Experimental Study on Compressive Strength of Concrete by Using Reclaimed Water

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***Abstract*- Ideals with the introduction to treated domestic wastewater utilized in concrete preparation where the scarcity of fresh water. Discuss the physical properties of materials and chemical properties of treated domestic wastewater experimental programme is presented in mix proportion of M20 grade concrete are present. Compressive strength results of M20 grade concrete cast by using treated wastewater. M20 grade at 7days the average compressive strength for all mixes will be same at the end of 14 days marginal increase in compressive strength. By using natural sand, M-sand and washed M- sand. Compressive strength at 28days will be higher, tensile strength of the concrete is nearly same and higher strength is achieved at the age of 28days. Flexural strength is comparatively high. At the age of 28days by using reclaimed water**

Index terms- Cement, natural sand, M-sand, Washed M-sand, Coarse Aggregate, Treated waste water

I. INTRODUCTION

Concrete is the most commonly used as a construction material in the world. Concrete is commonly made by mixing Portland cement withstand, crushed rock and water. Ordinary concrete typically contains about 70%-80% of aggregate, 20-12% of cement and 10%-8% of mixing water by mass. On an average 150 liters water is required for 1m³ of concrete. Construction of 100,000sq.ft.multi-storey structure can require about 10 million liters water for production, curing and site development activity. A double lane flyover can consume 70 million liters water on the same scale. Also concrete industry water is used for mixing, aggregate washing, curing of concrete and for washing concrete related mechanical machines. But about 97 percent of water is held in the oceans, while only 3 percent is fresh water. Of the freshwater, only 1 percent is easily accessible as ground or surface water, the remains are stored in glaciers and icecaps. Moreover, freshwater is not evenly distributed across land surfaces, and there are a number of heavily populated countries located in arid lands where fresh water is scarce. Hence, the ultimate and last option will be treating the wastewater 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 water is used and save the freshwater. Almost 80% of the water used for domestic purpose comes out as wastewater. Impurities in water used for mixing concrete, when excessive, may affect not only the concrete strength but also setting time. Therefore, certain optional limits may be set on chlorides, sulfates, alkalis, and solids in mixing water or appropriate tests can be performed to determine the effects that impurity can have on various properties.

II. PRELIMINARY INVESTIGATION OF MATERIALS AND METHODOLOGY USED FOR PREPARING CONCRETE SPECIMENS

Cement

43 grade of cement confirming to Indian standards code IS 8112:1989 is applied in this investigation. We Preferred Coramandal King Cement.

Natural sand

Natural sand conforming code IS 1542-1992, zone II and it is suitable for concreting, plastering and masonry construction.

M- sand

Manufacturing sand conforming code IS 383, zone II and it is suitable for concreting, plastering and masonry construction.

Washed M- sand

Washed Manufacturing sand conforming code IS 383, zone II and it is suitable for concreting, plastering and masonry construction.

Coarse Aggregate

Angular crushed broken aggregated of maximum size 20mm.

Water

The Treated waste water at Naidu-Nagar treatment plant is used for the preparations of blocks is to be resist the properties like strength and sturdiness.

Methodology

The "conventional wisdom" in concrete technology literature has been that water used for mixing and curing concrete would be satisfactory, i.e., potable and fit for human consumption. The reason for this is that municipal drinking water seldom contains more than 1000mg/l of dissolved solids and color waters containing organic materials may retard the hydration of cement. Many organic compounds that are also available in untreated industrial waste may affect the hydration of cement. Mixing and curing is sparse, some information is available and researches have concluded some important information on this possibility. With limited portable water resources and ever increasing demand for water in various industrial and domestic uses, the need to conserve water and develop new water resources becomes more urgent. The use of water considered unfit for human consumption violating more essential in construction uses. The water was reclaimed by coagulation- flocculation, sedimentation, filtration, aeration, chlorination and reclamation operation followed activated sludge treatment. This reclaimed wastewater was used to cast 150mm x150mm x 150mm cubes &150 mm and 300mm in length for cylinders.

Reclaimed water has been collected from naidunagar treatment plant about 5 km from M.I.T. The wastewater samples were collected at mid depth of stream representing whole part of stream.

Fig 1.0 Raw water before treated in treatment plant

Fig 2.0 Raw water after treated in treatment plant

Fig 3.0 material preparation before commencement of project

After the collection of treated water in the treatment plant then it is analyzed in the laboratory and results are tabulated below.

Table 1.0 Characteristics of reclaimed and tap water

Sl no	Parameters	Reclaimed water	Tap water (mg/l)	standard values As per BIS (mg/l)
1	Ph	8.05	7.5	6.5-8.5
2	Chlorides	135	200	250
3	Calcium	40	16.5	75
4	Magnesium	12.6	13.59	30
5	Acidity	NIL	-	-
6	Alkalinity	NIL	-	-
7	Total Hardness	52.6	30.09	200
8	Carbonates	NIL	-	-
9	T. D. S	600	320	2000
10	Sulphate	84	16	200

III. EXPERIMENTAL INVESTIGATION OF CONCRETE INGREDIENTS

Properties of cement

Table 2.0 Consistency of cement

SL NO	TYPES OF WATER	VALUES	PERMISSION LIMIT
01	Wastewater	30%	30-32%
02	Tap water	30%	30-32%

Table 2.1 Initial and Final setting of cement

NO	TYPES OF WATER	VALUES	PERMISSIBLE LIMIT
01	Wastewater	80min	>30 mins
02	Tap water	65min	>30 mins

SLNO	TYPES OF WATER	VALUES	PERMISSIBLE LIMIT
01	Wastewater	350min	Not less than 600 min
02	Tap water	240min	Not less than 600 min

Properties of fine aggregates

Table 3.0 sieve analysis of fine aggregate

IS SIEVE SIZE	CUMULATIVE PERCENTAGE		SPECIFICATION AS PER IS 383-1970 IN RESPECT OF 4.75MM NOMINAL SIZE OF AGGREGATE		
	Retained	Passing	Zone 1	Zone 2	Zone 3
4.75mm	1.4	98.6	90-100	90-100	90-100
2.36mm	4.1	95.9	60-95	75-100	85-100
1.18mm	22.2	77.8	30-70	55-90	75-100
600mm	59.0	41.0	15-34	35-59	60-79
300	94.2	5.8	5-20	8-30	12-40
150	99.7	0.3	0-10	0-10	0-10

Table 3.1 properties of fine aggregate

Sl. No	PROPERTY	UNIT	VALUES			VALUES
			Natural sand	M- SAND	Washed M-Sand	
01	Specific gravity	-	2.56	2.63	2.67	2.75
02	Dry bulk density	Kg/m³	1539.24	1427	1560	1427
03	Water absorption	%	2.7	1.0	1.5	2.7
04	Moisture content	%	2.2	0.4	1.1	2

Properties of coarse aggregates

Table 4.0 sieve analysis of coarse aggregate

IS SIEVE SIZE	CUMULATIVE PERCENTAGE		SPECIFICATION AS PER IS 383-1970 IN RESPECT OF 20mm NOMINAL SIZE OF AGGREGATE	
	Retained	Passing	Graded	Single sized
40mm	0	100	100	100
20mm	13.6	86.4	95-100	85-100
12.5mm	90	10	-	-
10mm	99.65	0.35	25-55	0-20
4.75mm	100	0	0-10	0-5

Table 4.1 properties of coarse aggregate

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01	Specific gravity	-	2.56	2.63	2.67	2.75
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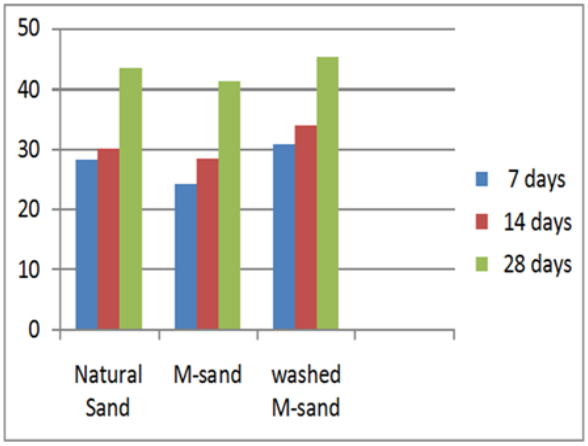
Table 5.0 Concrete Mix Design Proportions For M20

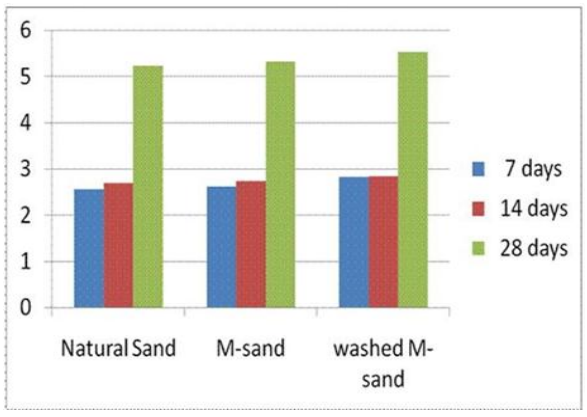
Sl no	Concrete Materials	Proportion by weight in kg	Proportion in ratio
1	Cement	343.4	1
2	Water	183	0.53
3	Fine aggregate	601	1.75
4	Coarse aggregate	1172	3.41

Results and discussions

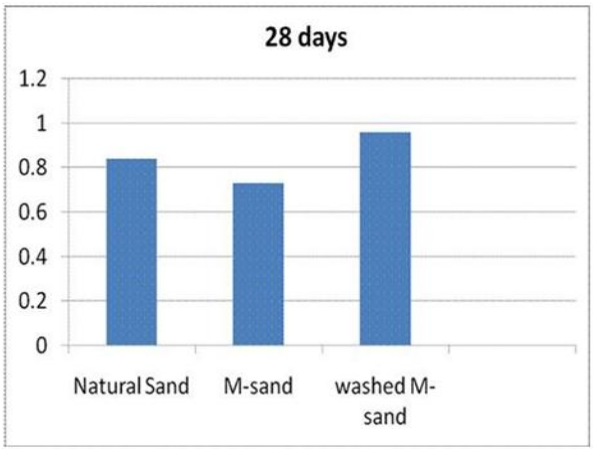
Graph 1.0 compressive strength of concrete on 7, 14 and 28 days



Graph 2.0 Tensile strength of concrete on 7, 14 and 28 days



Graph 3.0 Flexural strength of concrete on 28 days



CONCLUSIONS

1. The chemical composition of treated wastewater is similar to that of ground water Therefore the study concludes that ground water may be replaced by the treated wastewater in concrete mix.
2. Using treated wastewater in making concrete mix will decrease the consumption of tap water in concrete mixes.
3. The quality of mixing treated wastewater does not affect on the consistency, initial and final setting time.
4. The compressive strength of concrete made with the treated wastewater gives more compressive strength than that of concrete made with tap water. Hence ground water can be replaced with treated water particularly at place where there is scarcity of fresh water.
5. At present, in the world 16% of the fresh water is being used for concreting which can be saved by utilizing treated water. This will not save the precious fresh water but will also provide opportunity to manage the waste water otherwise which is being big environmental disaster.
6. Based on the study, the treated water from Naidu-Nagar treatment plant which is located near MIT college, Mysore can be used for concrete work.

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