ISSN: 0974-2115
www.jchps.com Journal of Chemical and Pharmaceutical Sciences

Effect of high range water reducers on sorptivity and water permeability of concrete

M. Hemapriya*, T.P. Meikandaan
[1]Department of Civil Engineering, Bharath Institute of Higher Education & Research, Bharath University, Chennai, Tamilnadu
***Corresponding author:E-Mail:meihemapriya@gmail.com**

ABSTRACT

The durability of concrete is mainly affected by a factor called permeation, such permeation of any external agents such as water, gas, air; etc causes deterioration to the structure. The present study deals with such factors of water permeability and sorptivity of concrete. Two concrete with two grades of mixes i.e. M25 & M35 used with super plasticizer, 2% were proposed for the present study. The basic tests for both fresh and hardened were studied. The samples were tested for two different periods of curing 7 and 28 days.Sorptivity tests and permeability tests have been conducted on test samples after 28 days of curing and the sorptivity and coefficient of permeability have been studied for the two grades of concrete namely, M25 and M35.

KEY WORDS: superplasticizer, permeability, sorptivity, water reducing agents

1. INTRODUCTION

Concrete is the most widely used construction material because it can be cast into any desirable shape. In general concrete has more compressive strength and poor tensile strength. Further, strong concrete is not said to be durable concrete, since durability of concrete depends on so many factors. Water cement ration is the basic point for concrete durability. Another important point for consideration is the permeability of concrete. Water absorption of the concrete can be tested by using surface absorption test but sorptivity test can give more precise results about the absorption.

2. EXPERIMENTAL PROGRAM

Materials and mix proportions: Here the concrete mix is M25 and M35 grades of concrete. The material used to producing concrete are cement of 53 grade (OPC), coarse aggregate of size 20mm, fine aggregate (sand), super plasticizer (sika plastocrete)

Compressive strength: The compressive strength test is carried out after 7days curing and after 28 days curing. The compressive strength of the specimen after 7 days and 28 days are tabulated below.

Table.1. 7 Days Compressive Strength of Concrete

Sl.No.	% of HWR	Compressive Strength (N/mm^2)	
		M25	M35
1.	0%	19.64	27.40
2.	2%	21.45	28.65

Table.2. 28 Days Compressive Strength of Concrete

Sl.No.	% of HWR	Compressive Strength (N/Mm^2)	
		M25	M35
1	0%	33.83	42.20
2	2%	36.20	45.80

Flexural Strength: The value of flexural strength of concrete after 7days and 28 days curing have tabulated

Table.3. 7 Days Flexural Strength of Concrete

Sl.No.	% of Hwr	Flexural Strength (N/Mm^2)	
		M25	M35
1	0%	2.60	3.50
2	2%	2.80	3.80

Table.4. 28 Days Flexural Strength of Concrete

Sl.No.	% of HWR	Flexural Strength (N/Mm^2)	
		M25	M35
1.	0%	4.10	5.50
2.	2%	4.50	5.85

Split tensile strength of concrete: The value of flexural strength of concrete after 7days and 28 days curing have tabulated

Table.5. 7 Days Split tensile Strength of Concrete

Sl.No.	% of HWR	Split Tensile Strength (N/Mm^2)	
		M25	M35
1.	0%	3.0	4.23
2.	2%	3.37	4.36

Table.6. 28 Days Split tensile Strength of Concrete

Sl.no.	% of HWR	Split tensile strength (n/mm^2)	
		M25	M35
1.	0%	3.90	4.80
2.	2%	4.50	5.30

Sorptivity:

Table.7. 7 Days Sorptivity test for concrete without HWR

Sl.No.	Time (Square Root Scale) – Min ($\sqrt{T}$)	I (Increase In Mass Per Unit Area) G/Mm^2		S (Sorptivity) Mm/Min$^{0.5}$	
		M25	M35	M25	M35
1	5.48	0.584	0.526	0.107	0.096
2	7.75	0.78	0.72	0.101	0.093
3	9.49	0.955	0.865	0.101	0.091
4	10.95	1.125	0.99	0.103	0.09
5	12.25	1.255	1.095	0.102	0.089
6	13.42	1.37	1.217	0.102	0.091
7	14.49	1.48	1.305	0.102	0.09
8	15.49	1.525	1.417	0.098	0.091

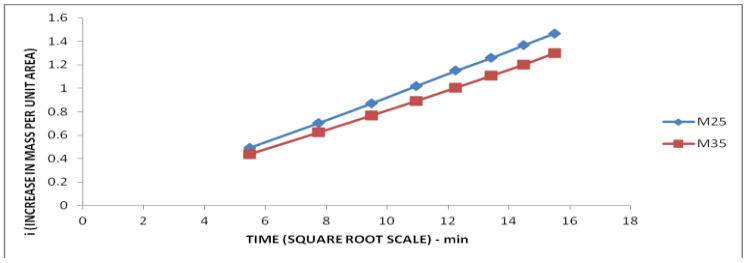


Table.8. 7 Days Sorptivity test for concrete with 2% of HWR

Sl.No.	Time (Square Root Scale) –Min ($\sqrt{T}$)	I (Increase In Mass Per Unit Area) G/Mm^2		S (Sorptivity) Mm/Min$^{0.5}$	
		M25	M35	M25	M35
1	5.48	0.476	0.42	0.087	0.077
2	7.75	0.634	0.585	0.082	0.075
3	9.49	0.768	0.69	0.081	0.073
4	11	0.872	0.8	0.08	0.073
5	12.3	0.974	0.91	0.08	0.074
6	13.4	1.08	1.005	0.08	0.075
7	14.5	1.12	1.085	0.077	0.075
8	15.5	1.224	1.12	0.079	0.072

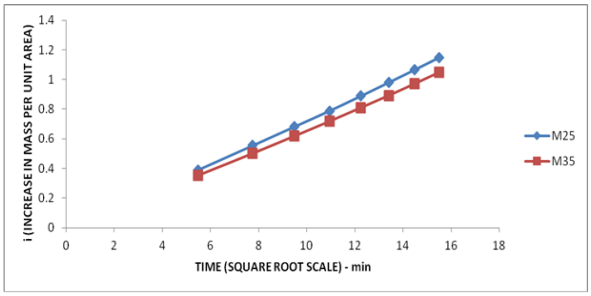


Table.9. 21 Days Sorptivity test for concrete without HWR

Sl.No.	Time (Square Root Scale) –Min ($\sqrt{T}$)	I (Increase In Mass Per Unit Area) G/Mm^2		S (Sorptivity) Mm/Min$^{0.5}$	
		M25	M35	M25	M35
1.	5.48	0.532	0.494	0.097	0.09
2.	7.75	0.744	0.686	0.096	0.089
3.	9.49	0.922	0.802	0.097	0.085
4.	10.95	1.085	0.944	0.099	0.086
5	12.25	1.174	1.075	0.096	0.088
6	13.42	1.296	1.164	0.097	0.087
7	14.49	1.402	1.286	0.097	0.089
8	15.49	1.495	1.355	0.097	0.087

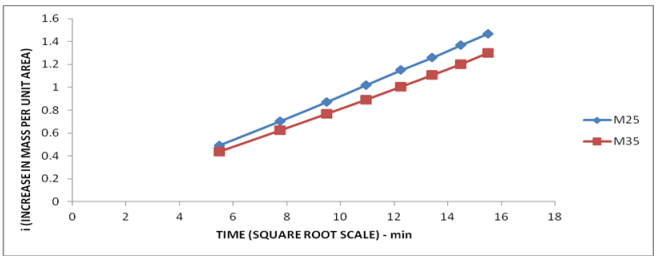


Table.10. 21 Days Sorptivity test for concrete with 2% of HWR

Sl.No.	Time (Square Root Scale) –Min ($\sqrt{T}$)	I (Increase In Mass Per Unit Area) G/Mm^2		S (Sorptivity) Mm/Min$^{0.5}$	
		M25	**M35**	**M25**	**M35**
1.	5.48	0.414	0.395	0.076	0.072
2.	7.75	0.594	0.544	0.077	0.07
3.	9.49	0.705	0.645	0.074	0.068
4.	11	0.82	0.774	0.075	0.071
5	12.3	0.916	0.866	0.075	0.071
6	13.4	0.995	0.924	0.074	0.069
7	14.5	1.094	1.025	0.076	0.071
8	15.5	1.195	1.096	0.077	0.071

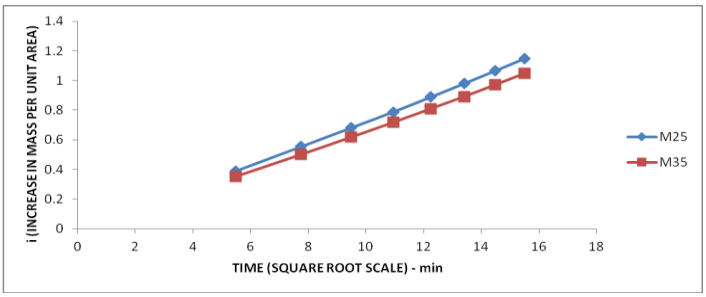


Table.11. 28 Days Sorptivity test for concrete without HWR

Sl.No.	Time (Square Root Scale) –Min (√T)	I (Increase In Mass Per Unit Area) G/Mm^2		S (Sorptivity) Mm/Min$^{0.5}$	
		M25	M35	M25	M35
1.	5.48	0.493	0.438	0.09	0.08
2.	7.75	0.705	0.624	0.091	0.081
3.	9.49	0.873	0.769	0.092	0.081
4.	10.95	1.02	0.892	0.093	0.081
5	12.25	1.15	1.005	0.094	0.082
6	13.42	1.26	1.107	0.094	0.082
7	14.49	1.37	1.203	0.095	0.083
8	15.49	1.47	1.3	0.095	0.084

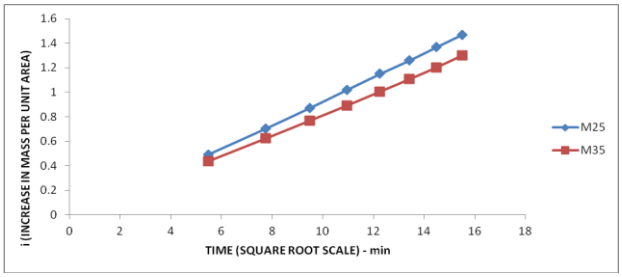


Table.12.28 Days Sorptivity test for concrete with 2% of HWR

Sl.No.	Time (Square Root Scale) –Min (√T)	I (Increase In Mass Per Unit Area) G/Mm^2		S (Sorptivity) Mm/Min$^{0.5}$	
		M25	M35	M25	M35
1.	5.48	0.39	0.35	0.071	0.064
2.	7.75	0.55	0.5	0.071	0.065
3.	9.49	0.68	0.62	0.072	0.065
4.	11	0.79	0.72	0.072	0.065
5	12.3	0.89	0.81	0.072	0.066
6	13.4	0.98	0.89	0.073	0.066
7	14.5	1.07	0.97	0.073	0.067
8	15.5	1.15	1.05	0.074	0.068

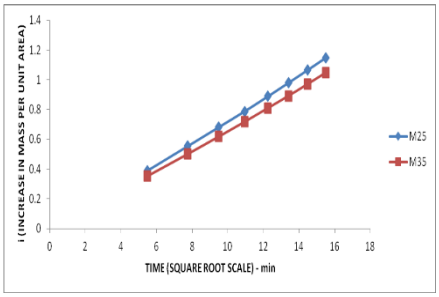
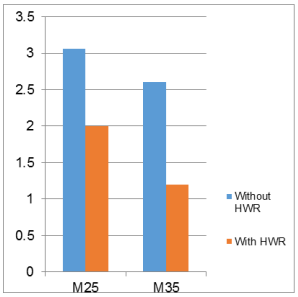


Table.13. Water permeability of concrete

Sl.No.	% of HWR Added	Co-Efficient Of Permeability (M/S) (1 X 10^{-11})	
		M25	M35
1.	0%	3.06	2.60
2.	2%	2.0	1.20



Summary: To study the effect of admixture on permeability of concrete 30 nos of cube samples using M25 grade of concrete and 30nos of cube samples using M35 grade of concrete have been cast and tested. For analyzing the workability and strength characteristics of M25 grade of concrete and M35 grade of concrete, cylinder and beam samples have been cast and tested. In addition to water permeability test with AIMIL permeability setup, Sorptivity test have been conducted using the cube samples. It is observed that the strength characteristics of super plasticized concrete increases with the increase in dosage of super plasticizers added. Sorptivity and permeability test samples have shown a marked performance since laboratory samples with due care in mixing, placing and compacting.

3. CONCLUSION

The workability of the concrete such as compaction factor and vee-bee degree increases with increase in percentage of superplasticizer for both the grades of concrete. The compressive strength, flexural strength and split tensile strength of M25 and M35 grades of concrete increases with the increase in the dosage of superplasticizer added (up to 2.5 %). In general the properties of hardened concrete such as compressive strength, split Tensile strength and Flexural strength are increasing with increase in percentage of superplasticizer. The Sorptivity of both M25 and M35 grades of concrete decreases with the increase in the dosage of superplasticizer added. The co-efficient of permeability of M25 and M35 grades of concrete decreases with the increase in the dosage of superplasticizer.

Scope for further studies:

- The sorptivity test can be conducted on the matured concrete samples.
- Permeability test can be conducted for extended period of time and in addition to water permeability, air and vapour permeability & rapid chloride permeability tests can also be conducted.

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