Effect of Saline Water in Mixing andCuring on Strength of Concrete at Coastal Area

Supriya C L[1], Harshith H.J[2], Manjunath H S [3], Chetan K M[4]

Abstract— **Presently, concrete is most widely used construction material due to its good compressive strength and durability. It is estimated that the consumption of concrete in the world is around 12 billion tons every year. The strength and durability of concrete will be fully developed only if it is cured. Curing of concrete structure is essential if it is to perform the intended function over the design life of the structure. Concrete is needed to be provided with moisture for a minimum period of 28 days for good hydration and to attain desired strength. Any laxity in curing will badly affect the strength and durability of concrete. Anarea like sea side, or the area where saline water is available for the curing, is a scarcity of pure water where curing with normal water is difficult and in cases where large areas like pavements have to be cured. In this paper, to find out the effect of saline water in mixing and curing on strength of concrete, 3 concrete cubes are casted and cured with fresh water and 3 concrete cubes are casted and cured with saline water. These cubes are cured for 7, 14 and 28 days and are tested for compressive strength respectively.**

Key Words: ***Curing, Durability, Strength, Salt, Concrete, Saline* water *Compressive Strength***

I. INTRODUCTION

Concrete is one of the major building material which is used in modern day construction. Concrete isused in large quantities due to its excellent structural performance and durability. Concrete is used for numerous purposes in construction such as construction of buildings, dams, foundations, highways, parking structures, pipes, and poles. Also, the use of concrete offshore drilling platforms and oil storage tanks is already on the increase. Concretepiers, decks, break-water, and retaining walls are widely used in the construction of harbors and docks. Floating offshore platforms made of concrete are also being considered for location of airports, power plants, and waste disposal facilities in order to relieve land from pressures of urban congestion and pollution. It isvery tough to find an option for concrete in construction, which is durable and economic. The durability of concrete is generally regarded as its ability to resist the effects and influences of the environment, while performing its desired function.

Concrete is a composite material composed mainly of water, aggregate, and cement. Water is an important ingredient of concrete as it actively participates in chemical reaction with cement. Proper curing of concrete structures is important to meetperformance and durability requirements. Due to rapid growth of population the world is facing a number of problems. Researchers say on the near future, fresh water will be scare and very difficult to get. It is said that in 2025 half of the mankind will live in the areas where fresh water is not enough. Curing of concrete stands for procedures devoted to promote cement hydration, consisting of control of time and humidity conditions immediately after the placement of concrete mixture in to form work. Curing is designed primarily to keep the concrete moist, by preventing the loss of moisture from the concrete during the period in which it is gaining strength. The amount of mixing water in concrete at the time of placement is normally more than must be retained for curing. However excessive loss of water by evaporation may reduce theamount of retained water below that necessary for development of desired properties. Curing is carried out by supplying water to the surface of concrete in a way that ensures that it is kept continuously moist.

II. OBJECTIVES

- To determine the compressive strength for the proportion of M-20 for the period of 7, 14and 28 days respectively.
- Compare the compressive strength between normal water cured blocks and salinity watercured blocks.

III.MATERIALS AND METHODOLOGY

MATERIALS

Cement**:** Cement is a main element of concrete as itacts as binding material, binds aggregate together. OPC cement confirming to IS: 12269 shall be used for the experimental work.

FIG 1.1 Cement

Coarse Aggregate: Crushed stone aggregate of maximum size 20mm confirming to IS 383-1970.

Coarse Aggregate

Fine Aggregate (Sand): The fine aggregate passing through 4.75mm sieve conformed to IS:383-1970.

FIG 1.2 Fine Aggregate

Saline Water**:** Seawater is water from sea or ocean. Sea Saline water is used for the experiment.

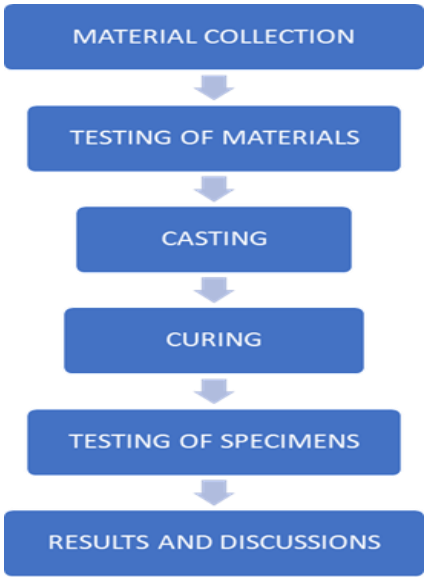
FIG 1.3 Saline Water

METHODOLOGY

Apparatus**:** Cube moulds of size 150×150×150mm, Tamping rod, Compression testing machine.

Procedure:

- To find out the effect of Saline water on compressive strength of concrete, 3 concretecubes are casted and cured with fresh water and 3 concrete cubes are casted and cured with Saline water.
- Calculate the required materials to prepare the concrete cubes as per the proportion.
- Mix the materials thoroughly.
- Once after concrete is properly mixed using the saline water and portable water respectively.
- Concrete will be poured to mould.
- Fill the cube moulds in approximately 3layers by ramming each layer for 25times respectively.
- Immediately cover the mould with wet mats.
- The specimens are removed after 24 hoursfrom the mould and cured in water for 7,14,and 28 days respectively and tested for compressive strength.



Methodology Flowchart

IV. TESTS AND PROPERTIES

Cement: Laboratory tests conducted on specificgravity, fineness, initial, final setting time and Normal consistency of cement.

Table 1: Physical Properties of Cement

Sl. No	Property ofCement	Values Obtained	
		Normal water	Saline water
1	Standard consistency	29%	29%
2	Initial setting time	60 minutes	70 minutes
3	Final setting time	195 minutes	200 minutes
4	Specific gravity	2.39	2.56
5	Fineness	8%	

Coarse Aggregate: The physical properties of coarse aggregate like specific gravity, sieve analysis, water absorption tests are conducted in accordance with IS: 2386.

Table 2**:** Physical Properties of Coarse Aggregate

Sl. No	Property ofCoarse Aggregate	Values Obtained	
		Normal water	Saline water
1	Specific Gravity	2.56	2.58
2	Fineness Modulus	1.13	-
3	Water Absorption	0.5	0.6

Fine Aggregate**:** The physical properties of fine aggregates like specific gravity, sieve analysis, water absorption tests are conducted in accordance with IS: 2386.

Table 3**:** Physical Properties of Fine Aggregate

Sl.No	Property ofFine Aggregate	Values Obtained	
		Normalwater	Saline water
1	Specific gravity	2.53	2.57
2	Fineness modulus	2.78	-
3	Water Absorption	1.5	1.6

Workability:

1. The main aspect affecting the workability of the concrete is its water content.
2. Slump test is used to find out the workability of the fresh concrete.

Table 4**:** Physical Properties of Fresh Concrete

Sl.No	Property of fresh concrete	Values Obtained	
		Normal water	Saline water
1	Slump test	0.45%	0.45%

Compressive Strength Test

- The compressive strength of concrete that is ultimate strength of concrete is defined as theload which causes failure of the specimen divided by the area of the cross section in the uniaxial compression, under a given rate of loading.
- To avoid variation in the result ofcompression test, great care is taken during the casting of the specimens and while applying the load as well.
- The concrete cubes are cured for a period of 7,14 and 28 days and after the desired curingperiod is done, cubes are removed from the curing tank and weighed and tested for compressive strength.
- Compressive strength of concrete is calculated by using the formula below.

Ultimate load/ cross-sectional area of specimen

Fig 1.4: Preparation of Mould

Fig 1.5 Demolding of Mould

Compressive Strength Test

Mix Designation	Average CompressiveStrength (N/mm²)		
	7 days	14 days	28 days
Fresh water	19.12	22.56	29.22
Saline water	11.68	17.88	23.53

Table 5: Compressive Strength Test

V. CONCLUSION

- From the results it is clear that, there is a gradual increase in the concrete cubes whichare casted and cured with fresh water as compared with the concrete cubes casted andcured with saline water.
- The rate of the strength gain in salt water cubes is slow as compared to the fresh watercubes.
- The surface of cubes casted and cured using sea water are darker in color as compared to normal water cubes.
- The use of saline water in construction activities should not be encouraged because the compressive strength is low compared tothe fresh water.
- And there is a need of higher research to be carried out to study the effect of seawater in mixing and curing of concrete.
- Also sea water changes its normality in billions of years, so this effect is due to change in normality should also be checked experimentally.

Comparison between Saline Water and Normal Water Cube

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