EXPERIMENTAL INVESTIGATION OF TEXTILE WASTE WATER REUSING IN CONCRETE

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Abstract - *As a sustainable approach this project is conducted to study the possibility of reuse of treated waste water in concrete, concrete is the most widely used construction material in the world. Production of Portland cement used in concrete produces 2.5 billion tons of carbon dioxide and other greenhouse gases worldwide. In addition concrete is one of the largest water consuming industries. Approximately about 150 liters of water is required for per cubic meter of concrete mix. Demand of fresh water by the construction sector is expected to increase due to high increase in the growth of construction activities in India. In this study, the experiments were performed to investigate the adsorption capacities of locally available low cost bio-adsorbents like neem leaves, orange peels, peanut hulls, activated Corban and coconut coir pith powders to remove color in a textile industry waste water. Conducted the experiments at pH of parameters like adsorbent dosage, temperature, and contact time and agitator speed using batch adsorption method. From the experimental investigations, the maximum color from the textile industry waste water was obtained at an optimum adsorbent dosage of an optimum contact time of an optimum temperature and an optimum agitator speed. This project presents the reuse of treated waste water and potable water in concrete for both mixing and curing. Concrete in prepared for M-40 grade concrete with SNF super plasticizer for both treated waste water and portable water and cured for an age of 7 day,14 days and 28 days. Compressive strength, durability properties and microscopic study both concrete prepared with treated waste water and portable water is studied.*

Key Words: *Textile waste water, concrete, Reference concrete mix, Waste water treatment….*

1. INTRODUCTION

Water is a colorless and chemical substance. Water is the main constituents of earth's streams, lakes & oceans, and the fluids of most living organisms. The chemical formulae of water is H2O, means each molecules of water contains 2 atoms of hydrogen and one atom of oxygen. It also occurs in nature as snow, glaciers, icepacks, icebergs, clouds, fog, dew, aquifers and atmospheric humidity. The following pie chart shows the availability of fresh water in the world. Water is mainly used for agriculture, drinking, washing, transportation, chemical uses, heat exchange, fire extinction, recreation, industries, food processing and for medical uses etc..

Day by day due to less availability of clean and safe drinking watertodaynearlyabout1billionpeople don't have access to it, yet we take it for granted, we waste it and even we are paying too much for getting pure drinking water from little plastic bottles. Water is the main foundation for life till today so money countries are struggling for searching a fresh water. The below shown graph fives the per capita per yearly availability of fresh water from this graph availability of water is keep on decreasing year by year. This graph shows the world scarcity of water. Concrete is the second industry to consume more water for preparing concrete, for hydration purpose and for curing, etc., to overcome these water scarcity problems and as a sustainability approach to the world regarding scarcity of water in our paper we used treated waste water in concrete instead of portable water.

2. LITRATURE REVIEW

Ooi et.al, 2001 Made the feasibility study of using treated effluent for concrete mixing was studied. Treated effluent from sewage treatment plants in Malaysia is currently being wasted through direct discharge into waterways. With proper water quality control, this treated effluent can also be considered as a potential water resource for specific applications. Two tests were carried out namely compressive strength test and setting time to determine the feasibility of using treated effluent for concrete mixing. The results were compared against the tests conducted on control specimens who used potable water. The results showed that treated effluent increases the compressive strength and setting time when compared with potable water.

Al-Ghusain et.al, 2003, also reported that treated wastewater was not shown to have an adverse effect on concrete. On the other hand, raw sewage reduced the 3 and 28-day compressive strength by 9%. The results (setting time, and mortar and concrete strength tests) showed that biologically treated average domestic sewage is similar from distilled water when used as mixing water. In Malaysia, researchers carried out two tests to determine the feasibility of using treated effluent for concrete mixing. Their results showed that treated effluent increases the compressive strength and setting time when compared with potable water and that treated effluent could be used as mixing water in concrete. EPA has presented suggested guidelines for water reuse. Three configuration alternatives for water reuse systems are presented. One of the sources is the effluent generated by domestic wastewater treatment facilities.

ATA Olugbenga (2014), conducted a series of tests to investigate the effect of different types of mixing water from different sources on compressive strength of concrete. The results revealed that the sources of water used in mixing concrete have a significant impact on the compressive strength of concrete. The results suggested using river water in concrete production where potable water is scarce.

Al-Joulani (2015), reported results of the effect of different types of wastewater on some concrete properties. The author investigated workability, natural absorption, splitting tensile strength and compressive strength. The results of using treated wastewater in concrete mixtures showed minor reduction (11%) in compressive strength after 28 curing.

M.K., et. al. (2015), reported review of the literature on the effect of quality of mixing water for making concrete. The authors compiled the allowable limits of physical and chemical impurities in mixing water, and their test methods from different countries standards. The authors concluded that using non-traditional mixing water in concrete making influenced the reaction process and therefore, the setting time, compressive strength and also lead to softening of concrete.

Sameer N. S. et. al., (2016), presented experimental results of replacement of potable water by treated wastewater in concrete mixing. Water samples used were primary treated wastewater (PTWW), secondary treated wastewater (STWW) and tap water (TW). The results for PTWW, STWW and TW suggested that STWW is appropriate for using in construction industry.

Manjunatha M. (2017), presented results of experimental study on reuse of treated wastewater in concrete production. Potable water and treated wastewater were used to prepare concrete mixtures and for curing. The result showed that the treated wastewater is suitable and could be used in concrete production at permissible limits. The results showed no big differences exist between concrete cubes made of both treated wastewater and portable water. The initial and final setting time of cement mixing treated wastewater is within the IS limit. Workability is good and the compressive strength increased by using treated wastewater in concrete mixtures, at the end of 7 days curing.

Hummaira Kanwal et al. (2017), reported results on the effect of using wastewater (WW), treated wastewater (TWW) and treated sewage (TS), on compressive strength of concrete, as compared with concrete made using fresh water (FW). The tests results showed that workability were between 25-50 mm, but the ultimate compressive strength of concrete made with wastewater (WW) was decreased and the strength of concrete made with treated wastewater and treated sewage (TWW, TS) at the age of 28 days do not change significantly.

3. EXPERIMENTALINVESTIGATION

CEMENT: Ordinary Portland Cement (OPC) conforming to IS 456-2000 was used for this study, its chemical and physical properties are given in table. The cement was tested for its mineral content using .The specific gravity (SG) of cement was determined according to the IS 456-2000 using the small pycnometer method. The fineness of the cement was determined by conducting the mechanical sieve analysis test according to IS 456-2000.

COARSE AGGREGATE: The aggregate is free from crack and dust. The granite used for this research work was passing 20mm and retain 4.75mm.The specific gravity as well as impact value test for both coarse and fine aggregate were done as specified in IS456-2000 the aggregate free from crack and dust.

FINE AGGREGATE: The fine aggregate used was mining sand passing by 4.75 mm sieve. The grading of fine aggregates, when determined as described in IS: 2386 (Part I) 1963 shall be within the limits given in table 4 and shall be described as fine aggregate.

WATER: water is essentially required in concrete for complete chemical hydration of cement in concrete. Water used in concrete should be free from suspended solids, alkali, organic impurities etc., and it should be equal to drinking water quality standards or else it directly effects on the strength of concrete. In our project we prepared a concrete with portable drinking water versus treated wastewater.

SLUDGE WATER: Sludge is a semi- solid slurry that can be produced from a range of industrial processes, from water treatment, wastewater treatment or on-site sanitation systems.... Industrial wastewater treatment plants produce solids that are also referred to as sludge.

TEXTILE WASTE WATER: Industrial waste is the waste produced by industrial activity which includes any material that is rendered useless during a manufacturing process such as that of factories, industries, mills, and mining operations. It has existed since the start of the Industrial Revolution.... (See Industrial waste water treatment)

PREPARATION OF TESTSPECIMENS: The granite powder collected from polishing units was dried. As per the mix proportions, given in table-1 the quantities of various ingredients were weighed. Initially cement and granite powder were mixed thoroughly. Further sand and coarse. aggregate were added to the mix. Once all the materials were mixed well, Cubes of size150mm X150mmX150mm and cylinder were cast. The specimens were cured in curing tank for a period of 28days.

MIX DESIGN: The mix design was carried out based on the recommended guidelines in Indian standards (IS 10262-2009). The basic assumption made in the Indian standard method for mix design is that the compressive strength of the workable concrete is by the large governed by the water cement ratio. In this method the water content and

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proportion of fine aggregate corresponding to a maximum size of aggregate are first determined from the reference Values of workability, water-cement ratio, and the grading of fine aggregate. The water Content and proportion of fine aggregate are then adjusted for any difference in workability, water/ cement ratio and grading of fine aggregate in any particular case.

Characteristics compressive strength required in the field at 28 days =25Mpa
Grade designation = M40
Maximum size of aggregate=20mm
Degree of workability =0.90
Degree of quality control = Good
Type of exposure = Mild
Specific gravity of cement = 3.15
Specific gravity of coarse aggregate=2.67
Specific gravity of fine aggregate = 2.465
Water absorption of coarse aggregate = 0.15%
Water absorption of fine aggregate = 1%

Table -1: Mix proportions of concrete with waste water

Mix design	Normal water	Sludge water	Textile Waste Water
w/c ratio	0.50	0.50	0.50
Cement content (kg)	3.9	3.9	3.9
Fine aggregate(kg)	7.4	7.4	7.4
Coarse aggregate(kg	11	11	11
Water (lit)	1.97	1.97	1.97

4. RESULTS AND DISCUSSION

COMPRESSIVE STRENGTH

Figure -1: Compressive Strength Test

Table -2: Compressive strengths of cubes with different types of waste water in 7, 14 & 28 days

Type of water	7 days (N/mm2)	14 days (N/mm2)	28 days (N/mm2)
Normal water	18.65	20.92	21.67
Sludge water	19.42	21.34	23.18
Textile Waste Water	20.12	22.89	24.94

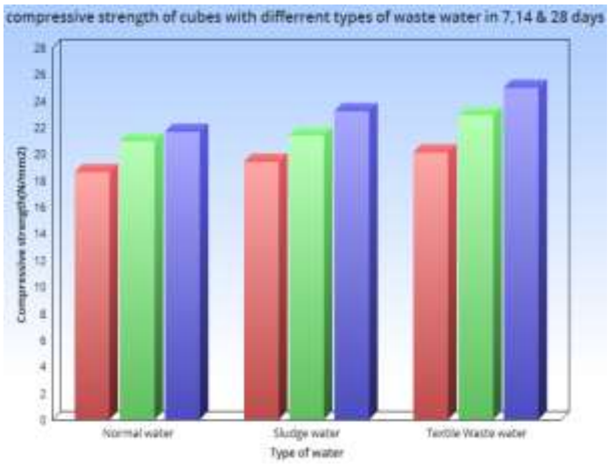

Chart -1: Compressive strength

SPLIT TENSILESTRENGTH

Figure -2: Split Tensile Strength Test

Table -3: Split tensile strength of cylinder with different types of waste water in 7, 14 & 28 days

Type of water	7 days (N/mm2) x10⁴	14 days (N/mm2) x10⁴	28 days (N/mm2) x10⁴
Normal water	**2.02**	**2.10**	**2.24**
Sludge water	**2.09**	**2.19**	**2.32**
Textile Waste Water	**2.13**	**2.27**	**2.56**

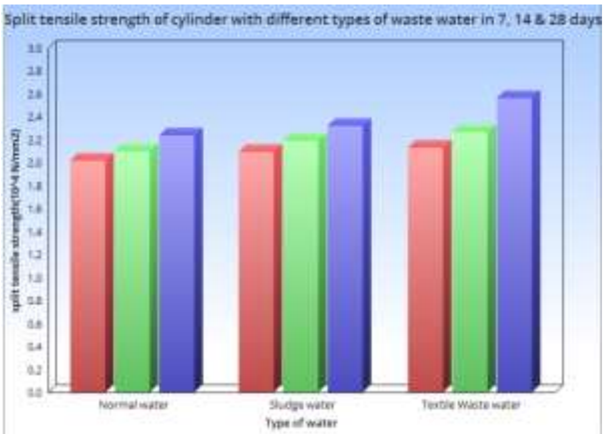

Chart -2: Tensile strength

Figure -3: Flexural Strength of Concrete

FLEXURAL STRENGTH OF CONCERTE

Table -4: Flexural strength of with different types of waste water in 7, 14 & 28 days

Type of water	7 Days (N/mm2) x10⁴	14 Days (N/mm2) x10⁴	28 Days (N/mm2) x10⁴
Normal water	4.62	4.74	4.86
Sludge water	4.20	4.81	4.93
Textile Waste Water	4.13	4.95	5.38

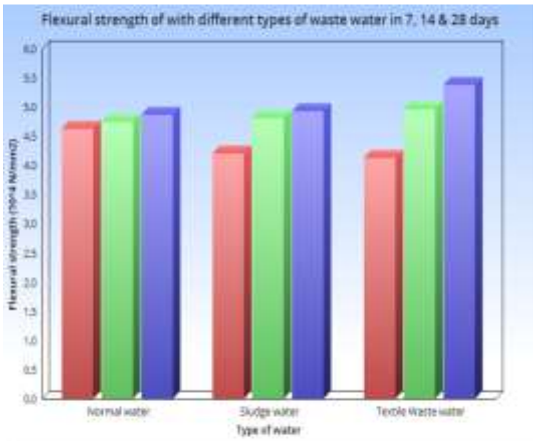

Chart -3: Flexural strength

5. CONCLUSION

The study has evaluated the use of treated waste water for concrete production. The water quality analysis showed that treated waste water is suitable for concrete production according to permissible limit so fixing water for concrete. The consistency, initial and final setting time of cement by mixing treated waste water is within the IS limit. The compressive strength of the concrete is increased by mixing treated waste water at the end of 7 days. The preliminary research findings suggested that significant differences do not exist between concrete cubes made of both treated waste water &portable water. Treated waste water can be used in the preparation of concrete for both casting & curing purposes without affecting the target mean strength of the concrete at the age of 28 days curing for M-40 grade concrete. Workability of concrete is good. With the comparison of concrete prepared with treated waste water and portable water gives similar results. Now a days there is so much scarcity of water i.e. there is a need to arrange other sources of water for concrete or construction of building units. Low cost and environmental friendly concrete can be produced by using treated waste water in concrete. Concrete cost can be reduced by using treated waste water in concrete.

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BIOGRAPHIES

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