Reuse of Treated Waste Water in Construction Industry

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***Abstract*— This paper attention on the reuse of treated waste water in construction business which helps to reutilize the waste water. The current water problem in India, there should to seem for other sources of water. India discharges Treated Waste Water (TWW) in natural water bodies, which can be used in construction activity.**

In this paper we focus on the use of Primary Treated Waste Water (PTWW), Secondary Treated Waste Water (STWW), and Tap Water (TW) for the mixing of concrete and the strength Parameters of water were tested which was found well as per IS 456-2000 limits. TWW tests were for the making of concrete and taking a compressive strength, concrete cubes for 7, 14 and 28 days and tensile strength on cylinder and for flexural strength beams were casted for 28 days. Hence results for PTWW, STWW and TW suggested STWW is appropriate for using in construction industry.

***Keywords*—Primary Treated Waste Water (PTWW), Secondary Treated Waste Water (STWW), and Tap Water (TW), compressive strength, split tensile test, flexure test.**

I. INTRODUCTION

In construction activity concrete being the largest part in construction material for making of concrete and curing of concrete large quantity of water is required. Annual global production of concrete is about 5 billion cubic yards. Which mean the approx (for simplification) concrete consumption of our world is one tonne per person per year, and it's the second most consumed material after water. The average water required for domestic purpose in developing country is 273 liter per person per day and as per IS10262-2009, 186 liters water is required for 1m3 of concrete. On an average 150 liters water is necessary for 1 cu.m of concrete. The 10 million liters water can be used for production, curing and site development activity for a 100,000 sq. m. area of multistory construction & for the construction double lane flyover the amount of water is nearly 70 million liter, also in construction water can be used for washing of sand & aggregate, mixing of concrete, curing and washing for mechanical machines. As per Indian Standard (IS) the potable water should be use for the concreting, but about 97 percent of water is in the oceans, while only 3 percent is potable water, only 1 percent is easily available on ground or surface water, the residue are stored in glaciers and icecaps. Moreover, freshwater is not equally spread over the ground, and there are a number of heavily populated countries located in waterless lands where fresh water is not enough.

Hence, the final and end choice will be treating the waste water and using it. But the community has not accepted to use treated waste water for drinking purpose. So we can utilize this treated waste water in the construction where the huge amount of water is used and save the potable water.

Utilize of treated waste water in concrete mix due impurities in its can change the some properties of the concrete. For this study the water samples PTWW and STWW were collected from Bhandewadi sewage treatment plant, Nagpur, India.

So if we can utilize the treated waste water in construction industry, we can save a lot of potable water and try to spread awareness and value of water.

II. LITERATURE REVIEW

Mr. K.J. Kucche, etc. study the reaction between water and cement affect the setting time, compressive strength and also lead to softening of concrete. All the impurities may not have adverse effect on the properties of concrete. The use of impure water for concrete mixing is seen to favourable for strength development at early ages and reduction in long term strength.

Mohammad Shekarchi & etc. characterized and used as mixing and curing water. Physical and mechanical tests were performed on cement paste, mortar and concrete specimens. Some durability characteristics of concrete have been also investigated. The results confirm the feasibility of using biologically treated waste water in concrete industry when it is compared with the results of reference specimens made up with tap water.

III. MATERIALS AND METHODS

An experimental analysis was carried out to calculate the probability of treated waste water in concrete. We had performed various tests on cement and concrete.

Cement, sand, aggregate, PTWW, STWW and TW were used as per IS standards.

Treatment and characteristics of waste water

Primary treatment consists of temporarily holding the sewage in a sluggish basin where heavy solids partials can be settled down to the bottom while oil, grease and lighter solids float to the surface. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment. Some sewage treatment plants that are connected to a combined sewer system have a bypass arrangement after the primary treatment unit. This means that during very heavy rainfall events, the secondary

and tertiary treatment systems can be bypassed to protect them from hydraulic over loading and the mixture of sewage and storm water only receives primary treatment.

A. Material Used

Cement

Ordinary Portland cement (Ultra tech 43Grade) is used Cement is a fine, grey powder. It is mixed with water and materials such as sand & aggregate to make concrete. The cement and water form a paste that binds the other materials together as the concrete hardens. The ordinary Portland cement contains two basic ingredients namely argillaceous and calcareous. In argillaceous materials clay predominates and in calcareous materials calcium carbonate predominates.

Fine Aggregates

The sand used for the experimental program of sieve analysis. The sand was first sieved through 4.75 mm sieve to remove any particles greater than 4.75 mm and then was washed to remove the dust. The sand conforming to zone I as per IS 383-1970 was used for making reference concrete.

Course Aggregate

All types of aggregates are suitable. The normal maximum size is generally 10-20 mm. Consistency of grading is of vital importance. Coarse aggregate, conforming to IS 383-1970, Regarding the characteristics of different types of aggregate, crushed aggregates tend to improve the strength because of the interlocking of the angular particles, whilst rounded aggregates improve the flow because of lower internal friction.

Water

Generally, water that is suitable for drinking is satisfactory for use in concrete. Water from lakes and streams that contain marine life also usually is suitable. The water used for the study is obtained from Bhandewadi sewage treatment plant. We have used three types of water in this project i.e. primary treated waste water (PTWW), secondary treated waste water (STWW) and tap water (TW) for casting of specimen. We have found the pH of all these water and the results are satisfactory for the use in concrete.

TABLE I
PH VALUE OF DIFFERENT WATER SAMPLE

Sr. No.	Type of Water	pH
1	Tap Water(TW)	6.80
2	Primary Treated Waste Water(PTWW)	6.11
3	Secondary Treated Waste Water(STWW)	6.42

B. Experimental Work:

Compressive strength of concrete

The M20 grade of concrete has been designed for preparing the concrete cubes as per IS. The mix proportion of concrete cube was 1:1/2:3 (cement: fine aggregate: coarse aggregate) and the water cement ratio was 0.45. The cubes were casted by each type of water. The dimensions of cubes were 150 x 150 x 150mm. The concrete cubes were tested after 7 days, 14 days and 28 days of curing. The test was performed according to IS 516 -1959 under compressive testing machine.

TABLE III
AVERAGE COMPRESSIVE STRENGTH OF CONCRETE

Mix	Curing Period	Types of Water	Average Compressive Strength(MPa)
M20	7 Days	TW	14.58
		PTWW	18.46
		STWW	24.17
	21 Days	TW	12.45
		PTWW	16.46
		STWW	22.19
	28 Days	TW	13.47
		PTWW	21.34
		STWW	30.54

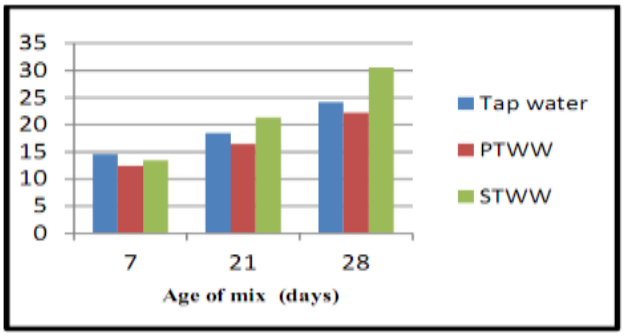

Fig. 1 Average Compressive Strength of Concrete

Tensile strength of concrete

Cylinders were casted for 28 days by M20 grade of concrete. The cylinders were 150 dia. x 300mm.The cylinders were casted by mixing each types of water and tested under compressive testing machine according to IS standard.

TABLE IIIII
AVERAGE SPLIT TENSILE STRENGTH

Mix	Curing Period	Types of Water	Average Split Tensile Strength (MPa)
M 20	28 Days	TW	2.47
		PTWW	2.28
		STWW	2.52

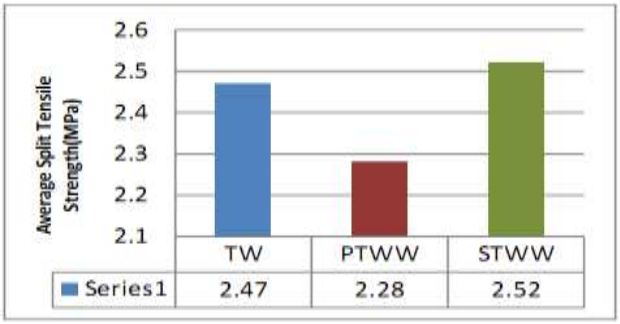

Fig. 2 Average Split Tensile Strength

Flexural strength of concrete

The beams were casted for 28 days of curing to check the flexural strength of concrete. The dimensions of beams were 100*100*700mm. beams were casted by using PTWW, STWW and TW. The beam were tested under universal testing machine as per guideline of IS: 516-1959; (Method of test for strength of concrete) and IS: 9399-1979(Specification for flexure testing of concrete).

TABLE IVV
AVERAGE FLEXURAL STRENGTH

Mix	Curing Period	Types of Water	Average Flexural Strength(MPa)
M20	28 Days	TW	7.6
		PTWW	4.4
		STWW	5.4

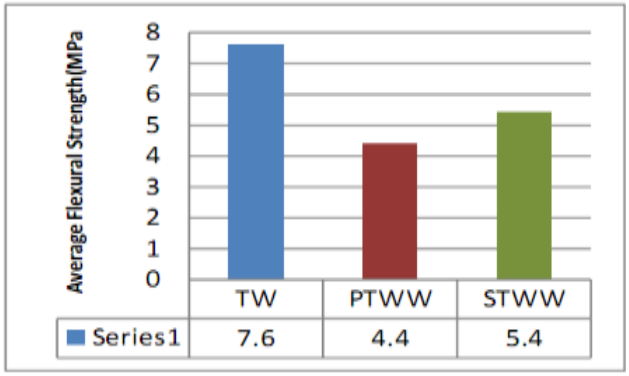

Fig. 3 Average Flexural Strength

IV. RESULTS AND DISCUSSION

- It is found that the 7 days compressive strength of STWW is more than 0.31% PTWW & 0.66 % of TW.
- It is found that the 14 days compressive strength of STWW is more than 0.35% PTWW & 0.79 % of TW.
- It is found that the 21 days compressive strength of STWW is more than 0.44% PTWW & 1.27 % of TW.
- It is found that the 28 days tensile strength of cylinder of PTWW & STWW is nearly same.
- It is found that the 28 days flexural strength of beam of TW is more than 0.43% STWW & 0.73 % of PTWW.

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