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Experimental Investigation of Concrete Behavior with Waste Waters

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ABSTRACT
Water in India is primarily a state subject. Water is the main part of our life. It is a fact that if water is used there will be waste. So the waste water generation will never stop. In construction industry concrete being the most widely construction material used, uses most of the water. In construction industry water is used for mixing, aggregate washing, curing of concrete and for washing concrete related mechanical machines. Also water is used for domestic purposes. So as said above when we use water, waste water is produced. And due to this waste water there is a great environmental impact.The present work deals with the results of experimental investigations on waste water used in concrete. Effect of these different types of waste water on various strengths of concrete are studied. Various strengths considered for investigation are compressive strength, flexural strength, split tensile. Cube of size 150 mm for compressive strength, beams of size 100 mm X 150 mm X 700 mm for flexural strength, Cylinder dia 150 mm and 300 mm length for Split tensile strength were cast. Results were observe and comparison of results of concrete with that of water showed the significant improvements in the results of various strengths like as compressive strength, flexure strength and splitting strength with different types of waste water.

Introduction

Wastewater, also written as waste water, is any water that has been adversely affected in quality by anthropogenic influence. Municipal wastewater is usually conveyed in a combined sewer or sanitary sewer, and treated at a wastewater treatment plant. Treated wastewater is discharged into receiving water via an effluent sewer. Wastewaters generated in areas without access to centralized sewer systems rely on on-site wastewater systems. These typically comprise a septic tank, drain field, and optionally an on-site treatment unit. The management of wastewater belongs to the overarching term sanitation, just like the management of human excreta, solid waste and storm water (drainage).

In India and many other countries worldwide, water used in the manufacture of concrete must be potable. At present, it is currently thought that concrete properties are highly influenced by the water type used and its proportion in the concrete mix, but actually there is little knowledge of the effects of different, alternative water sources used in concrete mix design. Therefore, the identification of the level and nature of contamination in available water sources and their subsequent influence on concrete properties is becoming increasingly important. Of most interest, is the recycled washout water currently used by batch plants as mixing water for concrete. Recycled washout water is the water used onsite for a variety of purposes, including washing of truck agitator bowls, wetting down of aggregate and run off.

Sewage is the subset of wastewater that is contaminated with feces or urine, but is often used to mean any wastewater. Sewage includes domestic, municipal, or industrial liquid waste products disposed of, usually via a pipe or sewer (sanitary or combined), sometimes in a cesspool emptier. Sewerage is the physical infrastructure, including pipes, pumps, and screens, channels etc. used to convey sewage from its origin to the point of eventual treatment or disposal. It is found in all types of sewage treatment, with the exception of septic systems, which treat sewage on site.

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 we can use this treated waste water in the construction industry where the large amount of share of water is used and save the freshwater. This paper explains how treated waste water can be used in construction industry and reduces the load on nature. The impurities present in the waste water can affect the properties of the concrete when used for mixing in concrete. Also the impurities may not affect all properties of concrete but some. The water samples untreated waste water, Pre process waste water and Treated waste water were collected from JSPM Waste Water Treatment Plant, Wagholi, Pune, India. The waste water was tested in the laboratory of JSPM's Imperial college of Engineering and Research, Pune, India which was found to be as per the IS standards. The main objective of this work is to improve the knowledge and understanding of the torsional responses in concrete members, both with and without reinforcement.

Methodology

This is dealing with the test carried out on water, cement and concrete. The test carried out on water are determine the pH ,determine the total suspended solid, determine alkalinity, determine the hardness , determine the hardness, determine the BOD & COD for NW, UWW, PPWW, and TWW. The test carried out on the cement are Standard consistency of cement, Initial and Final setting time of cement, Compressive Strength of cement. Test carried out on concrete are workability i.e. Slump cone test, Compressive strength of concrete, Split tensile test, Flexural Strength of concrete. Test Conducted on Hardened Concrete: Confirming to IS 516-1959.

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Table 2.1. Experimental Results of Compressive Strength of NW

Days	Samples	Load in KN	Strength in Mpa	Mean Strength in Mpa
3	A1	273.96	12.18	13.06
	A2	295.00	13.11	
	A3	312.75	13.90	
7	A4	463.50	20.60	21.32
	A5	488.25	21.70	
	A6	487.13	21.65	
28	A7	758.93	33.73	35.12
	A8	777.15	34.54	
	A9	826.20	36.72	

Table 2.2. Experimental Results of Compressive Strength of UWW

Days	Sample	Load in KN	Strength in Mpa	Mean Strength in Mpa
3	A1	340.20	15.12	14.40
	A2	318.83	14.17	
	A3	312.98	13.91	
7	A4	554.18	24.63	27.30
	A5	680.63	30.25	
	A6	607.95	27.02	
28	A7	915.98	40.71	40.63
	A8	923.85	41.06	
	A9	902.70	40.12	

Table 2.3. Experimental Results of Compressive Strength of PPWW

Days	Sample	Load in KN	Strength in Mpa	Mean Strength in Mpa
3	A1	383.40	17.04	23.47
	A2	459.68	20.43	
	A3	741.38	32.95	
7	A4	684.68	30.43	29.73
	A5	767.70	34.12	
	A6	554.63	24.65	
28	A7	1032.08	45.87	45.81
	A8	982.58	43.67	
	A9	1077.53	47.89	

Table 2.4. Experimental Results of Compressive Strength of TWW

Days	Sample	Load in KN	Strength in Mpa	Mean Strength in Mpa
3	A1	312.53	13.89	13.87
	A2	311.85	13.86	
	A3	312.08	13.87	
7	A4	394.20	17.52	17.34
	A5	384.75	17.10	
	A6	391.50	17.40	
28	A7	724.73	32.21	32.14
	A8	700.65	31.14	
	A9	744.08	33.07	

Table 2.5. Experimental results Split Tensile Strength of NW:

Days	Sample	Load at Failure in KN	Strength in Mpa	Mean Strength in Mpa
28	0/C-1	173.09	2.45	2.58
	0/C-2	169.56	2.40	
	0/C-3	204.89	2.90	

Table 2.6. Experimental results Split Tensile Strength of UWW

Days	Sample	Load at Failure in KN	Strength in Mpa	Mean Strength in Mpa
28	0/C-1	300.26	4.25	4.09
	0/C-2	305.91	4.33	
	0/C-3	261.41	3.70	

Table 2.7. Experimental results Split Tensile Strength of PPWW

Days	Sample	Load at Failure in KN	Area	Strength in Mpa	Mean Strength in Mpa
28	0/C-1	332.06	141300	4.70	4.62
	0/C-2	322.16	141300	4.56	
	0/C-3	324.99	141300	4.60	

Table 2.8. Experimental results Split Tensile Strength of TWW

Days	Sample	Load at Failure in KN	Area	Strength in Mpa	Mean Strength in Mpa
28	0/C-1	233.15	141300	3.30	3.31
	0/C-2	222.55	141300	3.15	
	0/C-3	245.86	141300	3.48	

Table 2.9. Experimental results of flexural Strength of NW

Days	Sample	Load at Failure in KN	Deflection in mm	Strength in Mpa	Mean Strength in Mpa
28	A-1	502.95	8.38	4.79	4.72
	A-2	480.90	8.02	4.58	
	A-3	504.00	8.40	4.80	

Table 2.10. Experimental results of flexural Strength of UWW

Days	Sample	Load at Failure in KN	Deflection in mm	Strength in Mpa	Mean Strength in Mpa
28	B-1	560.70	9.35	5.34	5.22
	B-2	547.05	9.12	5.21	
	B-3	535.50	8.93	5.10	

Table 2.11. Experimental results of flexural Strength of PPWW

Days	Sample	Load at Failure in KN	Deflection in mm	Strength in Mpa	Mean Strength in Mpa
28	C-1	626.85	10.45	5.97	5.54
	C-2	549.15	9.15	5.23	
	C-3	570.15	9.50	5.43	

Table 2.12. Experimental results of flexural Strength of TWW

Days	Sample	Load at Failure in KN	Deflection in mm	Strength in Mpa	Mean Strength in Mpa
28	D-1	420.00	7.00	4.00	4.50
	D-2	514.50	8.58	4.90	
	D-3	483.00	8.05	4.60	

In present study cube compression test, flexural test on beams, split tensile test and shear and torsion test on plain and different types of steel fiber concrete (SFC) with constant fraction are carried out. The experimental results and results discussion for various tests are described below.

Compressive Strength Test:

A cube compression test is performed on standard cubes of plain and SFC of size 150 x 150 x 150 mm after 3, 7 and 28 days of immersion in water for curing. Results of various for NW, UWW, PPWW, and TWW as shown in Table 2.1 to Table 2.4 and graphical presentation of compressive strength is shown in Figures No-2.1.

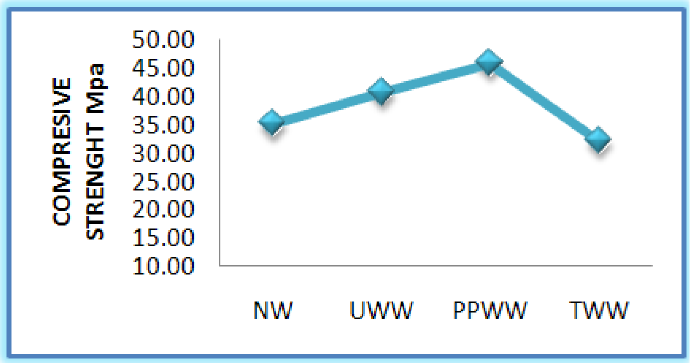

Fig 2.1. Graphical presentation of compressive strength (Mpa)

Split Tensile Test:

The split tensile test is well known indirect test used to determine the tensile strength of concrete. Due to difficulties involved in conducting the direct tension test, a number of indirect methods have been developed to determine the tensile strength of concrete. In these tests, in general a compressive force is applied to a concrete specimen in such a way that the specimen fails due to tensile stresses induced in the specimen.

The tensile strength at which failure occurs is the tensile strength of concrete. In this investigation, the test is carried out on cylinder by splitting along its middle plane parallel to the edges by applying the compressive load to opposite edges. The arrangement for the test is shown in photo with the pattern of failure. The split tensile strength of cylinder is calculated by the following formula. Experimental Results of for NW, UWW, PPWW, and TWW as shown in Table 2.5 to Table 2.8 and graphical presentation of compressive strength is shown in Figures No-2.2.

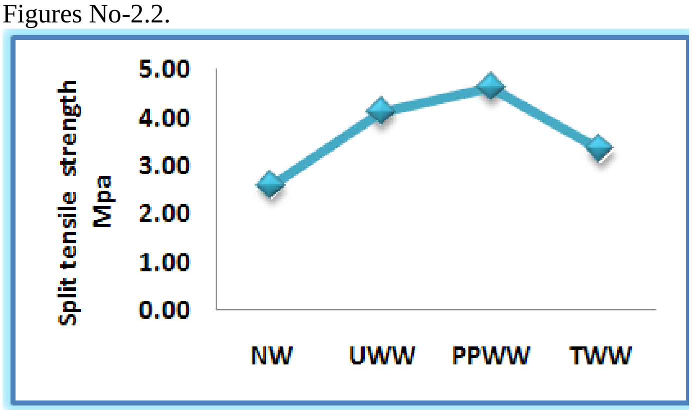

Fig 2.2. Graphical presentation of Split Tensile Strength (Mpa

Flexural Test:

Standard beams of size 150 x 150 x 700mm are supported symmetrically over a span of 400mm and subjected two points loading till failure of the specimen. The deflection at the center of the beam is measured with sensitive dial gauge on UTM. The two broken pieces (prisms) of flexure test are further used for equivalent cube compressive strength. Experimental Results of for NW, UWW, PPWW, and TWW as shown in Table 2.9 to Table 2.12 and graphical presentation of flexural Strength is shown in Figures No-2.3.

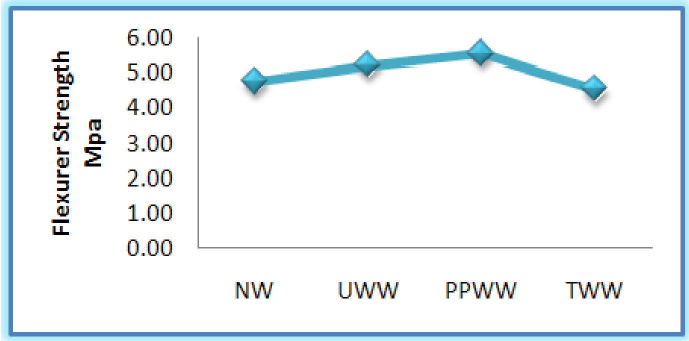

Fig 2.3. Graphical presentation of flexural Strength

Result and Discussion:

1. In general, the significant improvement in various strengths is observed with the inclusion of Pry primary treated waste water as compare with Natural, Untreated and Treated Waste Water.

From comparative statement of Compressive strength, its improves in pry-primary waste water as compare with Natural, Untreated and Treated Waste Water. Strength comparison between all types of waste waters as NW, UWW, PPWW, and TWW is 35.12 Mpa, 40.63 Mpa,45.81 Mpa and 32.14 Mpa respectively.

i. Flexural strength: Flexural strength and tensile strength also enhanced in pry-primary waste water as compare with Natural, Untreated and Treated Waste Water. Strength comparison between all types of waste waters as NW, UWW, PPWW, and TWW is 4.72 Mpa, 5.22 Mpa, 5.54 Mpa and 4.50 Mpa respectively

ii. Split tensile strength: It is observed that the tensile strength also improved in pry-primary waste water as compare with Natural, Untreated and Treated Waste Water. Strength comparison between all types of waste waters as NW, UWW, PPWW, and TWW is 2.58 Mpa, 4.09 Mpa, 4.62 Mpa and 3.31 Mpa respectively.

Conclusion

1. From above discussion it is conclude that, all mechanical properties viz. compressive strength, flexure strength, splitting strength, are improved by in pry-primary waste water as compare with Natural, Untreated and Treated Waste Water..
2. All strength likes compressive strength, flexure strength and splitting strength are improved in pry-primary waste water as compare with Natural, Untreated and Treated Waste Water.

Feather future work

Next feather work will be casting of plain and reinforced beams and check for pure torsional effect by especially casted frame.

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