water on compressive strength of mortar graphs are drawn and presented graphically. The Figure-7 shows variation compressive strength for mineral admixtures in presence of NW. The Figure- 8 shows variation compressive strength due to mineral admixtures in presence of water magnetised which is magnetised for 24hrs. The Figure-9 shows variation compressive strength due to mineral admixtures in presence of MW, which is magnetised for 48hrs. The Figure-10 shows variation compressive strength due to mineral admixtures in presence of MW, the period of magnetised is for 72hrs.



Figure-1: Magnetic Water preparation.



Figure-2: Casting of mortar cubes.



Figure-3: Testing of mortar cubes.

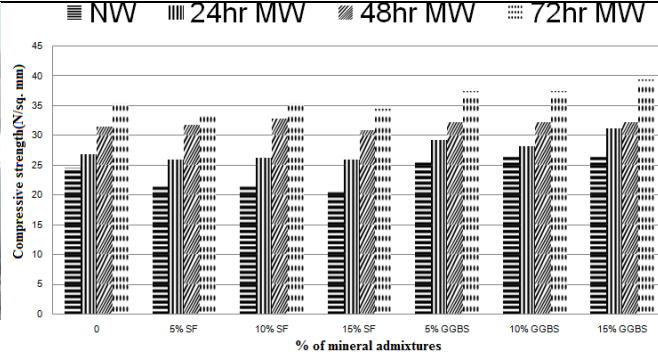


Figure-4: 7 days strength of mortar cubes.

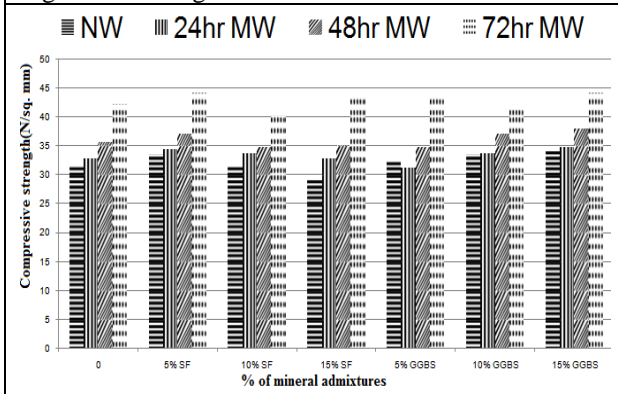


Figure-5: 14 days strength of mortar cubes.

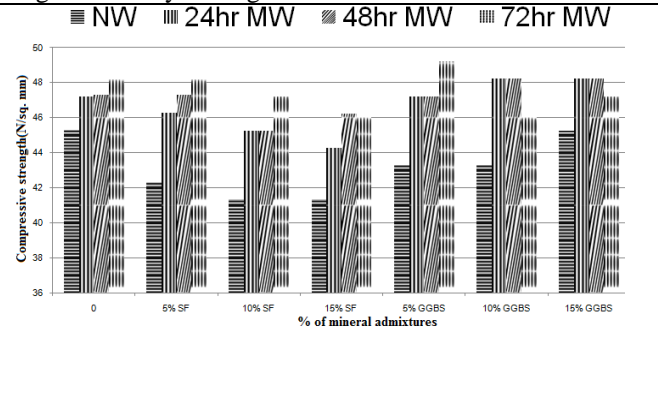


Figure-6: 28 days strength of mortar cubes

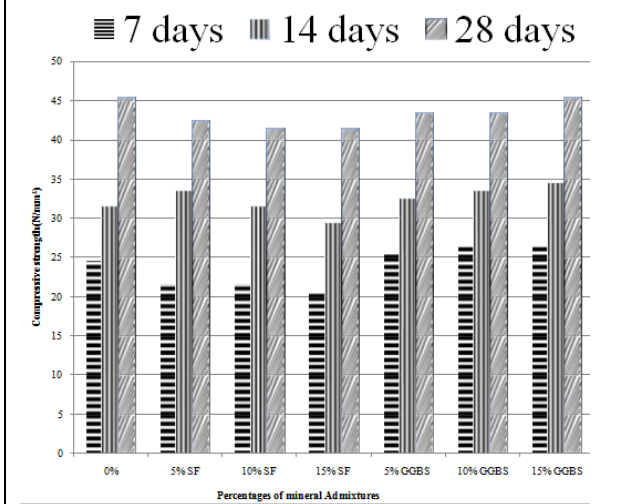


Figure-7: Compressive strength of mortar cast with NW

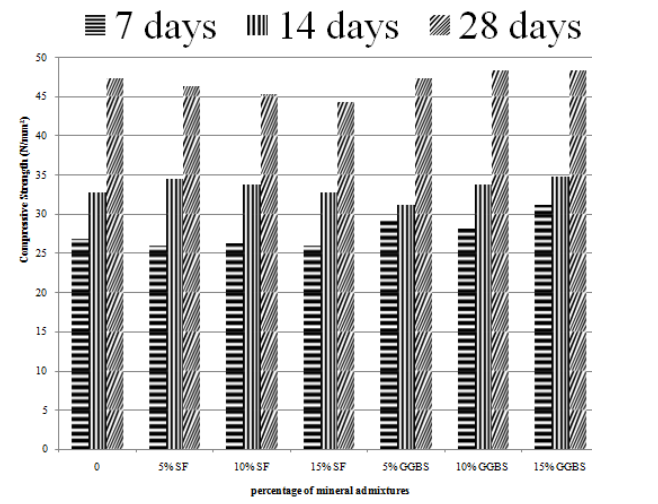
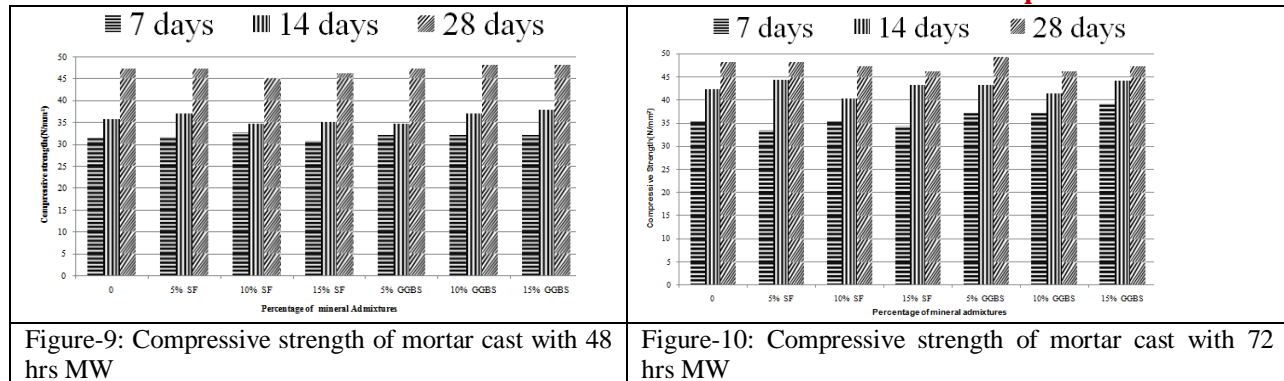


Figure-8: Compressive strength of mortar cast with 24 hrs MW



III. CONCLUSION

The following conclusions are drawn from the present experimental investigation.

1. The compressive strength of mortars is increasing in all the curing periods when MW is used instead NW.
2. The effect of mineral admixtures (SF and GGBS) is same in NW and MW.
3. The compressive strength of mortars increasing as duration of MW is increased.
4. The compressive strength of mortars increasing up to optimum dosage of mineral admixtures and then reducing.

REFERENCES

1. B. Siva Konda Reddy, Vaishali G. Ghorpade and H. Sudarsana Rao, "Influence of Magnetic Water on Strength Properties of Concrete" *Indian Journal of Science and Technology*, Volume 7(1), January 2014, Pp 14–18.
2. Nan Su and Chea-Fang Wu., "Effect of magnetic field treated water on mortar and concrete containing fly ash" *Cement and Concrete Composites*", volume 25, Pp.681-688, (2003).
3. Nan Su, Yeong-Hwa. Wu and Chung-Yo Mar., "effect Magnetic water on the engineering properties of concrete containing granulated blast furnace slag" *Cement and Concrete Research*, Vol.30, 2000, Pp. 599-605.
4. Yasser R. Tawfic and Wael Abdelmoez "The Influence of Water Magnetisation on Fresh and Hardened Concrete Properties" *The International Journal of Civil Engineering and Technology*, Volume 4, Issue 6, November-December 2013, Pp 31-43.
5. B. Siva Konda Reddy, Vaishali G. Ghorpade and H. Sudarsana Rao "Use of Magnetic Water for mixing and curing of Concrete ", *International Journal of advanced engineering research and studies*, Volume IV/I, October-December 2014, Pp 93-95.
6. Mehta P.K, Paulo J.M "Concrete Micro structure, properties and materials" 3rd edition, The McGraw-Hill Companies, Inc. U.S.A,2006.
7. M.Raj kumar, "Effect of magnetized water on cement mortars", A Project report to Submitted to Kakatiya institute of technology and science Warangal, Telangana State to Partial fulfillment for the Award of M.Tech degree during the academic year 2016-2017.
8. M.S.Shetty, "Concrete technology theory and practice", S. Chand & Company Ltd., New Delhi.2006
9. IS:383-1970, "Specification for Coarse and Fine Aggregates from natural sources for concrete" (Second revision), BIS New Delhi.