



Sustainable Water Management in Concrete Production: Utilization of Treated Wastewater in Concrete Curing and Mixing.

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Abstract

This study evaluates the feasibility of using primary and secondary treated domestic wastewater for mixing and curing concrete. Rapid urbanization and industrial expansion have significantly increased water demand, causing stress on freshwater resources. This paper investigates the compressive strength of M20 concrete cured and mixed with various proportions of treated wastewater. Test results after 7 and 28 days demonstrate that secondary treated wastewater, particularly in a 60:40 ratio with potable water, achieves compressive strengths comparable to standard mixes. This research supports the sustainable reuse of wastewater in construction, reducing reliance on freshwater without compromising structural integrity.

1. Introduction

Concrete production is a major consumer of freshwater. With increasing water scarcity, alternative water sources are essential for sustainable construction. This study explores the use of treated domestic wastewater—both primary and secondary—for concrete mixing and curing, aiming to reduce freshwater demand while maintaining acceptable structural performance.

2. Materials and Methods

2.1 Materials



- Cement: OPC 53 Grade
- Fine aggregate and coarse aggregate per IS 383:1970
- Water: Potable water, Primary Treated Wastewater, and Secondary Treated Wastewater

2.2 Concrete Mix

- Mix design: M20 grade (1:1.5:3)
- Water-cement ratio: 0.5
- Cube size: 150mm x 150mm x 150mm
- Curing periods: 7 and 28 days

2.3 Water Sampling

Wastewater samples were collected from the Basti Peer Dad 50 MLD STP, Jalandhar. Physicochemical properties were analyzed for pH, COD, BOD, TDS, and DO.

2.4 Experimental Design

Seven sets of cube samples were prepared:

- 100% potable water
 - 60:40, 70:30, 80:20 mixes of primary treated wastewater and potable water
 - 60:40, 70:30, 80:20 mixes of secondary treated wastewater and potable water
- Each set included three cubes tested for compressive strength at 7 and 28 days.

3. Results and Discussion

3.1 Chemical Characteristics of Water Samples

Parameter	Potable Water	Primary Treated	Secondary Treated
pH	7.1	7.01	7.30
COD (mg/l)	<50	660	44
BOD (mg/l)	<10	250	6
DO (mg/l)	>4	0.5	5.4
TSS (mg/l)	<10	666	12

3.2 Compressive Strength Results

Mix Ratio	7-Day Avg (N/mm ²)	28-Day Avg (N/mm ²)
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100% Potable	13.59	23.96
PTWW 60:40	13.66	17.29
PTWW 70:30	13.33	17.25
PTWW 80:20	13.33	17.14
STWW 60:40	13.55	22.00
STWW 70:30	13.51	21.69
STWW 80:20	13.47	21.73

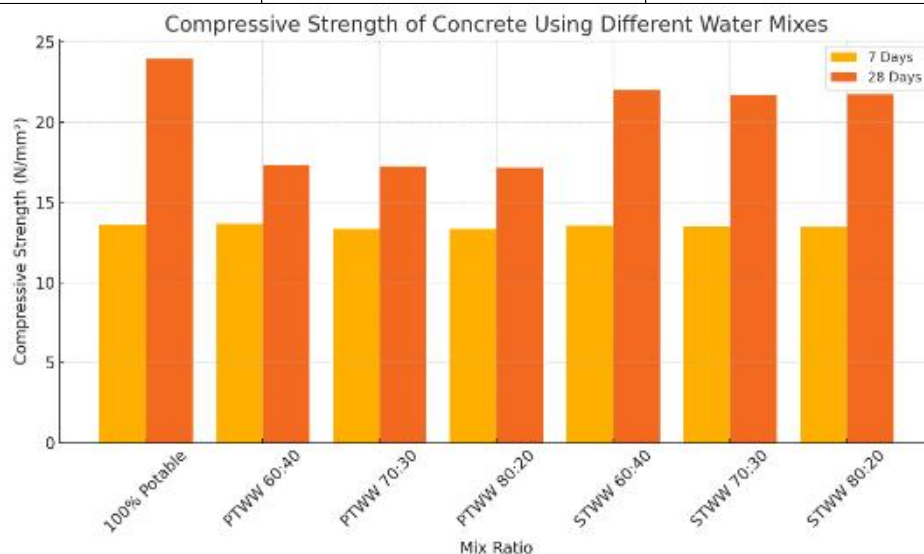


Fig : 1 The bar graph above clearly compares the compressive strength of concrete mixes at 7 and 28 days using different water combinations.

4. Conclusion

This research demonstrates that secondary treated domestic wastewater can be effectively used in concrete mixing and curing with minimal compromise in compressive strength, particularly in a 60:40 ratio with potable water. This approach can significantly reduce the dependency on freshwater, offering an environmentally sustainable alternative for the construction industry. However, primary treated water showed reduced strength and may require further purification or limited application.



References

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