EFFECT OF PRIMARY TREATED WASTE WATER IN CONCRETE MIX

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Abstract

Concrete is the most widely used construction material in the world, making it one of the largest water consuming industries. Approximately 150 liters of water is required per cu. m. of concrete mixture without considering other applications of water at the concrete industry. But water is a critical environmental issue and water supplies and water quality are becoming more limited worldwide. The waste water sample is collected from "MYLSANDRA WASTE WATER TREATMENT PLANT", water sample used is Primary Treated Waste Water (PTWW), which was analyzed for its chemical properties in laboratory. In M20 concrete mix the potable water was replaced with the PTWW in different dilution ratios of 20%, 40% and 100%. The compressive strength result obtained from treated effluent showed an increase in 10.68% for 28 days compared to fresh water. From this study, it is believed that the recommended reuse of 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.

Key Words: Compressive strength, Waste water, primary treatment

1. INTRODUCTION

Portland cement concrete is the most widely used manufactured material. Judging from the modern trends, the future of concrete looks brighter because for most purposes it offers suitable engineering properties at low cost combined with energy savings and ecological benefits. It is desirable that engineers know about concrete than about building material.

Due to the growing agriculture, urban and industrial needs, water table in every continent are falling, by this the drinking water are becoming scare. It is suggested that with water, practical large scale solution is to use the resources which are not currently efficient. The most widely used construction material is concrete, commonly made by mixing Portland cement with sand, crushed rock and water. Normal concrete consists about 70% aggregate, 20% cement and 10% mixing water by mass approximately. Concrete industry is consuming annually 1 billion tons of mixing water in the world. Moreover large quantity of fresh water is used for curing of concrete.

Nowadays ground water is depleting in a fast manner and lot of money are required and spent for search of water in the vicinity of water source . So the used water can be recycled and used for industrial activities like construction purposes, if the water is found to be suitable. The partially treated water consists of lot of total dissolved solids which affect water so much. The waste water even if it is stored unused also it is a major pollution problem to the environment.

The concrete industry has therefore serious impact on the environment with regard to consumption of water. Thus there is a need to study alternative to fresh water for mixing and curing of the concrete.

Almost 80% of the water used for domestic purpose comes out as waste water . Impurities in water used for mixing concrete strength but also setting time, certain optional limits may be set on chlorides, sulfates, alkalis, solids in mixing water or appropriate tests can be performed to

determine the effects that impurity can have on various properties. So an attempt is made to utilize the polluted water for construction purposes by making primary treatments. In addition to this, ground water as well as cultivable lands are also polluted. If the water is utilized for some other domestic purposes it leads to a lot of human illness in their study haven given the impact of this problem in detail. To minimize these problems the waste water can be used for construction work without affecting the surrounding environment. By utilization of this water, water scarcity can be reduced.

1.1 Literature Review

Vidhya Lakshmi [(1)] The concrete mix proportions of ratio 1:1.5:3 of grade 53 ordinary Portland cement, mix sand, coarse aggregate of 20mm nominal size were cured and tested at 7,14 & 28 days. The casted specimens of size (150*150*150) mm cubes and (150*300) mm cylinders were tested for compressive strength. The size of (150*300) mm cylinders were tested to determine the split tensile strength. At 7,14 & 28 days test showed that secondary treated wastewater increases the load carrying capacity and compressive strength is 9.62% more in case of secondary treated wastewater. Concrete prepared by using secondary

Marca Silva (2) Sewage treatment plant water from Milwaukee metropolitan sewage district is characterized. A total of 3 batches were prepared with potable water and one with recycled water in 2007, Mortar cubes of 50mm size were prepared according to ASTM standards. Water cement ratio of 0.485, mortar was mixed according to ASTM C305.Flow of the mortar was then determined. After 24hours moulds were removed and specimens were immersed in a saturated lime water curing tank. The compressive strength development was measured after 1, 7, 14, 28, 56 & 91days of casting the average flow for mortar cubes made of potable water and reclaimed water was 98.1% and 89.5%. Compressive strength of mortar cubes with sewage treatment plant water showed the improvement in strength during 3-28 days. The preliminary research suggested that there are no such significant differences between mortar cubes of potable water verses sewage treatment water

Ramkar A P [(3)] They made a study on effect of treated waste water on strength of concrete. Ordinary Portland cement 53 grade, specific gravity of coarse aggregates of 20mm size, specific gravity of 2.61, waste absorption 0.3% natural sand are used. Sample from the sewage treatment plant at Ahmednagara is collected. Waste quantity of used waste is analyzed for PH, TSS, hardness, BOD and COD is done and compared with standards consistency of cement paste was found by VECAT apparatus followed by IS4031 was obtained at 7 days ,28 days with water cement ratio 045 and 1:3 cement and sand proportion.

H Vijay [(4)] Scope of the study restricted to plain concrete without reinforcements. Ordinary Portland cement-53 grade, specific gravity -3.15, fine aggregates of size less than 4.75mm with specific gravity of 2.64, absorption value 1%, coarse aggregates of size 2.64, absorption value 0.5% were used. Portable water sample from NMAMIT campus central reservoir was collected. Specific gravity and water absorption was carried out on aggregates, 9 set of cube size(150*150*150)mm of water/cement ratio 0.45 was prepared for each trail by mixing with fresh, treated , garage, daily waste respectively and tested for 3,7 and 28 days of curing. From the test results it was seen that no side effects on concrete replacement of fresh water by treated effluent increases the strength of concrete

1.2 Materials and Methodology

- OPC 53 grade confirming to IS grade produced from single source will be used.
- Locally available fine aggregate will be used.
- The maximum size of coarse aggregate is limited to 20 mm to get maximum increase in compressive strength. A sieve analysis conforming to IS – 2386 -1963 will be carried for coarse aggregate (20 mm -12mm) and other tests are carried out in the laboratory as per IS -2386-1963.
- The primary treated waste water is collected from MYLSANDRA WASTE WATER TREATEMENT PLANT. The laboratory tests are carried out as per IS-3025.

- MIX DESIGN: mix design is carried out as per IS -10262-2009 for M20 concrete by varying water cement ratio (0.45).
- CASTING: 5 concrete cubes each will be casted according to the mix proportions and by .45 water cement ratio for 3 dilution ratios 100%, 80% and 60% primary treated waste water.
- For M20 concrete different combination of concrete mixing will be carried out as given below:
- 15specimens are casted using 100% tap water.
- 15 specimens are casted using 100% primary treated waste water.
- 15 specimens are casted using 80% primary treated waste water and 20% fresh water
- 15 specimens are casted using 60% primary treated waste water and 40% fresh water
- CURING: Curing will be done by immersing the specimen in tap water separately. Five concrete blocks of each dilution ratio are tested for compressive strength in 7,14,28 days.

2. Experimental Work

The primary treated waste water is collected from MYLSANDRA WASTE WATER TREATMENT PLANT and its chemical properties are analysed in a laborator

Table -1: Waste Water properties

TEST PARAMETER	UNITS	RESULTS	TOLERABLE LIMITS	TEST METHOD
PH value	-----	7.4	6-8	IS:3025(P-11)-1983 RA- 2012
TSS	mg/l	1650	2000	IS:3025(P-17)-1983 RA-2003
Total alkalinity	mg/l	321	250	IS:3025(P-23)-1986RA-2003
BOD	mg/l	573	-	APHA, 5210, B, 22ND EDITION
COD	mg/l	2360	-	APHA, 5220, B, 22ND EDITION
Chloride	mg/l	144	2000-3000	IS:3025(P-32)-1984 RA-2009
Acidity	mg/l	<1	50	IS:3025(P-22)-1984 RA-2014

Table -2: Cement properties

TESTS	**RESULTS**	**REQUIREMENTS AS PER IS:8112-1989**
Normal Consistency	37%	Not specified
Initial Setting Time	45min	Shall not less than 30 minutes
Final setting time	325min	Shall not less than 600 minutes
Specific gravity	3.24	Not specified
Fineness	3%	Should be less than 10 % of its weight

Table -3: Aggregate properties

Test	**Result**
Coarse Aggregates	
Specific gravity	2.63
Water absorption	0 .67
Fine Aggregates	
Zone	Zone -I
Fineness modulus	1.80
Specific gravity	2.60

Table -4: Sieve Analysis of fine aggregates

IS sieve Designation	IS sieve Designation	Zone I
10mm	100	100
4.75mm	100	90-100
2.36mm	95.25	60-95
1.18mm	49.15	30-70
600	27.45	15-34
300	7.20	5-20
150	1.60	0-10

Chart -1: Sieve analysis Chart

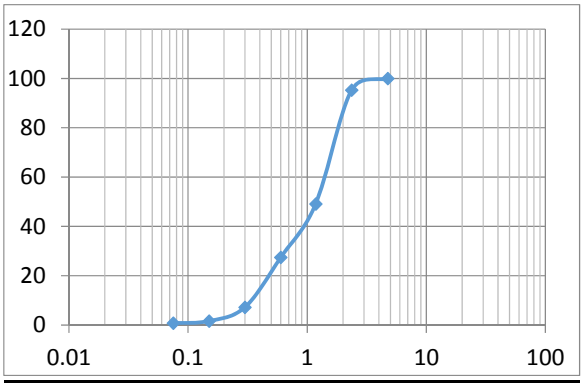


Table -5: Mix Proportion Details

Dilution ratio	0%	20%	40%
Water cement ratio	0.45	0.45	0.45
Cement content(kg/m$^{3)}$	413.33	413.33	413.33
Primary treated waste water (kg/m^3)	199	159.2	199.4
Potable water (kg/m^3)	0	39.8	79.6
Fine aggregate (kg/m^3)	680	680	680
Coarse aggregate (kg/m^3)	1750	1750	1750

3. Test Results

Chart -2: Average Compressive strength of cubes (Potable water)

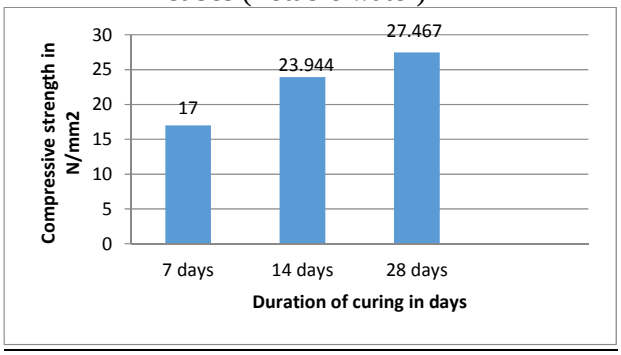


Chart -3: Average Compressive strength of cubes (100% primary treated waste water)

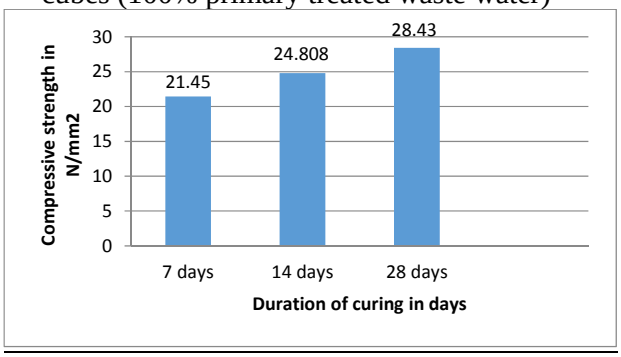


Chart -4: Average Compressive strength of cubes (80% primary treated water+20% potable water)

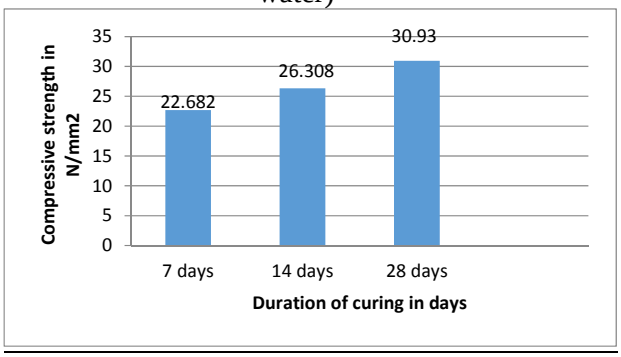


Chart -5: Average Compressive strength of cubes (60% primary treated water+40% potable water)

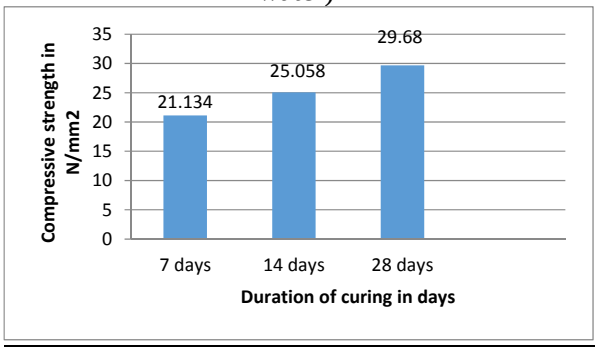
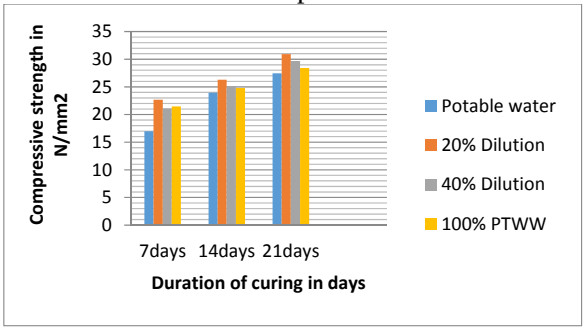


Chart -6: Comparative results



3. CONCLUSIONS

Based on the experimental Results the following conclusions were drawn:

- The consistency, initial and final setting time of cement paste by mixing PTWW is within the IS limit.
- The mean target strength is achieved at cement quantity of 413.33 kg/m3 with W/C ratio 0.45 at all the dilution ratios.
- Tests performed in this study suggest that primary treated wastewater is an interesting candidate for use in concretes for applications in the mixture.
- It has been observed from table 5.1 to 5.2.3, the concrete with 20% dilution ratio at 28 days, the maximum compressive strength of 30.93 MPA is obtained.
- The rate of strength developed in primary treated waste water is uniformly increasing throughout the age of curing.
- From this experiment is concluded that PTWW contains less impurities and is fit as per IS provision.
- The compressive strength of mortar is increased by mixing PTWW at the end of 28 day for all the dilution ratios especially for 20% primary water diluted with potable water.
- There is a significant increase in the load carrying capacity, the compressive strength of the primary treated wastewater concrete when compared with the conventional concrete.
- The compressive strength is 10.68 % more in case of concrete cubes confined with primary treated wastewater

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