

Experimental Studies On Durability of Magnetic Water Concrete

Gone Naresh Kumar¹, Joel Shamil²

¹M-Tech Scholar, CMR College of Engineering & Technology, Medchal Road Kaandalakoya (V) Rr Dist

²Associate Professor, CMR College of Engineering & Technology, Medchal Road Kaandalakoya (V) Rr Dist

Abstract: Water is the most studied material on the earth, Water (H₂O) is often perceived to be ordinary as it is transparent and treated to be homogenous consisting of just two hydrogen atoms attached to a single oxygen atom. But at nano level water is not homogeneous, exists as clusters of molecules depending on the temperature, pressure and forces existing. 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 which has found to change certain properties of water. These anomalous properties of water are unique for water and may result in many variations of macroscopic properties. As water structure is altered, by which specific surface area of water increases for hydration of cement particles and no extra water is available for the formation of undesirable capillary cavities. So by altering the structure of water, Water is more efficiently used in concrete which improves strength and durability properties of concrete. The present research work is carried out to investigate the effect of Magnetic Water on the Durability of magnetic water concrete (M30 grade and M40 grade). Effect of magnetic water on acid immersion and freezing & thawing of magnetic water concrete are studied. The investigation is carried out to study the durability aspect (% of weight loss & % strength loss) of MWC When cubes of M30 grade and M40 grade are immersed in Hydrochloric acid (HCL) (5%, 10% & 15%) and subsequent comparing with the corresponding properties of NWC. Also the experimental study of MWC specimens subjected to different cycles of freeze-thaw was reported. After 28 days of curing, the specimens were surface dried and then they were kept in freezer at -14^oC for 24 hours. After 24 hours of freezing, the specimens were taken out and kept in open atmosphere for 24 hours. This completes one cycle of freezing and thawing. The influences of freeze-thaw cycles on the mechanical properties the compressive strength, weight were measured after 0, 3, 6, 9, 12 and 15 cycles of freeze-thaw. It is observed that, in most cases, concrete made with magnetic water has superior durability than those of normal water concrete although there is no significant difference in its composition.

Keywords: slump test, acidimmersion, freezing & thawing, compressive strength test

1. Lab Testing

The following are the test conducted on the concrete cube samples are as follows

1. Slump test
2. Acid Immersion
3. Freezing & thawing

1) Slump Test

The results obtained (in mm) for various M30& M40 grade of concrete are tabulated below.

Workability of NWC and MWC of M30 gradeconcrete

S. No.	Type of Water	Slump Value
1	Normal Water(NWC)	65
2	Magnetic Water(MWC)	70

Workability of NWC and MWC of M40 grade concrete

S. No.	Type of Water	Slump Value
1	Normal Water(NWC)	60
2	Magnetic Water(MWC)	65

2) Acid Immersion

i. The amount of percentage of weight loss in M30 grade concrete, when cubes immersed in 5%, 10%, 15% HCL for 28 days are presented below tables

Percentage of HCL	Normal water concrete			Magnetic water concrete		
	Average weight of cube before immersion (kg)	Average weight of cube after immersion (kg)	Weight loss in %	Average weight of cube before immersion (kg)	Average weight of cube after immersion (kg)	Weightloss in %
5%	2.547	2.497	2.00	2.612	2.587	0.92
10%	2.593	2.500	3.57	2.626	2.580	1.73
15%	2.577	2.435	5.50	2.588	2.384	2.67

ii. The amount of percentage of strength loss in M30 grade concrete, when cubes immersed in 5%, 10%, 15% HCL for 28 days are presented below tables

Percentage of HCL	Normal water concrete			Magnetic water concrete		
	Average strength of Cube before immersion in N/mm2	Average strength of Cube after immersion in N/mm2	Strength loss in %	Average strength of Cube before immersion in N/mm2	Average strength of Cube after immersion in N/mm2	Strength loss in %
5%	38.8	36.47	6.00	46	44.92	2.34
10%	38.8	34.09	12.13	46	43.09	6.31
15%	38.8	27.00	29.00	46	38.74	15.78

iii. The amount of percentage of weight loss in M40 grade concrete, when cubes immersed in 5%, 10%, 15% HCL for 28 days are presented below tables

Percentage of HCL	Normal water concrete			Magnetic water concrete		
	Average weight of cube before immersion (kg)	Average weight of cube after immersion (kg)	Weight loss in %	Average weight of cube before immersion (kg)	Average weight of cube after immersion (kg)	Weight loss in %
5 %	2.593	2.560	1.24	2.690	2.674	0.43
10 %	2.611	2.540	2.45	2.593	2.568	0.95
15 %	2.670	2.555	4.27	2.625	2.565	2.27

iv. The amount of percentage of strength loss in M40 grade concrete, when cubes immersed in 5%, 10%, 15% HCL for 28 days are presented below tables

Percentage of HCL	Normal water concrete			Magnetic water concrete		
	Average strength of Cube before immersion in N/mm2	Average strength of Cube after immersion in N/mm2	Strength loss in %	Average strength of Cube before immersion in N/mm2	Average strength of Cube after immersion in N/mm2	Strength loss in %
5%	41	38.65	5.71	50.4	49.10	2.56
10%	41	37.56	8.37	50.4	48.00	4.76
15%	41	32.10	21.70	50.4	44.30	12.10

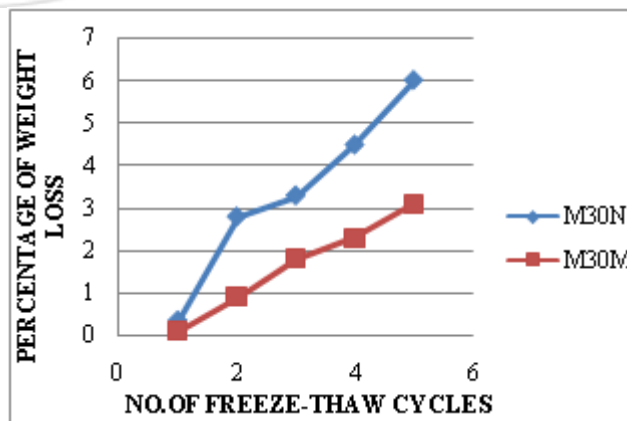
3) Freezing & Thawing

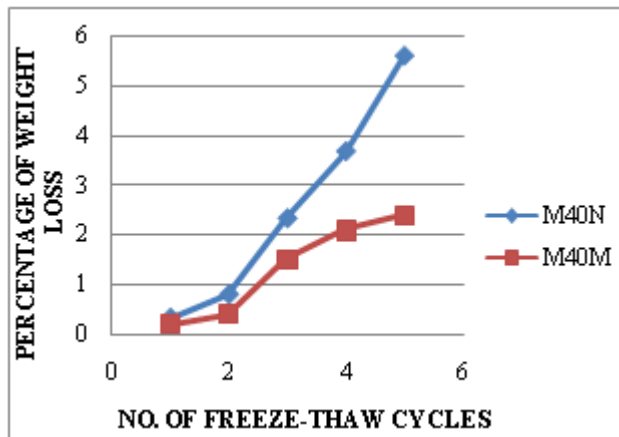
i. The effect of freeze-thaw cycles on the weight for M30 grade NWC and MWC (28days of curing) are presented in Table,

No. of Freeze-thaw cycles	NWC		MWC	
	Weight (kg)	% weight loss	Weight (kg)	% Weight loss
0	2.616	0.00	2.608	0.00
3	2.608	0.34	2.603	0.20
6	2.594	2.84	2.581	0.91
9	2.527	3.33	2.561	1.83
12	2.490	4.51	2.548	2.30
15	2.459	6.03	2.530	3.10

ii. The effect of freeze-thaw cycles on the weight for M40 grade NWC and MWC (28days of curing) are presented in Table,

No. of Freeze-thaw cycles	NWC		MWC	
	Weight (kg)	% weight loss	Weight (kg)	% Weight loss
0	2.621	0.00	2.598	0.00
3	2.612	0.33	2.593	0.25
6	2.595	0.80	2.588	0.41
9	2.559	2.33	2.559	1.55
12	2.526	3.68	2.544	2.13
15	2.474	5.60	2.536	2.40





2. Conclusion

- The workability of magnetic water concrete is slightly high compared to normal water concrete.
- The percentage weight loss for M30 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage weight loss in NWC is 2.00%, 3.57% and 5.50% and in MWC is 0.92%, 1.73% and 2.67% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.
- The percentage strength loss for M30 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage strength loss in NWC is in between 6.00%, 12.13% and 29.00% and in MWC is 2.34%, 6.31% and 15.78% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.
- The percentage weight loss for M40 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage weight loss in NWC is in between 1.24%, 2.45% and 4.27% and in MWC is 0.43%, 0.95% and 2.27% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.
- The percentage strength loss for M40 grade NWC is more as compared to MWC when specimens are subjected to HCL acid. The percentage strength loss in NWC is in between 5.71%, 8.37% and 21.70% and in MWC is 2.56%, 4.76% and 12.10% when immersed for 28 days in 5%, 10% and 15% of HCL respectively.
- The percentage weight loss for M30 grade NWC is more as compared to MWC when specimens subjected to Freezing & thawing conditions. The Weight loss after 15 cycles of Freeze-Thaw in M30 grade NWC is in between 6.03%, 5.40%, 3.00% and in MWC specimens is 3.10%, 2.02%, 1.20% at 28, 60 and 90 days of curing respectively.
- The percentage weight loss for M40 grade NWC is more as compared to MWC when specimens subjected to Freezing & thawing conditions. The Weight loss in NWC normal is in between 5.60%, 4.20%, 2.80% and in MWC specimens is 2.40%, 1.90%, 0.50% at 28, 60 and 90 days of curing respectively.

3. Future Scope

- The same investigation of influence of magnetic water on workability and strength properties and Durability of

concrete can be extended by varying the magnetic strength.

- The present investigation can be extended to make concrete of higher grades and different types of concrete.
- The present investigation can be done by using micro silica/ Nano clay/ fly ash.

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Author Profile



Gone Naresh Kumar is Pursuing M-tech from CMR College of Engineering & Technology, Medchal Road Kaandalakoya(V) RR Dist.

Joel Shamil is Associate Professor in CMR College of Engineering & Technology, Medchal Road Kaandalakoya(V) RR Dist