An Overview: Effect of Treated Waste Water on Properties of Concrete

Mr. S. P. Kale[1], Mr. S. M. Shinde[2], Mr. A. B. Shinde[3], Mr. N. B. Bodke[4], Mr. D. N. Dhaware[5], Prof. C. S. Chavan[6]*

[1,2,3,4,5] UG Student, JSPM's Imperial College of Engineering and Research, Wagholi, Pune

[6] Asst. Prof., JSPM's Imperial College of Engineering and Research, Wagholi, Pune

Abstract – Water is a critical environmental issue and water supplies and water quality are becoming more limited worldwide. The study deals with the effect of different type of treated waste water on properties of strength of concrete such as compressive strength, tensile strength, flexural strength and workability with respect to potable water. Water sample were used as treated waste water which was analysed for its chemical properties in laboratory. In that use of concrete mix of M30 the potable waste water was replaced with treated waste water.

Keywords- Treated Waste Water, Properties of Concrete

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1. INTRODUCTION

Water is the basic need of all living beings rather than air, food and shelter. Without water man cannot survive. In early days, water was primarily used for domestic needs like drinking, washing, bathing and cooking etc. But due to modernization, water is also required for industrial, construction purpose and sewerage purposes along with domestic needs. Also in construction industry water is used for mixing, aggregate washing, curing of concrete and for washing concrete related mechanical machines.

The mixing of water which is fit for drinking purpose is fit for concreting, but about 97 percent of water is in the oceans, while only 3 percent is fresh water is used. Out of that freshwater, only 1 percent is easily accessible as ground or surface water, the remains are stored in glaciers and icecaps. Moreover, freshwater is not evenly distributed across land surfaces, and there are a number of heavily populated countries located in arid lands where fresh water is scarce. The ultimate and last option will be treating the waste water and using it. So this treated waste water can be in the construction industry where the large amount of water is used and the Fresh water is used. This works aims to explain how treated waste water can be used in construction industry and reduces the load on nature.

The quality of the water plays an important role in the preparation of concrete. Impurities in water may interfere with the setting of the cement and may adversely affect the strength and durability of the concrete also. The chemical constituents present in water may actively participate in the chemical reactions and thus affect the setting, hardening and strength development of concrete. There are various sources of non-fresh water that were previously tested for use in concrete mixtures. Due to the different types of impurities that exist in each water types, it is difficult to draw a sound conclusion concerning the use of non-fresh water in concrete mixtures.

2. LITERATURE STUDY

[2.1] Miss. Kirtimala Laxman Narkhede, Mr. F. I. Chavan 2016 In this paper studied that construction industry water is used for mixing, aggregate washing, curing of concrete and for washing concrete related mechanical machines. The mixing ,water which is fit for drinking purpose is use, but about 97 percent of water is held in the oceans, while only 3 percent is fresh water. Moreover, freshwater is not evenly distributed across land surfaces, and there are a number of heavily populated countries located in arid lands where fresh water is scarce. The ultimate and last option will be treating the waste water and using it. But the humans have not accepted or will never accept the treated waste water for drinking purpose. So this treated waste water can be in the construction industry where the large amount of water is used and the freshwater is used. This works aims to explain how

treated waste water can be used in construction industry and reduces the load on nature.

[2.2] Ayoup M. Ghrair and Othman Mashaqbeh 2016 This study has evaluated the use of treated waste water for concrete and mortar production in bench and full scales. The water quality analysis showed that treated waste water is suitable for concrete and mortar production. This study has shown that treated waste water is a potential alternative for fresh water in the concrete industry. Therefore, the current guidelines for wastewater recuse should be revised by the governmental authorities to encourage the use of treated waste water as a substitute for fresh water in concrete production.

[2.3] KishanLal Jain, Abhishek Kumar, Ankit Kumar 2016 This paper reviews the possibility of replacing fresh water with waste water for making concrete. The strength is not affected so much by using waste water as replacement for waste water. From the literature it is seen that, the reaction between waste water and cement affect the workability, compressive strength and flexural strength. The reduced strength is within the acceptable limit. The use of impure water for concrete mixing is reduces the cost of the construction and in this way the process of construction becomes economical.

On replacement of fresh water with waste water(sewage water), we found that on increasing the composition of waste water strengths (compressive, flexural) goes on decreasing with further increase in waste water composition. The slump values are found to be decreasing with the increase in the % of waste water. Compressive strength of the M20 mix for 28 days decreases from 20 Mpa to 18.75 for 0 % and 100% replacement of fresh water with waste water. it is also noted that the flexural strength decreases from 4.1 to 3.3 Mpa for 0 & 100 % replacement respectively hence on the basis of above test conducted and results, it is found that although the strength decreases but the obtained strength is within the acceptable limit , and also the cost of construction also decreases as we are using waste water.

[2.4] Mr. K. J. Kucche, Dr. S. S. Jamkar, Dr. P. A. Sadgir 2015 Impurities present in water are reacting differently with different constituent of cement. These reactions mostly affect the setting time, compressive strength and may also cause straining of concrete surface. All impurities may not have adverse effects on the properties of concrete. Some impurities react such that, net result may be harmless or improve concrete properties. Hence it is difficult to draw a common conclusion for use of water for mixing and curing in concrete. The use of impure water for concrete mixing is seen to favourable for strength development at early ages. However the general consensus is that, there is reduction in the long term strength of concrete. But with proper mix design and acceptable tolerance limit of impurities in water, it may possible to use impure water in concrete mixing and curing also. On the other hand, there is a risk of steel corrosion in reinforced concrete, which is also a major concern for research.

[2.5] Abdul Razak.B.H1, Dr. D. L. Venkatesh Babu 2015 There is a decrease in the workability of concrete using treated waste water whereas gave better workability to concrete. There is no significant difference in the compressive strength value of concrete made using treated waste water and potable water. The tensile strength of concrete made using treated waste water was found to be lesser compared to that of potable water. Considerable construction cost can be reduced by utilizing the treated water for plain cement concrete.

Concrete made using treated waste water showed good fresh and hardened properties. Hence its usage can be beneficial for the concrete industry in terms of cost saving. Usage of treated waste water is most suitable for sustainable development. Potable water can be saved to a great extent. Concrete made using treated waste water is more suitable for plain concrete as there are possibilities of corrosion of reinforcement due to the organic and inorganic impurities present in the treated waste water. Further research on usage of treated waste water for production of reinforced cement concrete can be carried out by studying the corrosion of reinforcement.

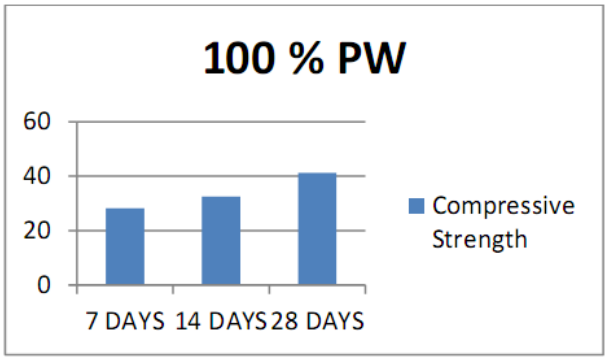
3. MATERIALS AND METHODOLOGY

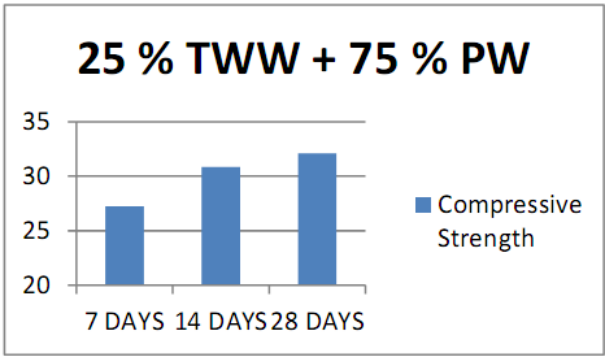
- OPC 53 grade confirming to IS grade produced from single source will be used.
- Locally available fine aggregate will be used.
- The maximum size of coarse aggregate is limited to 20 mm to get maximum increase in compressive strength. A sieve analysis conforming to IS – 2386 -1963 will be carried for coarse aggregate (20 mm -12mm) and other tests are carried out in the laboratory as per IS -2386- 1963.
- The treated waste water is collected from the JSPM'S SEWAGE WATER TREATEMENT PLANT. The laboratory tests are carried out as per IS-3025.
- MIX DESIGN: mix design is carried out as per IS -10262-2009 for M20 concrete by varying water cement ratio (0.45).
- CASTING: 3 concrete cubes each will be casted according to the mix proportions and by .45 water cement ratio for 4 dilution ratios 100%, 75%, 50% and 25% treated waste water.

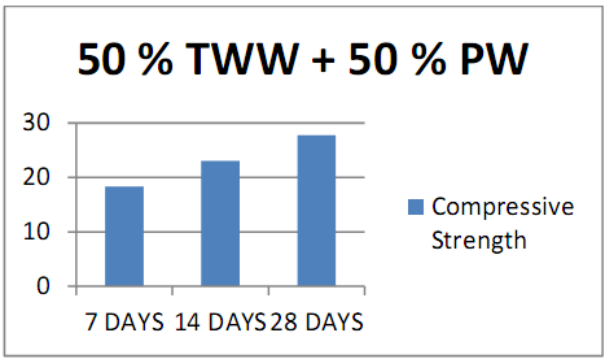
- For M30 concrete different combination of concrete mixing will be carried out as given below:
- 9 specimens are casted using 100% potable water (PW).
- 9 specimens are casted using 100% treated waste water (TWW).
- 9 specimens are casted using 75% treated waste water and 25% fresh water
- 9 specimens are casted using 50% treated waste water and 50% fresh water
- CURING: Curing will be done by immersing the specimen in tap water separately. Five concrete blocks of each dilution ratio are tested for compressive strength in 7,14 and28 days.

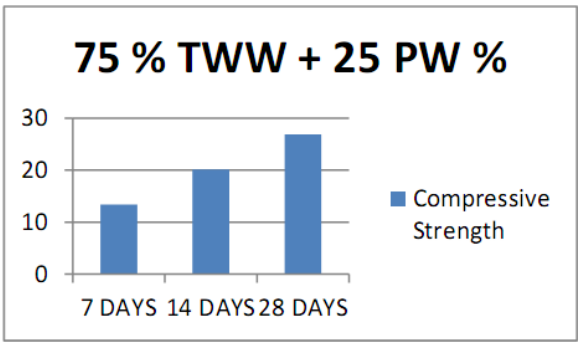
4. EXPERIMENTAL WORK AND RESULTS

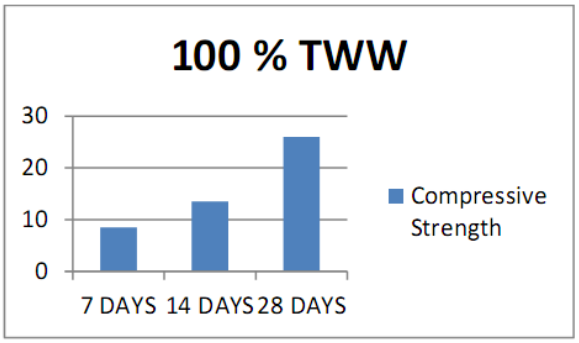
The treated waste water is collected from the JSPM'S SEWAGE WATER TREATMENT PLANT and its chemical properties are analysed in a laboratory.



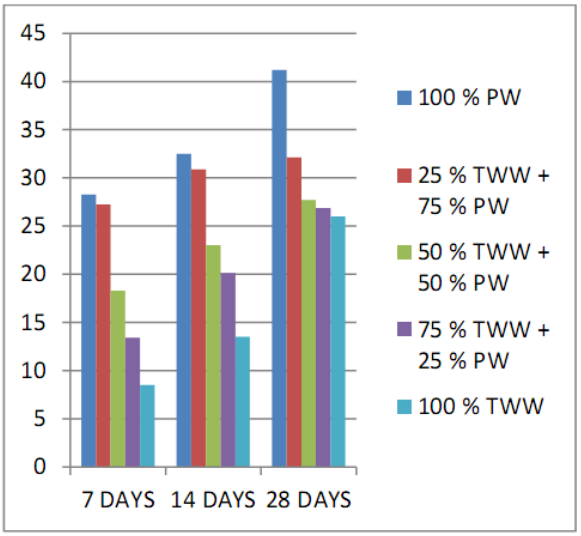


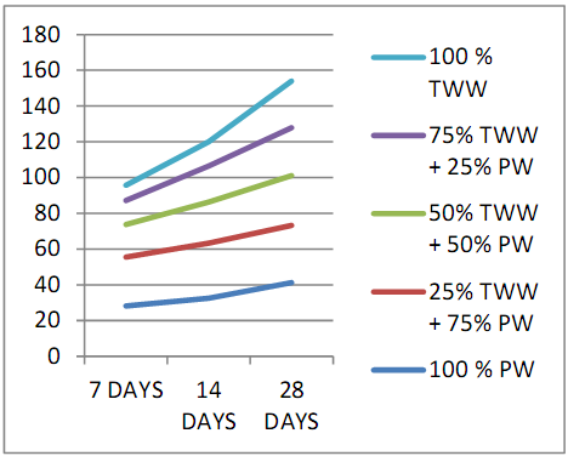






Comparative Results





Compressive Strength of Concrete

DAYS/% of TWW	100 PW	25	50	75	100 TWW
7	28.26	27.25	18.30	13.42	8.53
14	32.51	30.87	23.01	20.14	13.53
28	41.21	32.12	27.73	26.86	25.99

Test on Treated Waste Water:

TEST / % OF TWW	25	50	75	100
BOD	24	42	54	168
COD	240	270	321	375
P^H	6.3	6.3	6.2	6.2

3. CONCLUSION:

- Impurities present in water are reacting differently with different constituent of cement. These reactions mostly affect the setting time, compressive strength and may also cause straining of concrete surface.

- All impurities may not have adverse effects on the properties of concrete. Some impurities react such that, net result may be harmless or improve concrete properties.

- Also impurities present in water varies depending upon places, time, environment and human interference. Hence it is difficult to draw a common conclusion for use of water for mixing and curing in concrete. The use of treated waste water for concrete mixing is seen to favorable for strength development at early ages. However the general consensus is that, there is reduction in the long term strength of concrete. But with proper mix design and acceptable tolerance limit of impurities in water, it may possible to use treated waste water in concrete mixing and curing also. On the other hand, there is a risk of steel corrosion in reinforced concrete, which is also a major concern for research.

4. ACKNOWLEDGEMENTS

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Corresponding Author

Prof. C. S. Chavan*

Asst. Prof., JSPM's Imperial College of Engineering and Research, Wagholi, Pune

E-Mail – chetanchavan1203@gmail.com