Comparative Study of Quality of Water over Strength of Concrete Structure –An Analytical Approach

Velisala Supriya, D Satish Chandra, S.S. Asadi

Abstract: ***The construction of structures in the world is increasing rapidly. Due to this the demand for the water in construction also increased, with this the ground water levels are decreasing day by day. As we know on the earth surface there is 97.5 % of saltwater and 2.5% of fresh water. So, it is advisable to conserve the water for future generations. It can be achieved by utilizing the saltwater for construction purposes. This project outlines the comparative study of quality of water over strength of concrete structure by using fresh and saltwater (NaCl dissolved). As 90% seas and oceans contain salinity of 3.5% (35 ppp). The cubes are to be casted with fresh and 3.5 % of saline water prepared by mixing NaCl and the compressive strength results for 3, 7 and 28 days and tested compressive testing machine and the results are compared. As sodium chloride mixed water is used in concrete batching, there is either increase or decrease in strength of concrete. To know this strength variation this project also aims at the strength comparison for 3.995, 5, 10, 15, and 20% of NaCl mixed water as constituent of concrete.***

Index Terms: initial setting time, final setting time, sodium chloride (NaCl), compressive strength.

I. INTRODUCTION

Now a day's construction project around the world increasing at an experimental growth the developing countries were trying to boom their economic by implementing the infrastructure project and creating new employment opportunities to the youth. Even due to innovation of new type of countries such as PPP (public private partnership) contracts results in rapid growth of infrastructure projects. As there was an internal mitigation within the state within the country most of the people from the village were mitigating towards cities for employment opportunities and it leads to boom in real estate sector and new satellite cities were formed. With rapid growth of construction rate outside the cities and mostly due to increase in efficiency and technology in construction the profit rate has been increasing with decent rate so contract was showing interest in undertaking multiple projects [1]. In research with title "Evaluation of Influence of The Salt in the cement hydration to oil wells" by using the Non-conventional differential thermal analysis method author researched that 0 – 10% of the salt hydration process were increased and after up to 20% gradually it decreases [2].In another research with title "Effect of Different Types of Water on Compressive Strength of Concrete" author concluded that by using the different types of water for casting and curing of cubes there is no variation in the compressive strength [3].In this research work with title "Effect on Workability and Strength of Concrete due to Variation in Mixing Water Temperature" author concluded that due to the increasing of temperature conditions it decreases the workability of concrete [4].Finally in another research work by another author with title "Effect of Salt Water in the Production of Concrete" concluded that 8% of the strength decreases the concrete by using the salt in concrete [5].

II. RESEARCH SIGNIFINANCE:

Water is distributed across earth. Most water in the earth's atmosphere and crust comes from the world's oceans saline sea water, while freshwater accounts for only 2.5% of the total. Only 3% of the world's water is fresh water, and two-third of that is tucked away in frozen glaciers. Most of the people facing the problem for water scarcity as a result of this control the usage of fresh water and adopt the salt water in order to save fresh water to the further generation on that note as we use salt water for concrete which is cheap and reliable for construction. A revolutionary new salt-water concrete has to be more effective, strong, and durable than conventional fresh water concrete has to be implemented in order to decrease the usage of fresh water. The composition of the fresh concrete occupies 6 to 8%. Salt water is water that has more salinity than fresh water. In this research we study the properties of concrete with salt water and the extended in dosage of salt water to concrete.

III. METHODOLOGY

a. Number of literature reviews is studied.
b. Number of literature reviews is studied.
c. Various types of materials should be collected.
d. Number of experiments should be tested like specific gravity of cement, fine aggregate and coarse aggregate and also water absorption.
e. Cubes are prepared for different salt concentrations (3.5, 5, 10, 15)
f. The concrete cubes are casted with salt and cured with fresh water and also casted and cured with freshwater.

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g. The cubes are tested in the compressive testing machine. Then the results should be recorded.

A. Mix Design

As per IS 10262-2009 different quantities of mix design for M30 grade of concrete.

a. Grade designation = M30
b. Type of cement = OPC 53grade
c. Maximum normal aggregate size = 20mm
d. Maximum water cement ratio =0.45
e. Maximum cement content = 450kg/m^3
f. Exposure conditions = severe
g. Type of aggregates = crushed angular aggregates
1:1.41:2.62
h. Maximum water content = 186liters
i. Estimated water content = 197.16liters
j. Estimated cement content = 438.19kg/m^3
k. Volume of concrete = 1m^3
l. Volume of fine aggregate = 619.85kg
m. Volume of coarse aggregate = 1149.29kg

In this experimental work the strength of the concrete specimen is determine by preparing the concrete specimen or cubes, set the moulds with the help of clamps and screws and apply the oil inside the mould before placing the concrete mix proportion. After placing the concrete mix into the mould then tamp each layer into 25times by tamping rod demould the cube after 24hours and after put it for curing for 14, 21, 28 days and after cubes were tested in compressive testing machine then results were recorded.

Coarse aggregate: The maximum normal size of the 20mm aggregates is used. The specific gravity of coarse aggregate is 2.81as per IS 10262 – 2009 maximum 20mm of aggregates are used. These aggregates are required from nearest batching plant of Koneru Lakshmaiah Education Foundation(Deemed to be University).

Fine aggregate: The fine aggregate pass through 4.75mm sieve and is consider as grading zone II as per IS 10262 – 2009.The specific gravity of fine aggregate is 2.53 and these aggregates are required from nearest batching plant of Koneru Lakshmaiah Education Foundation (deemed to be University)

Fig. 1 shows the Compressive Testing Machine used for testing of cubes.

Fig. 1: Compressive Testing Machine (CTM)

Fresh water: For curing and casting of the concrete specimen using ordinary portable water.

Cement: OPC 53 grade of cement is used, the specific gravity of cement is 3.13

IV. RESULTS & DISCUSSIONS

Table I shows the Compressive strength attained by fresh water and respective salt percentages in water by Cubes.

Table I: Compressive strength attained by fresh water and respective salt percentages in water by Cubes.

Time of curing	Fresh water	3.5%	5%	10%	15%
14days	23.6	35	33	28	30
21days	26	40	33	28	15
28days	36.8	43	36	36	35

Table II shows the Results obtained for different characteristics of cubes.

Table II: Results obtained for different characteristics of cubes

S.no	Characteristics	Standard values	Obtained values
1	Initial setting time	Not less than 30 minutes	40
2	Final setting time	Not more than 600 minutes	520
3	Standard consistency	20 to 50	26
4	Fineness	<10	4.8

Fine and Coarse aggregate: The properties of coarse and fine aggregates are shown in below the Table III.

Table III: Test results for fine and coarse aggregate

S.no	Characteristics	Fine aggregate	Coarse aggregate
1	Specific gravity	2.53	2.81
2	Total water absorption	1	0.9

***Compressive Test Results*:** The compression test results after the 14, 21, 28 days of curing. The cubes are casted with salt water and cured with fresh water and also cast and cured with fresh water. The graph should be given below.

Below the Fig. 2 indicates the increasing the strength of concrete in 14, 21, 28 days of curing when compared with freshwater as well as salt water.

This Fig. 2 indicates the 14, 21, 28 days of curing strength.

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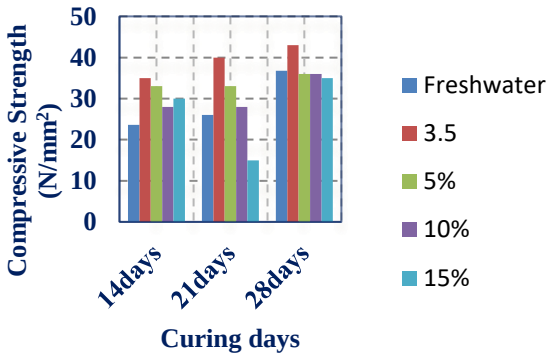

Fig. 2: Compressive Strength Vs Curing Days for cubes

Below the Fig. 3 indicates the 14, 21, 28days of curing the strength of the concrete is increased when compared with freshwater as well as salt water. This Fig. 3 indicates the 14, 21, 28days of curing.

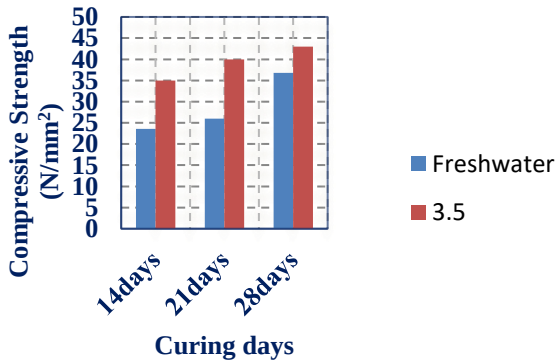

Fig. 3: Comparative Compressive strength among fresh water and 3.5% of NaCl in water

Below the Fig. 4 indicates 14, 21, 28 days of curing, the strength of the concrete is increased when compared with freshwater as well as saltwater.

This Fig.4 indicates the 14, 21, 28 days of curing strength.

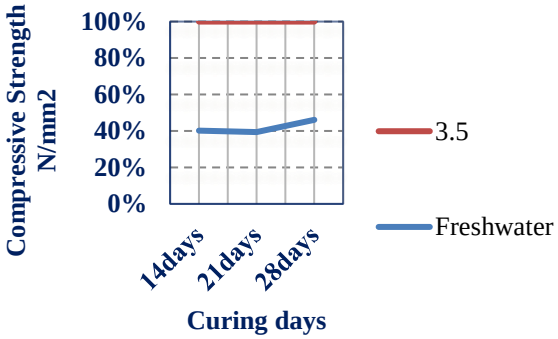

Fig. 4: Line diagram of comparative compressive strength

Below the Fig. 5 indicates the 14, 21, 28 days of curing, the strength of the concrete is increased when compared with freshwater as well as saltwater.

This Fig. 5 indicates the 14, 21, 28 days of curing strength.

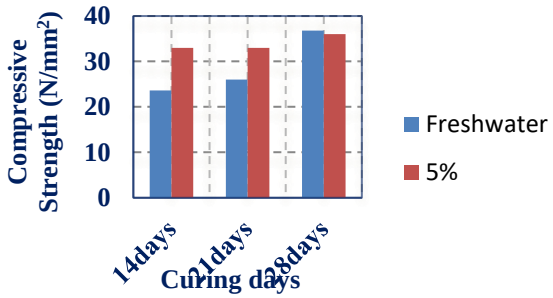

Fig. 5: Comparative Compressive strength among fresh water and 5% of NaCl in water

Below the Fig. 6 indicates the 14, 21, 28 days of curing, strength of the concrete will increase when compared with salt water as well as fresh water. This Fig. 6 indicates the 14, 21, 28 days of curing strength.

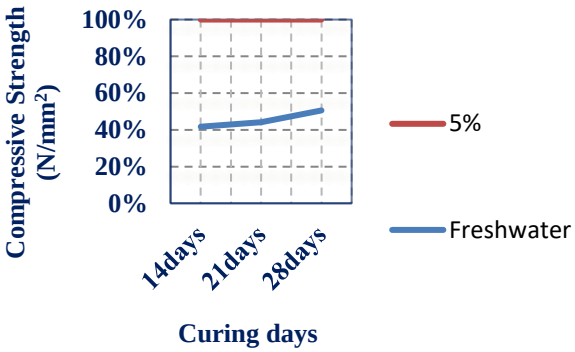

Fig. 6: Line diagram of comparative compressive strength

Below the Fig. 7 indicates the 14days of curing, increasing the strength of concrete cube when compared with freshwater as well as salt water.

This Fig. 7 indicates the 14 days of curing.

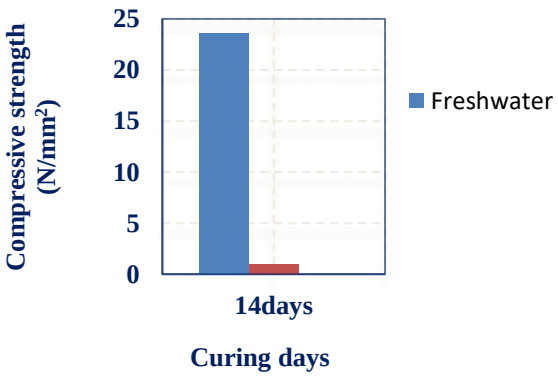

Fig. 7: Comparative Compressive strength among fresh water and 10% of NaCl in water

Below the Fig. 8 indicates the increasing the strength of concrete in 14 days of curing when compared with freshwater as well as salt water.

This Fig. 8 indicates the 14, 21, 28 days of curing strength.

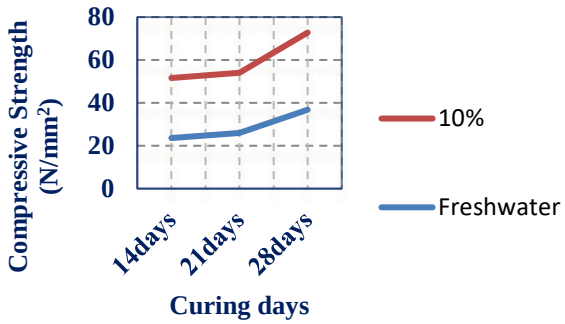

Fig. 8: Line diagram of comparative compressive strength

Below the Fig. 9 indicates the 14, 21, 28days of curing, increase the strength of concrete when compared with salt water as well as freshwater.

This Fig. 9 indicates the 14, 21, 28 days of curing.

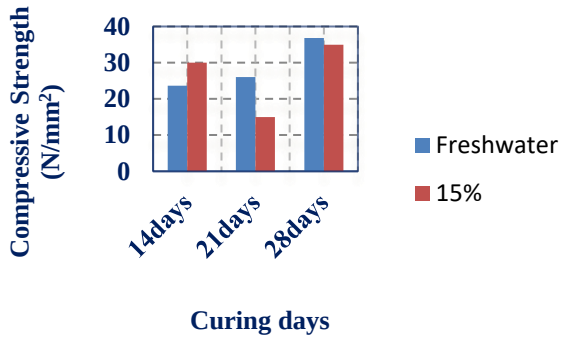

Fig. 9: Comparative Compressive strength among fresh water and 10% of NaCl in water

Below the line graph indicates the 15% of NaCl is added to the water the concrete strength will increase when compared to the fresh water.

This Fig. 10 indicates the 14, 21, 28days of curing strength.

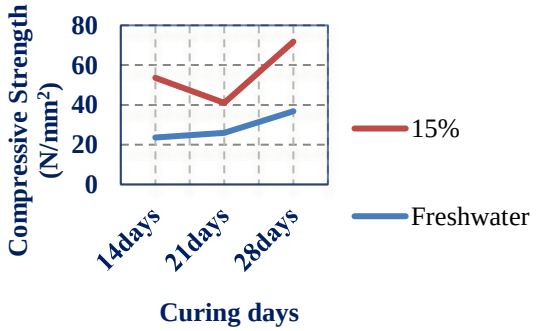

Fig. 10: Comparative Compressive strength among fresh water and 10% of NaCl in water

V. CONCLUSION

1. In this project work, experiments are conducted on M30 grade (1:1.41:2.62) of concrete, quality of water over strength of concrete structure was investigated.
2. In this investigation casted cubes with fresh water and calculated compressive strength using UTM and had 26kN/mm2 for 14days, 26kN/mm^2 for 21days and 36.8kN/mm^2 for 28days.
3. And also casted with 3.5% of NaCl in water and got 35N/mm^2 for 14days, 40N/mm^2 for 21days, 43N/mm^2 for 28days. And also casted with 5% of NaCl in water and got 33N/mm^2 for 14days, 33N/mm^2 for 21days, 36N/mm^2 for 28days. And also casted with 10% of NaCl in water and got 28N/mm^2 for 14days, 28N/mm^2 for 21days, 36N/mm^2 for 28days. And also casted with 15% of NaCl in water and got 30N/mm^2 for 14days, 15N/mm^2 for 21days, 35N/mm^2 for 28days.
4. Then concluded that cubes casted with 0-3.5% of NaCl in water increase the compressive strength and decrease the compressive strength for 5, 10, 15%.

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