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BEHAVIOUR OF CONCRETE WITH TREATED SEWAGE WATER

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Abstract*—This paper represents the experimental investigation of finding the feasibility of using treated effluent as a agent in concrete mix. This scope of study is restricted to only plain concrete cement without reinforcement. Brackish water collected from the residential building is effectively treated in treatment plants. The main objective of this project is to control the abundant use of drinking water in construction activities by implementing treated sewage effluent as mixing agent in concrete mix, curing and for other activities. This is perfectly suitable for arid areas where there is a shortage of rainfall and lack of natural resources. In that type of situation treated effluent is the best substitute to drinking water in concrete mix. This treated effluent can be directly used in concrete mix when it satisfies standards. Water sample of treated waste water is collected and tested and analyzed along with chemical parameters were within the ASTM standards limits and can be used satisfactorily in concrete mixing. By using treated effluent in place of freshwater, not only saved natural resources but also enhanced the compressive strength of concrete up to 0.97%, 0.05%, 0.40% at curing ages of 7,14 and 28 days.

***Keywords*— Treated Effluent, corrosion, Brackish Water, ASTM.**

I. INTRODUCTION

The use of water has become more important in concrete industry. Generally Fresh water is used in mixing concrete, washing or cleaning of aggregate and in curing of concrete. Rapid urbanization and increasing population have become a serious threat to quality of drinking Water. Pollution of rivers and ponds made the water restricted to use for drinking as well as in construction activities. Limited resources and objectionable quality of water has made the step forward to reuse treated Wastewater in concrete industry. Effluent generated from floor washings, sanitary and Toilet flushing is effectively treated in several stages at water treatment plants. This ensures a better solution to water scarcity problem and saves lot of freshwater. It enhances the strength of concrete without jeopardizing the strength parameters of Normal concrete mixture.An estimated 80%of Wastewater generated is being used in irrigation especially in China and India. Pollution control board has stated that Visakhapatnam generates a total sewage of about 87(approx.) MLD .This entire sewage water is going to be discharged at coastal areas after treatment. If we use this treated sewage water in construction activities, it helps in reducing the potable water demand.

Concrete is the largest water consuming agent in the construction. Generally, it consumes 150 lit of water for a cubic meter of concrete. Concrete, also releases over 2.5 Billion tons of carbon dioxide and other green house gases.mixing water is a major factor for compressive strength of the concrete because many specifications for making concrete mixtures require the quality of used water to be fit for drinking and ever since concrete began to use as the mixing water. It was also suggested that with water, as energy, the only practical, large scale solution is to use the resources which are not currently efficient an average sewage water container around 1000mg/l of solids in solution and remaining is of about 99.9% pure water. Treatment for reclaimed water is necessary as it contains harmful pathogenic bacteria and viruses. By using reclaimed water in place of freshwaterit has shown similar properties as like drinking Water in concrete mix. Wash water discharged from the RMC Plants also a serious threat to the natural water courses and is problem for ecosystem. so treatment of this wash water has become more important in some countries. Recently some investigation has made by researchers on using Effluent from sewage and industrial wastes, oily and brackish water from oil wells, including sea Water and alkali waterThe amount of water in concrete controls many fresh and hardened properties in concrete including workability, compressive strengths, permeability and water tightness, durability and weathering, drying shrinkage and potential for cracking. For these reasons, limiting and controlling the amount of water in concrete is important for both constructability and service life.

II. STUDY AREA

Sewage treatment plant at Appughar, located at East coast of Visakhapatnam with latitude of 17°44'30"N and longitude of 83°20'36"E. which is helmed in the kailasagiri hill range towards north and yarada hill on south. The treatment plant of apapughar is situated on the coastal area of Visakhapatnam. The domestic sewage water generated from the industries, urban utilization is sent through grits and screens to remove all the floating matter and other metal waste; this is to be settled in a collection tank and is pumped to primary sedimentation tank to remove sludge and is disposed off. Remaining water with having no change in total dissolved solids is sent to 8 aeration tanks. In theses tanks, Microbial action is developed with flash mixer. These bacteria oxidise the organic matter present in the waste water. Then this is sent to clarifiers This oxidize waste water is released out to oceans and rivers when only the BOD and COD are satisfied.and clarified with filter bed. Then the treated waste water is 156is charged out of the tanks.

Fig:1 25 MLD Capacity Sewage treatment plant, Visakhapatnam

fig :2 Satellite view of STP at Visakhapatnam

III. METHODOLOGY

The sewage water is collected 10 litres of sample at 25 MLD STP under Visakhapatnam Municipal Corporation, located at Appughar, Visakhapatnam. The tests are conducted for sewage effluent water as per the code IS 10500 for drinking water standards. M25 grade of concrete is selected and performed mix design with reference to the code IS: 10262- 2009. The mix proportions are as follows in table 1.

Table 1- The amount of materials taken for preparation of cubes

Mix proportions (kg/m^3) M25				
Cement	**Coarse aggregate**	**Fine aggregate**	**Water**	**W/c ratio**
43.86	128.77	63.41	19.73	0.45

IV. RESULTS AND DISCUSSION

Effect on the strength of concrete with replaced treated water:-
Results of strength for all of the concrete mixtures are presented in table 5.2 where the 7, 14 and 28 days average cube compressive strength of concrete specimen are presented. It indicates the compressive strength of the concrete with various amounts up to 100 percentage replacement with treated sewage water. The strength of the concrete prepared with tap water shows a slight increase in strength of concrete as compared to treated sewage water.

Table 2:- Normal ranges of drinking water and values of treated sewage values.

Test parameters	Values of treated sewage water	Normal reference ranges for drinking water
$_{P.}$H	7.2	6.5-9.0
D.O(mg/l)	2.0	>2.0
C.O.D(mg/l)	196	3000
B.O.D(mg/l)	140	200
T.S.S(mg/l)	25	<2.0
Residual Chlorine(Mg/L)	Nil	<1.0

Compressive Strength:

Table 3: The compressive strength values of cube at different percentages of water.

AGE (DAYS)	COMPRESSIVE STRENGTH (M P$_a$)				
	TREATED WATER				
	100% replacement of water	**75% replacement of water**	**50% replacement of water**	**25%replacement of water**	**0% replacement of water**
7	40.39	35	29	25	34
14	32.87	32.47	32.57	31.09	31.2
28	41.73	39.72	37.81	37.23	40.11

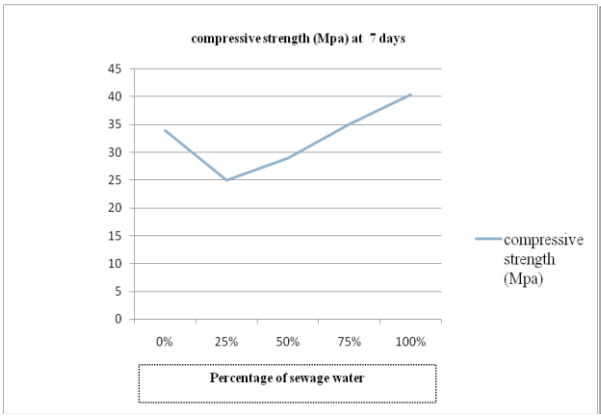


Fig:3 The graph shows the compressive strength at different % of water in 7 days

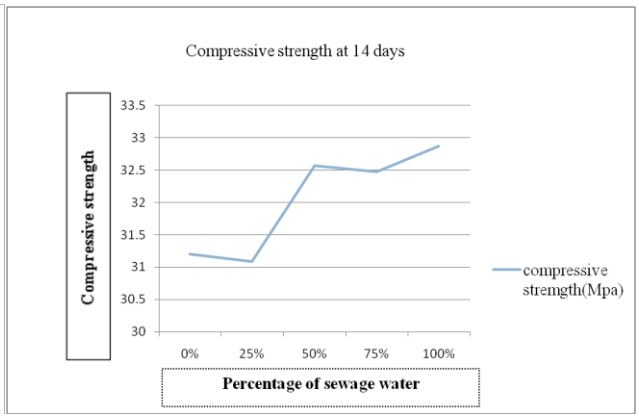
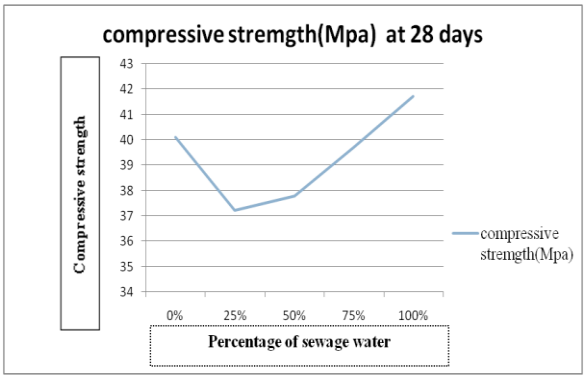


Fig:4 The graph shows the compressive strength at different % of water in 14 days

The graph (fig3, 4, 5) is drawn between percentage of water added in concrete and compressive strength of cube. The cube is casted with adding water at different percentages of 0%, 25%, 50%, 75% and 100% of water and cubes are cured for 7 days,14 days,28days. From the graph we observed that the compressive strength of the cube with treated has higher value than the potable water. From the graph (fig: 4) we observed that the compressive strength values of the cube are very close to each other at the age of 14 days. From the graph (fig:5) we observed that the compressive strength of the cube with treated water has slightly higher value than the potable water.



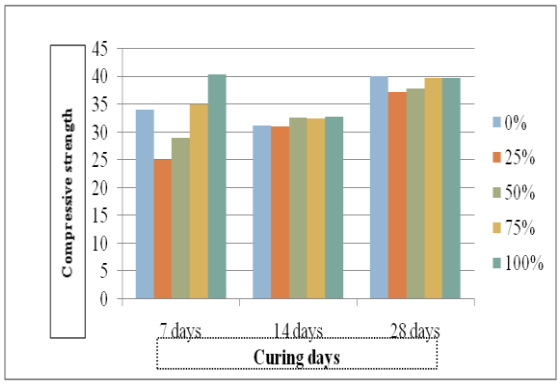


Fig 4. *The graph shows the compressive strength of at different percentages of water in 28 days.*
Fig 5.*The graph shows the comparison between compressive strength of treated water and potable water at different percentage*

From the graph (fig.5) which is drawn between compressive strength and age of curing. We obtain the values of the splitting strength at 7, 14 and 28 days which shows that the splitting tensile strength is lower than the potable water because of the impurities present in the water which plays a key role in decreasing of the compressive strength of the concrete.

V. CONCLUSIONS

On replacement of potable water with treated waste water, we found that on increasing the composition of waste water strengths (compressive) goes on increasing with further increase in waste water composition. The slump values are found to be decreasing with the increase in the % of treated sewage water. There is a decrease in the workability of concrete using sewage treated water. As the curing period increases the compressive strength of the concrete is also increased irrespective of the wastewater percentage used. It may be concluded from this study that the use of wastewater produced from car washing stations has negligible effect on the strength of concrete. However, the study should be extended to investigate the effect of wastewater on the durability of concrete, since it may contain harmful substances that may affect adversely the concrete after prolonged exposure times.

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