Feasibility of Using STP Effluent as a Replacement for Potable Water in Concrete

Dr. Chetan S. Deshpande[1], Atharva Nawkhare[2], Mayur Ghuge[3], Nayanshu Lokhande[4], Nidhish Bhagwat[5], Piyush Wasad[6], Prachi Ninawe[7]
St. Vincent Pallotti College of Engineering and Technology, Nagpur

***Abstract*— This paper investigates the feasibility of using Sewage Treatment Plant (STP) effluent water as a replacement of potable water in concrete production. The experiment involved comparing the parameters of potable water and STP effluent, followed by cube casting and compressive strength testing on M25 grade concrete prepared using various proportions of both water types, for 3,7,14,28 and 42 days compressive strength. Results shows that concrete cast and cured using STP water have higher compressive strength compared to concrete made with fresh water. The results suggest that STP water can serve as a sustainable alternative to potable water in concrete production without compromising strength.**

***Index Terms*—STP water, potable water, compressive strength.**

I. INTRODUCTION

Water is a key element in concrete production, influencing its workability, strength, and durability. The quality of water used for mixing and curing directly affects cement hydration and the overall performance of concrete. With increasing freshwater scarcity, exploring alternative sources like treated effluent from Sewage Treatment Plants (STPs) has become crucial. This study examines the feasibility of using STP water as a replacement for potable water in M25 grade concrete. The project, aligned with ongoing construction at St. Vincent Pallotti College of Engineering and Technology, Nagpur, demonstrates the potential of reusing STP effluent for concrete production.

II. OBJECTIVES

1. To investigate quality parameters of potable water and STP effluent.
2. To compare the short-term and long-term compressive strength of concrete casted and cured using various combinations of potable and STP water.
3. To evaluate the feasibility of using STP water as a replacement for potable water in concrete production.

III. LITERATURE REVIEW SUMMARY

Various studies have explored the use of treated wastewater as an alternative to potable water in concrete production. Research comparing tap water with different grades of treated wastewater showed that tertiary treated water provided the highest strength and lowest corrosion. Other studies confirmed that sewage and industrial effluents, when properly treated, can safely replace potable water without affecting concrete performance. Experiments using different water sources tap, borewell, and wastewater found that even non-potable water can yield satisfactory strength, making it suitable for regions facing water scarcity. Studies using STP treated water reported higher compressive strength when mixed in suitable proportions, while curing with limited wastewater (20–25%) also improved results. Overall, the literature indicates that STP effluent, when treated to required standards, can effectively substitute potable water in concrete production.

IV METHODOLOGY

This project is based on experimental investigation and field relevance, including the ongoing construction of the new academic block C at St. Vincent Pallotti College of Engineering and Technology, Nagpur, where STP water is being used in concrete works. The methodology adopted for this study is as follows:

V. EXPERIMENTATION

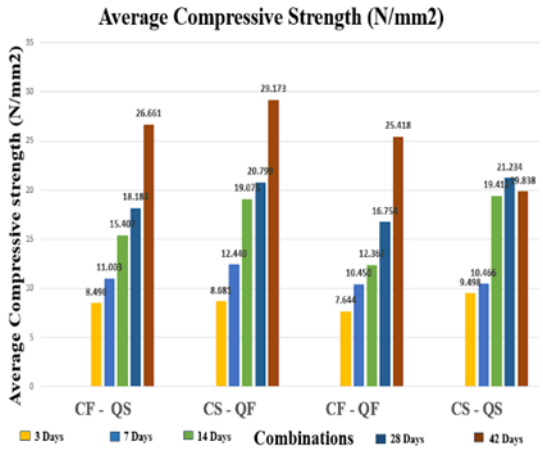
Test on Potable water and STP effluent as per IS 456-2000

Sr. no	Parameters	Potable water	STP effluent	Permissible limit
1	pH	7.57	7.9	6 – 8.5
2	Turbidity	9.7 NTU	19.8 NTU	Less than 2000 NTU
3	Chloride	115.02 ppm	232.15 ppm	500 ppm

Mix design of M25 (1:1:2) grade concrete
Water cement ratio 0.55 Quantity for 1 m3

Sr. no	Material	Weight (Kg)
1	Cement	540
2	Sand	640
3	Aggregate	1125
4	Water	297

VI. RESULTS AND DISCUSSION



The results showed that STP-treated water, when used for both casting and curing, achieved higher compressive strength than potable water. This indicates that properly treated STP effluent not only meets structural requirements but also contributes to sustainability.

VII. CONCLUSION

1. Based on the test results, both potable and STP water were observed to be suitable for use in concrete production.
2. Use of STP water for both casting and curing showed the highest compressive strength at all testing stages 3, 7, 14, 28 and 42 days.
3. Use of fresh water for both casting and curing resulted in lower compressive strength at every stage of curing.
4. STP water proved to be a better option than fresh water, considering both sustainability and compressive strength.
5. Thus, use of STP water in concrete production could help conserve fresh water resources without compromising material strength.

REFERENCES

[1] Indian Standard 456 (2000): Plain and reinforced Concrete Code of Practice [CED 2 Cement and Concrete], Bureau of Indian Standard, Manak Bhavan, Bahadur Shah Zafar Marg, New Delhi 110002

[2] Ibrahimal ghusain Mohammadj. Terro (2003) "Use of Treated Waste Water for Concrete Mixing in Kuwait" *Volume 30, issue 1, April 2003.*

[3] Ajay Kumar, Onkar Yadav, Amar Nath Kumar (2023) "A Review Paper on Production of Environment Friendly Concrete by Using Sewage Water" *Volume 11, issue 6, April 2023*

[4] Aman Dahiya, Er. Sandeep Pannu (2025) "Use of STP Treated Water in Concrete: Assessing Strength Properties and Promoting Sustainable Water Practices" *Volume 2, issue 2, April 2025*

[5] Rakesh A. More, Prof. S. K. Dubey (2014) "Effect of Different Types of Water on Compressive Strength of Concrete" Volume 5, issue 2 , April 2014

[6] K. J. H. ZHOU (2011) "Flexural Strength and Deformability Design of Reinforced Concrete Beams" Volume 14, issue 2, April 2011

[7] O.A. Dauda, J.O. Akinmusuru (2018) "Effect of Curing Methods on the Compressive Strength of Concrete" *Volume 1, issue 2, April 20*