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INVESTIGATION ON UTILIZING WASTEWATER FOR PRODUCTION OF CONCRETE

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Abstract: This study deals with the effect of different type of water samples on properties of strength of concrete such as compressive strength, tensile strength and workability of concrete. The water samples collected from waste water treatment plant will be tested. Water samples to be used are Potable water sample, Influent water sample, Effluent water sample which will be analyzed for its chemical properties like acidity, alkalinity, Cl, SO_4, Inorganic solids. In that use of concrete mix design of M30 or above M30 will be done. The concrete sample which are generated will be tested for Compressive strength, tensile strength and workability on concrete which will be compared with each other. The results will indicate the best water sample suitable for concrete mix design.

Keywords: Compressive strength, Tensile strength, Workability of concrete, Potable water, Influent water, Effluent water

I. INTRODUCTION

Concrete is a common construction material made from water, cement, aggregates, and sometimes admixtures. It is widely used in civil engineering projects. Water plays an important role in the chemical process of making concrete, as it accelerates the reaction between cement and aggregates. Water also helps fill the voids in the concrete by producing a gel-like paste. In this study, the effects of different types of water samples, including potable water, influent water, and effluent water from a waste water treatment plant, will be analyzed on the properties of concrete strength, such as compressive strength, tensile strength, and workability. The water samples will be tested for chemical properties such as pH, COD, BOD, and TSS. The concrete mix design used will be for M30 or higher grade

II. OBJECTIVES

- To study used of treated waste water (effluent) in concrete mix for M30 grade.
- Quality analysis of treated waste water (effluent) sample
- To analysis best performance of water sample in concrete mix design.
- To analyze compressive, tensile, & workability tests of concrete samples produce using treated waste water and normal water.

III. LITERATURE REVIEW

Dr. V. M. Inamdar et al [17]. (2010), The authors concluded that there is little difference in the results between concrete made with potable water and concrete made with treated waste water. Given the increasing scarcity of water nowadays, there is a need to explore alternative water sources for concrete production in construction projects. The authors suggest that treated waste water, which is often discharged into rivers, can be used as a viable option for concrete production.

Tarun.R.Naik et al [10].(2010) The authors concluded that there are no significant differences between mortar cubes made with potable water and sewage treatment plant water. Further research is needed to explore the potential outcomes and contributions of this research.

Some of the possible outcomes and contributions of this research include:

- Minimizing the need for the use of potable water
- Eliminating the need to expand potable water supply for concrete industry
- Minimizing the need to construct more water treatment facilities
- Saving potable water for drinking purposes.
- Making sewage treatment plants more economically attractive

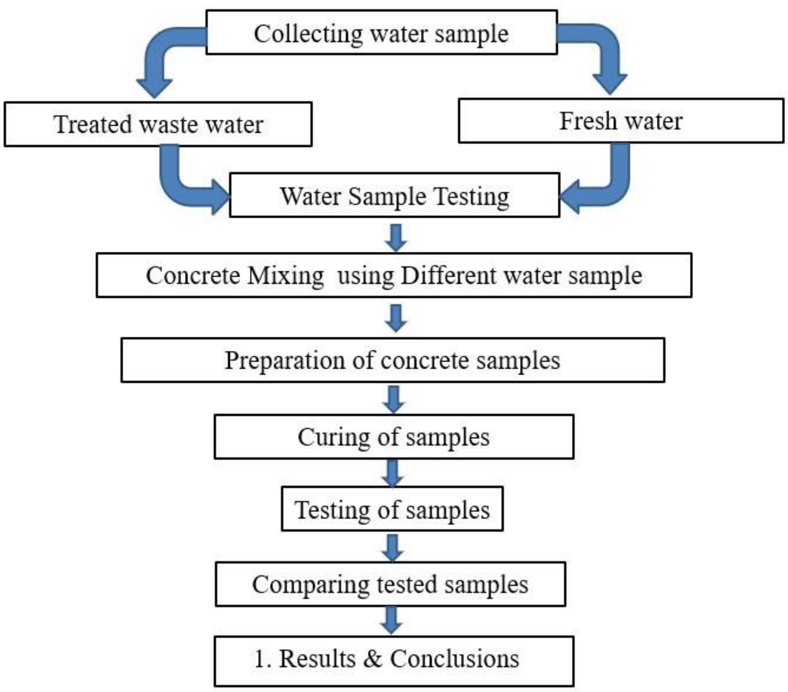
In conclusion, the authors suggest that further research is needed to fully explore the potential outcomes and contributions of using sewage treatment plant water in concrete production, which could have significant economic, environmental, and social benefits, including minimizing the use of potable water, reducing the need for water treatment facilities, and conserving potable water for drinking purposes.

K.S.AL-JABRI ab et al [1]. (2011) Authors concluded that, the chemical composition of wastewater from car washing stations was found to be higher than tap water but within ASTM standard limits. Some substances in the wastewater were found to have high concentrations, which could potentially raise concerns about corrosion and sulfate attack in reinforced concrete structures. However, the compressive strength of the concrete increased with longer curing periods regardless of the percentage of wastewater used. There was no significant difference in the compressive strength among different concrete mixtures after 28 days of curing, and the water absorption rates were similar between wastewater replacement mixes and the control mix. Overall, the use of car wash wastewater had negligible effects on the strength of concrete, but further studies are needed to investigate its impact on concrete durability over prolonged exposure times due to the possibility of harmful substances in the wastewater.

Preeti Tiwari et al [11]. (2014) The authors found that concrete cubes cured with salt water showed a slight increase in strength compared to those cured with fresh water. The rate of strength gain was slower in fresh water cubes, but all cubes continued to gain strength at 28 days. The fresh water cubes reached their maximum strength at 28 days, while the compressive strength of salt water cubes was slightly higher than that of fresh water cubes.

Cordelia Nnennaya Mamaal et al [2]. (2019) The authors concluded that the type of water used in mixing concrete has a significant impact on the compressive strength of the resulting concrete. Concrete made with potable water showed consistent strength gain over time, indicating reliable long-term strength. In contrast, concrete made with rainwater showed an initial increase in strength at 7 and 14 days, but a drastic reduction in strength at 28 days, indicating that rainwater may not be reliable for long-term strength. The study suggests that potable water is the best choice for concrete production, and in situations where potable water is not readily available, river water could be used as an alternative for mixing concrete.

IV. METHODOLOGY



V. QUALITY ANALYSIS OF WATER SAMPLES

Sr. No.	Parameters	Normal Water (mg/l)	Effluent Water (mg/l)	Std. as per IS 456-2000
1	Acidity	0.013	28.0	≤ 50.0
2	Alkalinity	192	170.0	≤ 250.0
3	Chlorides as Cl	36.43	45.0	≤ 2000.0
4	Sulphates as SO_4	74	8.5	≤ 400.0
5	Inorganic Solids	500	136.0	≤ 2000.0

Table 1 : Quality analysis of Water samples

VI. RESULTS

CTM Test:

To know the compressive strength of concrete

Fig 1 : CTM test on all concrete samples.

Compression test results:

- Compressive test result of concrete mix produced using **Normal water** (**W/C = 0.40**) for **28 days** of curing.

Sr. No.	Wt. of Cement (Kg)	Wt. of Sand (Kg)	Wt. of C.A. (Kg)	Peak Load (KN)	Compressive strength (N/mm²)	Average (N/mm²)
1.	1.58	2.30	3.8	658.5	29.26	
2.	1.58	2.30	3.8	617.6	27.44	30.38
3.	1.58	2.30	3.8	775.2	34.45	

Table 3 : CTM test results for Normal water in concrete mix.

- Compressive test result of concrete mix produced using **Treated waste water** (**W/C = 0.40**) for **20 days** of curing.

Sr. No.	Wt. of Cement (Kg)	Wt. of Sand (Kg)	Wt. of CNT (Gm)	Peak Load (KN)	Compressive strength (N/mm^2)	Average (N/mm^2)
1.	1.58	2.30	3.8	416.5	18.51	
2.	1.58	2.30	3.8	405.9	18.04	17.90
3.	1.58	2.30	3.8	386.4	17.17	

Table 4 : CTM test results for Treated waste water in concrete mix.

- Comparison of **Compressive test** result of concrete mix produced using **Normal water** and **Treaded waste water** (Effluent water) for **20 days** of curing. (**W/C = 0.40**).

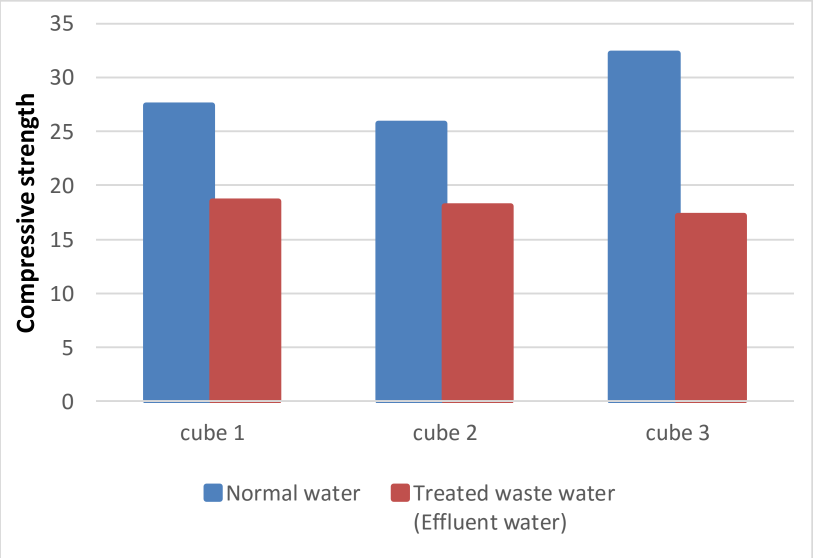


Fig 2 : Comparison of compressive strength of concrete mix samples

WorkabilityTest:
To determine the workability of concrete

Fig 3 : Workability test.

Workability test results:

Comparison of **Workability test** result of concrete mix produced using **Normal water** and **Treaded waste water** (Effluent water) (**W/C = 0.40**).

Degree of workability	Slump(mm)
Very Low	0-25 mm
Low	25-50 mm
Medium	50-100 mm
High	100-175 mm
Very High	Collapsed

Table 5 : Degree of Workability as per slump (mm).

1. Workability of concrete mix produced using **Normal Water** :-
   Slump = 60mm
   Therefore, workability of concrete is **Medium.**
2. Workability of concrete mix produced using **Treaded Waste Water** :-
   Slump = 70mm
   Therefore, workability of concrete is **Medium.**

Comparison of **Workability test** result of concrete mix produced using **Normal water** and **Treaded waste water** (Effluent water) (**W/C = 0.40**).

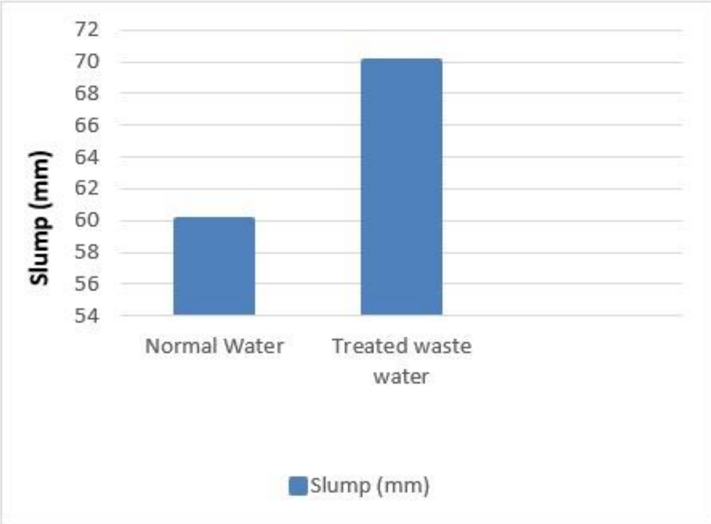


Fig 4 : Comparison of Workability test of concrete mix .

Tensile Test:

To know the tensile strength of concrete

Fig 5 : UTM Machine.

Comparison of **Tensile test** result of concrete mix produced using **Normal water** and **Treaded waste water** (Effluent water) for **20 days** of curing. (**W/C = 0.40**).

Sr. No.	Wt. of Cement (Kg)	Wt. of Sand (Kg)	Wt. of C.A. (Kg)	Peak Load (KN)	Tensile strength (N/mm²)	Average (N/mm²)
1.	2.46	3.56	6	179.280	2.54	
2.	2.46	3.56	6	187.800	2.65	2.45
3.	2.46	3.56	6	147.840	2.09	

Table 6 : UTM test results for Normal water in concrete mix.

- Tensile test result of concrete mix produced using **Treated waste water** (**W/C = 0.40**) for **20 days** of curing.

Sr. No.	Wt. of Cement (Kg)	Wt. of Sand (Kg)	Wt. of C.A. (Kg)	Peak Load (KN)	Tensile strength (N/mm²)	Average (N/mm²)
1.	2.46	3.56	6.00	86.280	1.22	
2.	2.46	3.56	6.00	80.350	1.13	1.15
3.	2.46	3.56	6.00	79.370	1.12	

Table 7 : UTM test results for Treated waste water in concrete mix.

- Comparison of **Tensile test** result of concrete mix produced using **Normal water** and **Treaded waste water** (Effluent water) for **20 days** of curing. (**W/C = 0.40**).

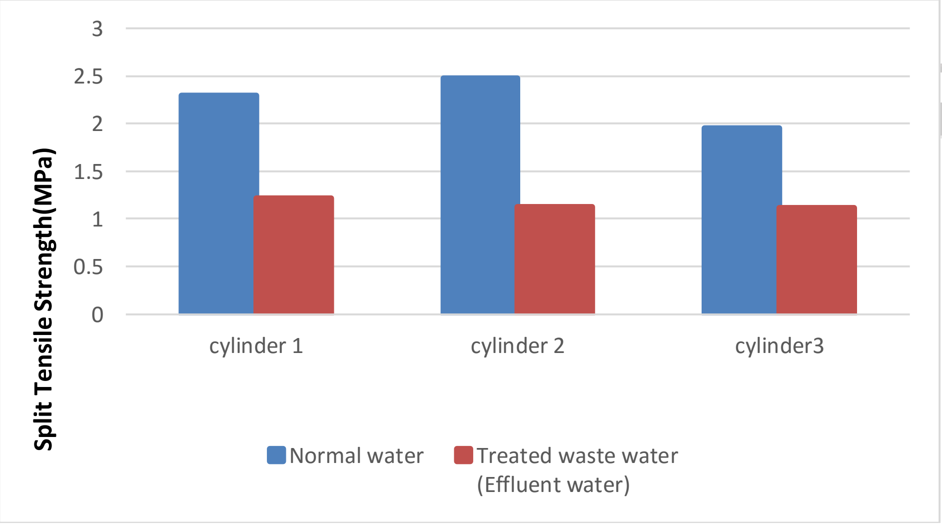


Fig 6 : Comparison of Tensile strength of concrete mix samples.

VII. CONCLUSIONS

1. There is no significant change in workability of concrete mix when normal water is replaced with Treated wastewater (effluent) keep the water cement ratio constant (W/C= 0.40).
2. When Treated wastewater is used in production of concrete mix, the compressive strength of concrete is reduced by 34.03% after 20 days of curing.
3. It is observed that when TWW replaces NW in concrete at W/C = 0.40 the tensile strength of 56.83% is achieved which shows that the tensile strength is reduced by 36.8% after 20 days of reducing.

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