IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

EFFECT OF PURNA RIVER BASIN WATER ON COMPRESSIVE STRENGTH OF CONCRETE

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Abstract:

The quality of water affects different properties of concrete. Limits are given in IS 456-2000 for different chemical constituents of water. Purna River comes under saline belt of Vidarbha region of Maharashtra state, India. Some talukas and villages under this talukas from Amravati, Akola and Buldana districts are come in saline belt. The water quality in this region has very high hardness value. The surface water and ground water in this region is highly conterminous. The study centered on the effect of water quality on compressive strength with quality of saline water as a case study. Water samples from different part of these districts are collected and chemical constituents of the water samples are determined in the laboratory. Concrete cubes are made by using this water samples and are compared with cubes made by using potable water. The results revealed that the chemical constituent of these water samples affects the strength characteristics of concrete.

***Index Terms* – water, compressive strength, purna river.**

I. INTRODUCTION

The strength, durability and other characteristics of concrete depends on the properties of its ingredients, on the proportion of mix, the method of compaction and other controls during placing, compaction and curing. The popularity of concrete is due to the fact that from the common ingredients, it is possible to adapt the properties of concrete to meet the demands of any particular situation. Water is the most important and least expensive ingredient of concrete. A part of mixing water is utilises in the hydration of cement to form the binding matrix in which the inert aggregates are held in suspension until the matrix has hardened. The remaining water serves as a lubricant between the fine and coarse aggregates and makes concrete workable. Both the quantity and quality of water affects the properties of concrete. The Ground Water Survey and Development Agency (GSDA), Government of Maharashtra identified 547 salinity-affected villages (136 in Amravati District, 318 in Akola District and 93 in Buldana District) of Vidharbha region, covering Purna river valley of 4693 sq km. The ground water in these villages is severely affected by salinity and poor quality. The water quality in this region has very high hardness value. The surface water and ground water in this region is highly contaminated.

Water serves the following purpose

1. To wet the surface of aggregates to develop adhesion because the cement pastes adheres quickly and satisfactory to the wet surface of the aggregates than to a dry surface.
2. To prepare a plastic mixture of the various ingredients and to impact workability to concrete to facilitate placing in the desired position.
3. Water is also needed for the hydration of cementing materials to set and harden during the period of curing.

II. LITERATURE REVIEW

Abrams[1] noticed that seawater with a total salinity of about 3.5 percent produces a slightly higher early strength but a lower long terms strength, the loss of strength is usually no more than 15% and can therefore often be tolerated. Thomas and Lisk [2] suggested that the sea water slightly accelerates the setting time of cement. Lea[3] reported that water containing large quantities of chlorides e.g. sea water tends to cause persistent dampness and surface efflorescence.Mc Coy [4] found that water with pH of 6.0 to 8.0, which does not taste saline or brackish, is suitable for use. Steinour [5] described that impurities in water may interfere with the setting of the cement, adversely affect the strength of the concrete or cause staining of its surface, and also lead to corrosion of the reinforcement. Addition of 2 per cent Sodium Benzoate reduces the compressive strength of concrete. IS 3025 [6] recommended that, testing of water play an important role in controlling the quality of cement concrete work. Systematic testing of the water helps to achieve higher efficiency of cement concrete and greater assurance of the performance in regard to both strength and durability. Water is susceptible to being changed due to physical, chemical or biological reactions which may take place at the time of sampling and analyzing. Hence it is necessary to test water before used for cement concrete production

III.MATERIAL AND METHODS

Sample stations are named as follows.

Sample Designation	Location/water sample
A	Potable water
B	Asegaon (Amravati District)
C	Gandhigram (Akola District)
D	Bhastan (Buldana District)

A total 16 cubes of having standard size 150 mm x 150mm x150 mm were cast and tested at 28 days for compressive strength having grade M20.

The used material properties are as follow.

Cement: Portland Pozzolana Cement (PPC) 53 grade ACC concrete plus is used in this study. The cement has Specific Gravity as 3.09 and Fineness as 6%

Fine & Coarse Aggregate: Locally available course aggregates having size 12 mm and crushed/manufactured sand is used.

Water: Water samples from different sample station is collected and tested for various properties. Underground bore well water from saline belt region is used for making concrete. The tests are performed as per IS 3025: 1964.

Design of Concrete Mix: The mix design is done as per Indian Standard code IS-10262 (2009)

Testing of Concrete: The testing of concrete is carried out as per IS 516-1959.

Results & Discussions

The sample collection stations are denoted as

Potable water – (A), Asegaon – Station (B), Gandhigram - Station (C), Bhastan- Station (D). The water testing results obtained are tabulated as follow.

Table 1.

Parameters	Maximum permissible Limit	Observed Values		
		A	B	C
TH (mg/l)	600	890	960	920

*TH = Total Hardness

Table 2.

Sample Designation	Average Compressive Strength (in N/mm^2)			
	7 days	14 days	21 days	28 days
A	13.8	18.2	19.2	21.2
B	16.7	18.6	16.1	15.2
C	18.1	19.4	16.2	14.6
D	17.5	18.9	16.1	14.8

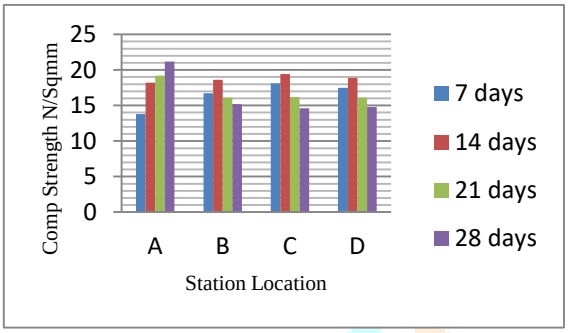

Figure -1.

The results obtained from the chemical analysis showed that the collected water samples have higher concentrations of hardness. From Table No.1 is can be seen that the hardness exceeds the permissible limits.Table No. 2 and Figure No.1 show that the compressive strength of concrete cubes produced with potable water increased with age and this goes a long way to depict the suitability of potable water for concrete. With potable water produced concrete, there was a progressive increment in compressive strength from 13.80 N/mm^2 to 21.20 N/mm^2.It was found from Table 2 that the compressive strength of concrete cubes produced with saline water at early age of 14 days tends to increase but later shows massive loss of compressive strength with its progression in age. The presence of elements such as Na, K, Ca, Cl helped to increase the rate of hydration which facilitated the early compressive strength increment but it later witnessed drastic reduction due to excessive hardness.

Conclusion and recommendations

Following the observations made in this study, it can be concluded that concrete produced with potable gained acceptable strength with age. Though, there was slight decrease in the strength but later on, the strength became steady. The concrete produced with saline water increases it's compressive at the 14days but later decreased drastically at the 21days and 28days.

Recommendations

1. Possibly Portable or fresh water should always be used for making concrete to achieve maximum compressive strength over time.
2. Saline or hard water should not be used for concrete production.
3. All water intended to be used for production of concrete must be checked and tested to make sure it conforms to the laid down standards.
4. Additions of some admixtures will enhance the results in a positive way.

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