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TO STUDY THE CONCRETE BEHAVIOUR WHEN PRODUCED USING WASTE WATER

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I. INTRODUCTION

In today world every technology is growing very swiftly. In this era of research, many types of research are going on to improve the strength of concrete mix and to get maximum output using minimum resources. We should also think of protecting our environment as well as to protect our natural resources. Water is a very important God gifted natural resource to the planet earth which should also be kept carefully for our next generation. Generally, potable water is used forthe production of concrete as this is free from minerals, pH variations, impurities and other water quality damaging substances. Sewage treatment plants are operated for cleaning sewage through various processes into reusable water. In the various stage of purification in STP water get purified up to a different degree. Many scholars are researching and doing great work in the direction of using wastewater after purification and getting hopeful results also. Like G.AsadollahfardiM.Delnavaz, V.Rashnoiee and N.Ghonabadi in 2016 researched on topic "Use of treated domestic wastewater before chlorination to produce and cure concrete" and found the satisfactory compressive strength of concrete produced. Further research in this direction is also going on. Day by day due to less availability of clean and safe drinking water today nearly about 1 billion people 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 plastc bottles. Water is the main foundation for life till today so money countries are struggling for searching a fresh 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. Treated waste water is water obtained from treatment plant after treating municipal waste water. Treated waste water is mainly used for gardening and in some situation for agricultural purpose. Treated waste water is hard water it mainly contains sulphate and chloride content. Day by day the production of bacteria's are more in treated waste water so while handling treated waste water proper care must be taken. Water in the concrete controls many fresh and hardened properties such as workability, compressive strength, permeability, durability, drying shrinkage and bonding properties. So for these reasons fresh and safe drinking quality water is required for concrete. For one cubic meter of concrete about 140 – 160 liters of water is required for the complete chemical hydration process.

II. LITERATURE REVIEW

KhushbooMeena, SalmabanuLuhar "Effect of wastewater on properties of concrete " (2019) This research-based to find the possibility of the usage of treated wastewater in concrete as an alternative to potable water. Tertiary treated wastewater (TTWW), secondary treated wastewater (STWW) and tap water (TW) were used in concrete. Compressive strength test, flexural strength test, chloride penetration resistance, carbonation resistance and abrasion resistance test were performed. Results reveal that the chloride concentration of concrete samples increased with a decrease in the quality of mixing water.

Mr. Manjunatha. M , Mr. Dhanraj M R Studied on the topic "An Experimental Study on Reuse of Treated Waste Water in Concrete – A Sustainable Approach" (2017) 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 tonne's of carbon dioxide and other greenhouse gases worldwide. In addition concrete is one of the largest water consuming industries. Approximately about 150 litres of water is required for per cubic metre 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. Without considering the other applications of water at the concrete industry, water is a critical environmental issue and water supplies, water quality are becoming more limited worldwide. This project presents the reuse of treated waste water and potable water in concrete for both mixing and curing. Concrete in prepared for M-20 grade concrete with SNF super plasticizer for both treated waste water and portable water and cured for a 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

Ayoup M. Ghrair * and Othman Al-Mashaqbeh Studied on the topic "Domestic Wastewater Reuse in Concrete Using Bench-Scale Testing and Full-Scale Implementation"(2016) : Studies that the Demand for fresh water by the construction sector is expected to increase due to the high increase in the growth of construction activities in Jordan. This study aims to evaluate the potential of scale-up of the application of treated domestic wastewater in concrete from bench-scale to a full-scale. On the lab scale, concrete and mortar mixes using Primary and Secondary Treated Wastewater (PTW, STW) and Distilled Water (DW) were cast and tested after various curing ages (7, 28, 120, and 200 days). Based on

wastewater quality, according to IS 456-2000, the STW is suitable for mortar and concrete production. Mortar made with STW at curing time up to 200 days has no significant negative effect on the mortar's compressive strength. Conversely, the PTW exceeded the maximum permissible limits of total organic content and E coli. for concrete mixing-water. Using PTW results, a significant increase in the initial setting time of up to 16.7% and a decrease in the concrete workability are observed. In addition, using PTW as mixing water led to a significant reduction in the compressive strength up to 19.6%. The results that came out from scaling up to real production operation of ready-mix concrete were in harmony with the lab-scale results.

G.Asadollahfardi, M.Delnavaz, V.Rashnoiee & N.Ghonabadi (2016) "Use of treated domestic wastewater before chlorination to produce and cure concrete" Studies that Concrete samples with different amounts of cement and superplasticizer admixture produced with both drinking water and treated wastewater and cured with treated wastewater before chlorination. The 28-day compressive strength of all of the concrete samples was 93–96% of the compressive strength of the control samples. A 28-day tensile strength of all samples was 96–100% of the tensile strength of the control samples and the setting time was increased by 15min. Concrete samples produced and cured with treated wastewater did not have a significant effect on water absorption, slump and surface electrical resistivity. A one-way analysis of variance (ANOVA) at the 5% significance level indicated no significant difference between concrete samples produced and cured with treated wastewater and control samples at the age of 90days.

III. METHODOLOGY & SAMPLING OF TREATED, UNTREATED WASTEWATER AND TESTING

Methodology of research on above said topic is as following:

- Waste water collection from sewage treatment plant.
- Waste water analysis for its chemical and physical properties.
- Waste water treatment process.
- Preliminary treated, primary treated, secondary treated and tertiary treated waste water sample collection for use in various ratios for concrete production.
- Design mix preparation of M25, using potable water 100%.
- Using design mix data and changing ratios of water used with various treated and untreated water concrete cube preparation.
- Concrete cubes compressive strength testing at various stage of curing.
- Comparison of results for compressive strength.
- Conclusion of the thesis.

Sampling:

For sampling of waste water beaker of 1000 ml has been taken. Beaker was rinsed with distilled water and dried before taking sample.

Each time for different sample beaker was rinsed with distilled water and dried before sampling.

The following samples were collected for quality testing and concrete production purpose:-

- Sample before preliminary treatment.
- Sample after preliminary treatment.
- Sample after primary treatment.
- Sample after secondary treatment.
- Sample after tertiary or final treatment.

IV. RESULTS & CONCLUSIONS

Concrete cubes were prepared using design mix which is shown below:-

Concrete Grade	Water	Cement	Fine Aggregate	Coarse Aggregate		Admixture (0.55% by wt. of cement)
				10mm	20mm	
M - 25	174	405	703	482	727	2.228
Ratio	0.43	1	1.736	1.190	1.795	0.0055

Here, 174 kg/cumecpotable water is used to prepare concrete sample.

And every time according to recommended trial mix slump 110mm (after 1.5 hr) we will keep the water content same ie. 174 kg/cumec.

Total concrete required to fill 6 cubes of 150mm x 150mm x 150mm is = 0.15 x0.15 x0.15 x6=0.02025

So approx. 0.03 cum concrete to be prepared using following components:

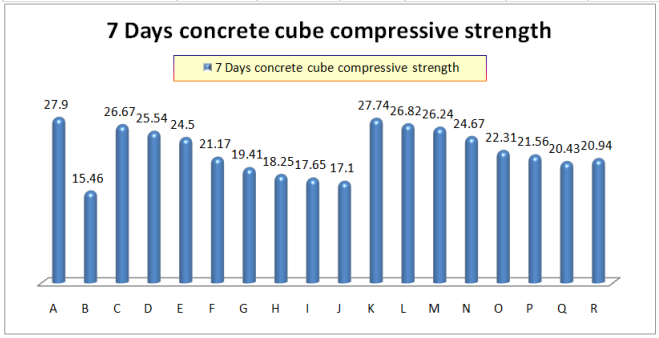
The concrete is made with different ratio of portable water and treated water as ashown in the below comparison chart. The all other quantities are same as per the design mix which is shown in above table.

Comparison of compressive strength at various time stages

At 7 Days:

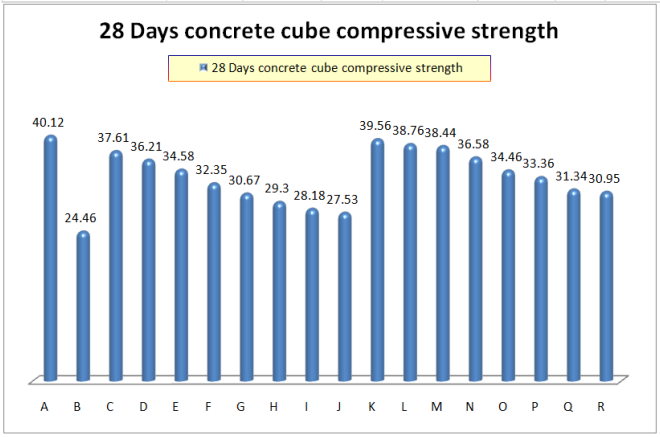
7 Days concrete cube compressive strength data

		7 days
(1.)	Potable water = 100%.	A 27.9
(2.)	Preliminary treated water = 100%	B 15.46
(3.)	Primary treated water : Potable water =5:95	C 26.67
(4.)	Primary treated water : Potable water = 10:90	D 25.54
(5.)	Primary treated water : Potable water = 20:80	E 24.5
(6.)	Primary treated water : Potable water = 40:60	F 21.17
(7.)	Primary treated water : Potable water = 60:40	G 19.41
(8.)	Primary treated water : Potable water = 80:20	H 18.25
(9.)	Primary treated water : Potable water = 90:10	I 17.65
(10.)	Primary treated water = 100%	J 17.1
(11.)	Secondary treated water : Potable water =5:95	K 27.74
(12.)	Secondary treated water : Potable water =10:90	L 26.82
(13.)	Secondary treated water : Potable water =20:80	M 26.24
(14.)	Secondary treated water : Potable water =40:60	N 24.67
(15.)	Secondary treated water : Potable water =60:40	O 22.31
(16.)	Secondary treated water : Potable water =80:20	P 21.56
(17.)	Secondary treated water : Potable water =90:10	Q 20.43
(18.)	Secondary treated water = 100%	R 20.94



7 DAYS concrete cube compressive strength results has been shown using bar chart for better comparative vision.
At 28 Days:
28 Days concrete cube compressive strength data

			28 days
(1.)	Potable water = 100%.	A	40.12
(2.)	Preliminary treated water = 100%	B	24.46
(3.)	Primary treated water : Potable water =5:95	C	37.61
(4.)	Primary treated water : Potable water = 10:90	D	36.21
(5.)	Primary treated water : Potable water = 20:80	E	34.58
(6.)	Primary treated water : Potable water = 40:60	F	32.35
(7.)	Primary treated water : Potable water = 60:40	G	30.67
(8.)	Primary treated water : Potable water = 80:20	H	29.3
(9.)	Primary treated water : Potable water = 90:10	I	28.18
(10.)	Primary treated water = 100%	J	27.53
(11.)	Secondary treated water : Potable water =5:95	K	39.56
(12.)	Secondary treated water : Potable water =10:90	L	38.76
(13.)	Secondary treated water : Potable water =20:80	M	38.44
(14.)	Secondary treated water : Potable water =40:60	N	36.58
(15.)	Secondary treated water : Potable water =60:40	O	34.46
(16.)	Secondary treated water : Potable water =80:20	P	33.36
(17.)	Secondary treated water : Potable water =90:10	Q	31.34
(18.)	Secondary treated water = 100%	R	30.95



28 DAYS concrete cube compressive strength results has been shown using bar chart for better comparative vision
5.3 Comparison of compressive strength of concrete cubes prepared from different quality of water :
Secondary treated water mixed concrete shows greater strength than primary or preliminary treated water mixed concrete.
As shown in above diagrams, concrete strength increases with increase in purity of water also.

V. CONCLUSION

It is concluded from the study that concrete can gain good strength when wastewater is used after secondary treatment. After primary treatment water mixed to form concrete is not providing required level of compressive strength.
Secondary treated waste water can provide strength adequately to the concrete mix. So only secondary treated waste water or with some part of portable water should be used to get good strength concrete.
Preliminary treated waste water is not useful for concrete production, because it does not provide concrete a good range of compressive strength. Some Situation is observed when primary treated waste water is used for concrete production. It provided strength greater than preliminary treated water mixed concrete but it was not upto desired level of compressive strength.
As the proportion of secondary treated water was increased with respect to potable water very low reduction in compressive strength of concrete was observed, but these compressive strength were not objectionable.
PH of each water samples mixed in different proportions should be tested before its use in concrete production to avoid corrosion of reinforcement embedded in concrete structure. If PH of water is less than 7 it will be called acidic and if it is greated than 7 it Is called basic. Mostly acidic water is more harmfull to RCC Structures.
It is very Important to re use waste water to save our natural resources. So treated waste water is good for concrete production if it has been treated upto a certain degree i.e secondary treatment
Mix design of M-25 grade concrete has been prepared for testing purpose but according to observed result, we can also prepare different designs mixed concrete of various grade for sustainable use of treated waste water. Hence we can save our water which is life line on earth.
Secondary treated water can be used with potable water in ratio of 5:95 or 10:90 to get very adequate compressive strength from concrete mix prepared. pH of treated water must be checked before use for concrete production to ensure water acidic or basic nature. If pH of water is about 7 then it should be used for concrete production so that it may not harm reinforcement used in RCC structure.
So, after this study it is very clear that we can use secondary treated water in production of concrete and hus we can save our very precious natural resource which is called water for our present and future use in essential works.

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