

# Influence of Recycled Waste Water as Mixing and Curing Agents on the Properties of Concrete

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**ABSTRACT:** This study deals with the effect of recycled or treated waste water on properties of strength of concrete such as compressive strength, tensile strength and flexural strength with respect to Potable/Normal water. Water is a critical environmental issue and water supplies and water quality are becoming more limited worldwide. The traditional method of mixing and curing of concrete is normally practiced by fresh water. Recycled/treated waste water is used for irrigation purposes. Lately, there has been an evolving interest towards the usage of recycled waste water for mixing and curing of concrete. From this study, we can conclude that the recommended use of treated waste water in plain concrete works will indirectly conserve the scarce water resources of the study area, as the regular water sources would be concentrated on supply of drinking and other potable water usage. The results indicate that the usage of recycled waste water gives better results in compressive, tensile and flexural strength compared with that of the strength gained by using normal water.

**KEYWORDS:** Recycled/Treated waste water, Compressive strength, Tensile strength, Flexural strength.

## I. INTRODUCTION

Concrete is world's most widely used construction material. It consists of fine aggregates, coarse aggregates, cement and water with given proportions. There are many number of stages in the production of concrete. The consumption of natural resources in construction is phenomenal and results in high cost. To overcome the use of natural resources and by attempting to use recycled/treated wastewater for sustainable construction. All recycling and reuse of waste water involves research aimed at acquiring a full application of recycled waste water in order to determine suitable and specific applications. Wastewater treatment, also called sewage treatment, the removal of impurities from wastewater, or sewage, before they reach aquifers or natural bodies of water such as rivers, lakes, estuaries, and oceans. Since pure water is not found in nature (i.e., outside chemical laboratories), any distinction between clean water and polluted water depends on the type and concentration of impurities found in the water as well as on its intended use. In broad terms, water is said to be polluted when it contains enough impurities to make it unfit for a particular use, such as drinking, swimming, or fishing. Although water quality is affected by natural conditions, the word pollution usually implies human activity as the source of contamination. Water pollution, therefore, is caused primarily by the drainage of contaminated wastewater into surface water or groundwater, and wastewater treatment is a major element of water pollution control. Recycled/Treated waste water used for irrigation purposes, later there has been an evolving interest towards the usage of recycled water for mixing and curing of concrete.

## II. RELATED WORK

The use of recycled waste water in concrete which helps in the conservation of the water normally to be used for the concrete. The present study focuses on the impact of using the recycled water in concrete which influences in increase in the strength when compared with that of conventional concrete. **Hummaira Kanwal, Sabahat Arif, Muhammad Afzal Javed, Amir Farooq, And Muhammad Arif Khan [1]** investigated on the 'Effect on Compressive Strength of Concrete Using Recycled Waste Water for Mixing and Curing of Concrete'. The study was conducted to evaluate the strength of concrete made with recycled waste water for structural use. Test results showed that workability of all the four mixes were between 25-50mm but ultimate compressive strength of concrete with WW was decreased and with RWW, TS at the age of 28 days do not change significantly. **Tadesse Mergiaw Miretu, Kaustav Sarkar, Bishwajit Bhattacharjee [2]** investigated on Curing of concrete with wastewater and curing compounds: Effect on strength and water absorption. The present study compares the



influence of four different surface curing agents, viz. (i) recycled wastewater, (ii) tap water and commercially available (iii) water based and (iv) resin-based curing compounds on the compressive strength and water absorption characteristics of ordinary concrete. The result was the observations establish the suitability of waste water curing in achieving better strength and water tightness to 28 days.

III. METHODOLOGY

3. 1. Materials and Their Properties

The following are the materials used,

3.1.1 Cement

The cement used was OPC-53 grade cement which conforms to the specifications of IS: 12269-1987. The properties of the cement is shown in Table.3.1.1 and tested using both portable and recycled water.

Table 3.1.1 Properties of Cement

Sl. No	Tests Performed	Normal Water	Recycled Water
1	Specific gravity	3.13	2.8
2	Initial Setting Time	30 minutes	33 minutes
3	Final Setting Time	300 minutes	370 minutes
4	Consistency	31%	30%

3.1.2 Fine Aggregate

The fine aggregate used was manufactured sand (m-sand). The fine aggregate conforming to zones is IS: 383-1970. The properties of the fine Aggregate are shown in Table.3.1.2.

Table.3.1.2 Properties of Fine Aggregate

Sl.No	Tests Performed	Results
1	Specific gravity	2.6
2	Moisture content	10%
3	Fineness modulus	4.1%

3.1.3 Coarse aggregate

Crushed stone was used as coarse aggregate conforming to IS: 383-1970. Maximum coarse aggregate size used was between 10-20mm. The property of the coarse aggregate is shown in Table.3.1.3.

Table.3.1.3 Properties of Coarse Aggregate

Sl. No	Tests Performed	Results
1	Specific gravity	2.8
2	Moisture content	3%
3	Fineness modulus	4%

3.1.4 Water

The properties of Portable water and Recycled water as per the IS: 10500. The results of the tests are shown in Table.3.1.4.

Table.3.1.4 Properties of Coarse Aggregate

Sl. No	Tests Performed	Normal Water	Recycled Water
1	pH	7.52	8.47
2	Total Hardness	286.2 mg/lit	218 mg/lit
3	DO	7.68 mg/lit	5.76 mg/lit
4	COD	21.5 mg/lit	25 mg/lit
5	BOD	4.2 ppm	5.8 ppm



**3.2 Admixtures**

**3.2.1. Conplast SP-430**

Conplast SP430 is a chloride free, super plasticising admixture based on selected sulphonated naphthalene polymer enabling the water content of the concrete to perform more effectively. The very high levels of water reduction possible allow major increases in strength to be obtained.

Table.3.2.1 Properties of Conplast SP-430

Sl. No	Properties	Conplast SP-430
1	Appearance	Brown liquid
2	Specific gravity	1.2
3	Chloride Content	NIL to BS 5075

**3.2 Experimental Investigations**

The experiment consists of the process of design the concrete mix  $M_{40}$  grade as per the Indian Standards (IS: 10262-2009). After the process of designing and calculating the mix proportions, the materials for the concrete that is cement, fine aggregate, coarse aggregate were mixed at the dry state before addition of the water. Then the calculated amount of water (recycled water) was added to it and thoroughly mixed to have a homogenous mix. Then the admixture conplast SP-430 is added to it and mixed thoroughly. The slump factor test was conducted as per the Indian Standards for the concrete mixes in order to know the workability of the concrete mix. Then in order to find the strength characteristics the specimen were casted. For the compressive strength test, the specimens were casted to the size of 150x150x150mm of typical size cubes. For the split tensile test, the specimens were casted in the size of cylinders of 150mm in diameter and 300mm in height. For Flexural strength test beams of 150x150x700 mm size are casted. The casted cubes and cylinders are cured for 3, 7 and 28 days and strength tests are conducted.

**IV. EXPERIMENTAL RESULTS**

The test results shows that, more strength of the concrete can also be achieved by using the recycled waste water and the obtained results is also greater than the strengths of normal concrete.

**4.1 Compressive Strength Test**

Table 4.1 Compressive Strength Test Results

MIX-TYPE	Compressive Strength Results		
	7 Days	14 Days	28 Days
Normal Concrete	27.76	37.5	46.9
Recycled Water	27.4	38.3	47.95

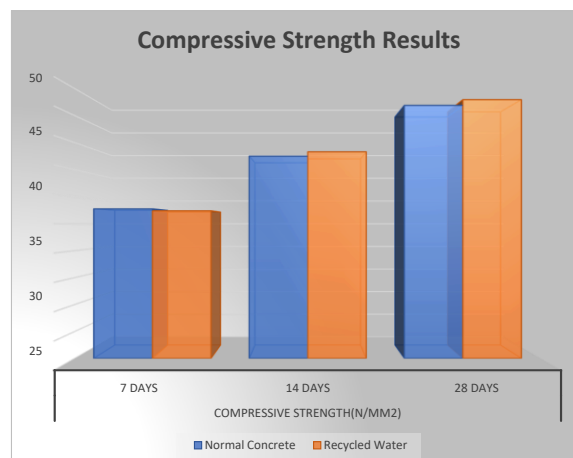


Chart -4.1: Compressive Strength results for 7, 14 and 28 days

In the compressive strength tests performed, the observation was that with the use of the recycled/treated waste water and the admixture the concrete had gained more strength for 14 and 28 days when compared with the normal concrete.

**4.2 Split Tensile Strength test**

Table 4.2 Split Tensile Strength Test Results

MIX-TYPE	Split Tensile Strength Results		
	7 Days	14 Days	28 Days
Normal Concrete	3.69	3.94	4.15
Recycled Water	3.9	4.02	4.93

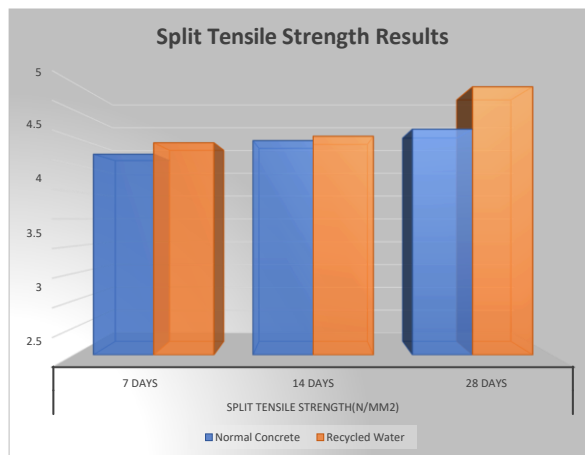


Chart -4.2: Tensile Strength result for 7, 14 and 28 days

In the split tensile strength tests performed, the observation was that with the use of the recycled/treated waste water and the admixture the concrete had gained more strength and there is an increase in strength for 7, 14 and 28 days when compared with the normal concrete.

**4.3 Flexural Strength test results**

Table 4.3 Flexural Strength Test Results

MIX-TYPE	Flexural strength Results		
	7 Days	14 Days	28 Days
Normal Concrete	3.75	4.09	4.32
Recycled Water	3.84	4.21	4.44

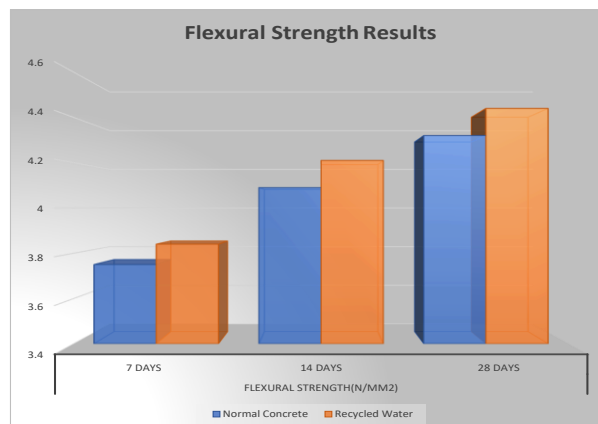


Chart -4.3: Flexural Strength results for 7,14 and 28 days

In the flexural strength tests performed, the observation was that with the use of the recycled/treated waste water and the admixture the concrete had gained more strength and there is an increase in strength for 7, 14 and 28 days when compared with the normal concrete.

#### V. CONCLUSION

After completion of all experiments, we conclude that treated waste water can be used not only for the irrigation purposes it can also be utilized for casting and curing of concrete. Based on the compression, split and flexural strength test we can conclude that,

- The compression strength test results obtained for 7, 14 and 28, there is an increase in strength for 14 and 28 days when compared with the strength of normal concrete.
- The split tensile strength test results obtained for 7, 14 and 28 days, there is an increase in strength for all the days of curing i.e., for 7, 14 and 28 days when compared with the strength of normal concrete.
- The Flexural strength test results obtained for 7, 14 and 28 days, there is an increase in strength for all the days of curing i.e., for 7, 14 and 28 days when compared with the strength of normal concrete.
- Using the recycled waste water for construction purpose is cheaper and economical when compared with the usage of normal or portable water. Recycled waste water is one of the alternative sources for mixing and curing of concrete.

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