Influence of Marine Water on Compressive and Flexural Potency of M_{30} Grade of Concrete

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ABSTRACT

The compressive and flexural potency of concrete that are casted and cured in both fresh water and marine water have been studied experimentally in this study. According to IS 10262:2009, the concrete mix design for M_{30} grade was completed. It was discovered that the mix composition was 1:1.662:2.356 with a W/C ratio of 0.44. Using fresh water and marine water, concrete cube case gauging 150 mm x 150 mm x 150 mm and beam case gauging 100 mm x 100 mm x 500 mm were cast. Additionally, both freshwater and saltwater water are used to cure these cast specimens. These specimens are tested for compressive and flexural potency values at 7, 14, and 28 days following the end of curing. According to the findings, specimens casted and cured in marine water displayed elevated compressive and flexural potency values than specimens cast and cured in fresh water.

Keywords—Marine water; Fresh water; Compressive Potency; flexural potency;

1. INTRODUCTION –

Concrete has been used in construction methods for a long time. Cement, sand, aggregates, water, and some admixtures make up its composition (if required). Each of these elements, with the exception of cement, are derived naturally. Concrete's workout, which influences its potency and durability, is significantly influenced by water. Marine water is water that has been obtained from the sea and contains a variety of substances in varying concentrations. Most salt water is quite invariable in chemical composition, as evidenced having of around 3.5 % soluble salts by weight. Mainly marine water have some chemical compositions.

The Atlantic Ocean's Na+ and Cl- ionic concentrations, which are primarily 11000 and 20000 mg/litre, correspondingly, are the highest. The factors of exposure to marine water that really can affect concrete can be studied by first investigating the ingredients of the particular concrete twisted up that may be impacted by these factors, then by moving on to the effects of the interaction between both the marine water and the concrete, and finally by considering the precautionary measures that must be taken to prevent abhorrent advances of the concrete as a result of the interaction with the marine water. The IS- 456:2000 code specifies the water standards.

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Specifications for blending and curing of concrete. In a few places, regional gulp downwater is unclean and may seat a large extent of salts due to industrial wastes pollutions.

A fifth of the earth's surface is made up of large bodies of water, some of which extend more than ten kilometers in length.

The sea water is handled as water containing a high percentage of sodium chloride, while the fresh water is an aerated expanse of water that is free of any kind of contaminants.

1.1. Consequences of marine water on concrete

At the time of 1840, J. Smeaton and L.J Vicat inaugurals the concrete behavior when the marine water comes into action.

J. Smeaton and L. J. Vicat shared their view on concrete in 1840. From their research, it was stated that the concrete structures which are in contact with marine water will undergoes chemical disintegration (Tibbetts, 1986). Mehta (1980) detailed that unsafe cracking and disintegration of concrete occurred when the concrete cylindrical specimen is unveiled to marine water which is given in Figure 1.

The disintegration process of the concrete structures when these are unveiled to marine water occurs due to the carrying of marine water through wind for a few mile from the seaside region (Olutoge, F. Adeyemi, 2014). In marine water the concrete is subjugate to frost action, abrasion effect of sand and due to other aqua bodies. (S. O. Osuji and E. Nwankwo, 2015). Even though the concrete possess the high structural achievement, it will be early disintegrated in marine water (Dr. Nagabhushana1, Dharmaraj Hebbal,2017). Due to the assertive marine nature, the triumphant achievement of marine structures will rely on their longevity hostile to the marine nature. Attributable to a large extent of unveilings of marine structures, they provide a wide chance to apprehend the convolutions of longevity of concrete[3]

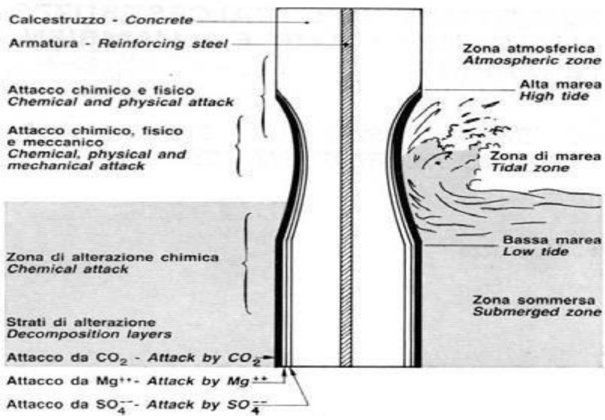

Fig 1 : Behavior of concrete after unveiled to marine water

The main damage caused by marine water to concrete structures is the deposition of chlorides on steel reinforcing, which leads to corrosion and the collapse and disintegration of structures. The usage of marine water is restricted as a result of this worry. By taking preventive action, this effect might be in some way diminished.

The contemporary investigation intends to investigate the compressive and flexural potency's of concrete that has been mixed with fresh and saltwater and has also been cured in both environments.

2. MATERIALS USED -

a) Cement: OPC 53 grade of Cement was used in this project.

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b) Fine Aggregate: The regionally feasible river sand passing through 4.75mm sieve was taken. And 2.62 is found to be the specific gravity of sand.

c) Coarse Aggregate: Maximum size of 20mm crushed granite stone aggregates is used in the mix. The specific gravity and fineness modulus of coarse aggregates are found to be 2.76 and 7.25.

d) Fresh Water: For both mixing and curing, locally available clean and portable water free from impurities was used.

e) Marine Water: Marine water used in this research is collected form Kottapatnam beach which is in kottapatnam mandal in Ongole revenue division.

3. EXPERIMENTAL PROCEDURE -

As per IS-10262:2009 [6], design for M_{30} grade of concrete done with w/c ratio of 0.44. The mix proportion is 1:1.662:2.356.A Total of 72 concrete specimens are prepared in two batches. The first batch having 36 cube specimens of size 150x150x150(mm). Out of which 18 cubes were casted adopting clean water and the remaining 18 cubes were casted adopting marine water. The 18 cube cases that are made with fresh water were further divided into two; 9 cube specimens cured in fresh water and the rest i.e., 9 cube specimens cured in marine water. And the other 18 cubes specimens that are made with marine water are cured in similar manner. The second batch involves the casting of 36 beams of gauge 100mm x 100mm x 500mm. The same procedure is followed as in the cubes in case of mixing and curing. Tables 3.1 and 3.2 provide specifics on how concrete specimens were prepared.

Table 3.1: Details of Concrete Cube Specimens

Age of Curing (Days)	F-F	F-M	M-F	M-M
7	3	3	3	3
14	3	3	3	3
28	3	3	3	3

Table 3.2: Details of Concrete Beam Specimens

Age of Curing (Days)	F-F	F-M	M-F	M-M
7	3	3	3	3
14	3	3	3	3
28	3	3	3	3

- ***F-F:*** Casted and Cured by adopting Fresh Water
- ***F-M:*** Casted adopting fresh water and cured with marine water
- ***M-F:*** Casted adopting marine water and cured with freshwater
- ***M-M:*** Casted and Cured by adopting Marine Water

Fig 3.1: Casted Cube Specimens

Fig3.2: Casted Beam Specimens

Each specimen undergoes a 7, 14, and 28-day curing process. After the curing period, all these specimens are tested in CTM and UTM for the Compressive and flexural potency values.

Fig3.3: Universal Testing Machine

Fig 3.4: Testing of Cube Specimens on CTM

Fig 3.5: Testing of Beam Specimens on UTM

4. RESULTS AND DISCUSSIONS –

Based on the test conducted on cubes and beams specimens the following results are obtained. The values of compressive potency and flexural potencys are given in Table 4.1 and Table 4.2. Accordingly the graphs are also plotted which are shown in Figure.4.1 and Figure 4.2.

Table 4.1: Variation of Compressive Potency of Cube Specimens

Concrete Designation	Age of Curing(Days)	Average Compressive Strength (N/mm^2)
F-F	7	25.47
	14	33.21
	28	39.54
F-M	7	25.22
	14	31.42
	28	37.6
M-F	7	25.92
	14	33.85
	28	40.2
M-M	7	26.1
	14	34.32
	28	41.33

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Table 4.2: Variation of Flexural Strength of Beam Specimens

Concrete Designation	Age of Curing(Days)	Average Compressive Strength (N/mm^2)
F-F	7	3.8
	14	4.77
	28	5.68
F-M	7	3.6
	14	4.51
	28	5.05
M-F	7	4.01
	14	4.82
	28	5.74
M-M	7	4.2
	14	5.01
	28	5.97

The Following figures show the graph plotted for variations of Compressive potencys and Flexural potency values for different ages of curing.

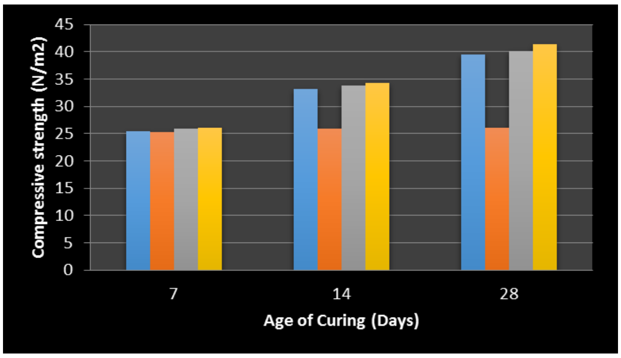

Fig 4.1: Graph showing variation of Compressive Potency of Cube Specimens

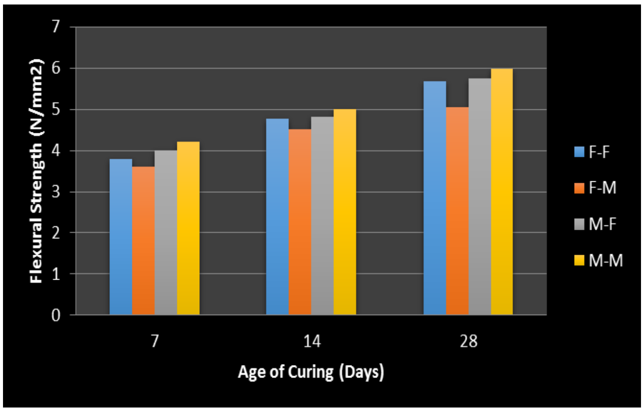

Fig 4.2: Graph showing variation of Flexural Potency of Beam Specimens

5. CONCLUSIONS –

An experimental work was accomplished to examine the compressive Potency and flexural potency variation when freshwater and saltwater were used to mix and cure the concrete. From the experimental results the obtained the following conclusions are made:

1. The compressive potency of concrete cubes casted with fresh water at 7,14 and 28 days was found to be 25.47 N/mm^2,33.21 N/mm^2 and 39.54 N/mm^2.
2. The flexural potency of concrete beams casted with fresh water is 3.8 N/mm^2, 4.77 N/mm^2 and 5.68 N/mm^2 at the age of 7, 14 and 28 days.
3. When marine water is used in concrete, the compressive and flexural potency values obtained at 7, 14 and 28 days are 26.1 N/mm^2, 34.32 N/mm^2 and 41.33 N/mm^2& 4.2 N/mm^2, 5.01 N/mm^2, 5.97 N/mm^2 respectively.
4. When all the casted specimens those are casted with both fresh and marine water there was a marginal increase of compressive and flexural potency values.
5. According to the research findings, using marine water for both the casting and curing procedures has no impact on the compressive and flexural potency values of concrete. In construction techniques, concrete can be employed without reducing potency values.

REFERENCES

[1] Dr. Nagabhushana1,Dharmaraj Hebbel(2017),"Effect Of Salt Water On Compressive Strength of Concrete". International Research Journal of Engineering and Technology (IRJET) e-Volume: 04 Issue: 05 | May -2017.

[2] Olutoge, F. Adeyemi1 and Amusan, G. Modupeola (2014) "The Effect of Sea Water on Compressive Strength of Concrete." International Journal of Engineering Science Invention Volume 3 Issue 7 ǁ July 2014 ǁ

[3] Md. Moinul Islam, Md. SaifulIslam (2012) Suitability of sea water on curing and compressivestrength of structural concrete.Journal of Civil Engineering (IEB),40 (1) (2012).

[4] Preeti Tiwari et al.(2014), Effect of Salt Water on CompressiveStrength Of Concrete Int. Journal of Engineering Research and Applications Vol. 4, Issue4(Version 5), April 2014.

[5] Mehta, P. K. (1980) "Performance of Concrete in Marine Environment", ACI. Pub.

[6] IS -10262:2009 Code book of "Concrete Mix Design.