STUDY ON COMPRESSIVE STRENGTH OF CONCRETE BY USING TREATED DOMESTIC WASTE WATER AS MIXING AND CURING OF CONCRETE

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Abstract

Chapter 1deals with Introduction to treated domestic waste water utilized in concrete preparation where there is a scarcity of fresh water. Chapter 2 discusses physical properties of Materials and chemical properties of treated domestic waste water. Experimental program is presented in Chapter 4 mix proportion for M20 and M40 grade concrete are presented in this chapter. Number of specimens to be cast for different curing regimes is also presented in this chapter. Chapter 3 elaborate average compressive strength results of M20 grade concrete cast by using Tap water as mixing and curing water for Mix M1 & treated domestic waste water as mixing and curing water for Mix M2 Similarly average compressive strength results of M40 grade concrete cast by using Tap water as mixing and curing water for Mix M3 & treated domestic waste water as mixing and curing water for Mix M4. Discussion of results covers, M20 grade concrete at the age of 7days the average compressive strength for all the 2 mixes is nearly same. At the age of 14days marginal increase in compressive strength is observed in case of mix M1 but in case of mix M2 compressive strength remains same as that of 7days.And at 28days curing age decrease in compressive strength was observed .This decrease in compressive strength may be due the use of treated domestic waste water for mixing and curing.

Keywords: *Cement, Fine aggregate, Coarse aggregate, Treated waste water, cement concrete*

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1. INTRODUCTION

Due to growing agriculture, urban and industrial needs, water table in every continent are falling, by this the drinking water resources are becoming scare. It is suggested that with water, practical large scale solution is to use the resoures 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 contains about 70 percent aggregate, 20 percent cement and 10 percent 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. The concrete industry has therefore serious impact on the environment with regard to consumption of water. Therefore there is a need to study alternative to fresh water for mixing and curing of the concrete. Water is used for domestic and industrial purposes from surface water bodies and underground water sources all over the world. In last few decades, there has been a tremendous increase in both domestic wastewater and industrial wastewater generation due to rapid growth of population and accelerated pace of industrialization. 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.

2. MATERIALS AND METHODOLOGY

1. Vasavadatta Opc 43 grade confirming to IS 12262-1987 cement was procured from single source.
2. Super plasticizer used in the present investigation is Fosroc conplast SP 430.The optimum dosage for different water cement ratio is found out by conducting marsh cone test.
3. Locally available fine aggregate belonging to zone-II was used.
4. The maximum size of the coarse aggregate was limited to 20mm to get the maximum increase in compressive strength. A sieve analysis confirming to IS:2386-1963 was carried out for coarse aggregate (20mm & 12mm) and other tests were carried out in the laboratory as per IS 2386-1963.
5. The treated domestic waste water collected from sewage treatment plant situated near kotnoor, Gulbarga **.** The laboratory tests were carried out as per IS 3025.

Si no	Parameters	Laboratory tap water (mg/l or ppm)	Treated domestic Waste water (mg/l or ppm)
01	P^H	7.6	7.6
02	$B.O.D_5$	-----	281
03	C.O.D	-----	876
04	Total solids	950	1054
05	Suspended solids	120	134
06	Dissolved solids	830	920
07	Chlorides	204	204
08	Fluoride	0.1	0.1
09	Color	Color less	Grayish
10	Bicarbonates	402	647
11	Total hardness	552	640
12	Nitrate	49	35
13	Sulphate	174	44

Mix design

Mix design was carried out as per IS10262-2009 for M20 and M40 grade concrete.

Casting

Three concrete cubes were cast according to the mix proportions. For M20 and M40 grade concrete different combination of concrete mixing were carried out as given below.

1) Three Specimens cast using 100% laboratory tap water
2) Three Specimens were cast using 100% treated domestic waste water.

Curing

Curing is done by immersing the specimens in curing ponds of laboratory tap water and treated domestic waste water under regular supervision. For each of these above three mixes, three curing ages were selected i.e. 7days, 14days, & 28days and two types of curing water were used.

1) Three Specimens cast and cured by using 100% laboratory tap water.
2) Three Specimens cast and cured by using 100% laboratory tap water.

Table-15: M20 Grade concrete cubes to be prepared and curing.

		Specimens cast using	
Type of specimen	Curing ages (Days)	100% pure water for mixing	100% treated waste water for mixing
		Curing under	
		`Fresh water	Treated Waste water
15cm cube	7	3	3
	14	3	3
	28	3	3

Table-16: M40 Grade concrete cubes to be prepared and curing.

		Specimens cast using	
Type of specimen	Curing ages (Days)	100% pure water for mixing	100% treated waste water for mixing
		Curing under	
		`Fresh water	Treated Waste water
15cm cube	7	3	3
	14	3	3
	28	3	3

3. RESULTS

M20 Grade concrete

1) Average Compressive strength of concrete (Tap water as mixing and curing water) for Mix M1:-
   The concrete cubes of M20 grade were prepared by using laboratory tap water and curing carried out by using laboratory tap water. The compressive strength test is carried out on each specimen and the results is depicted inFig-02.

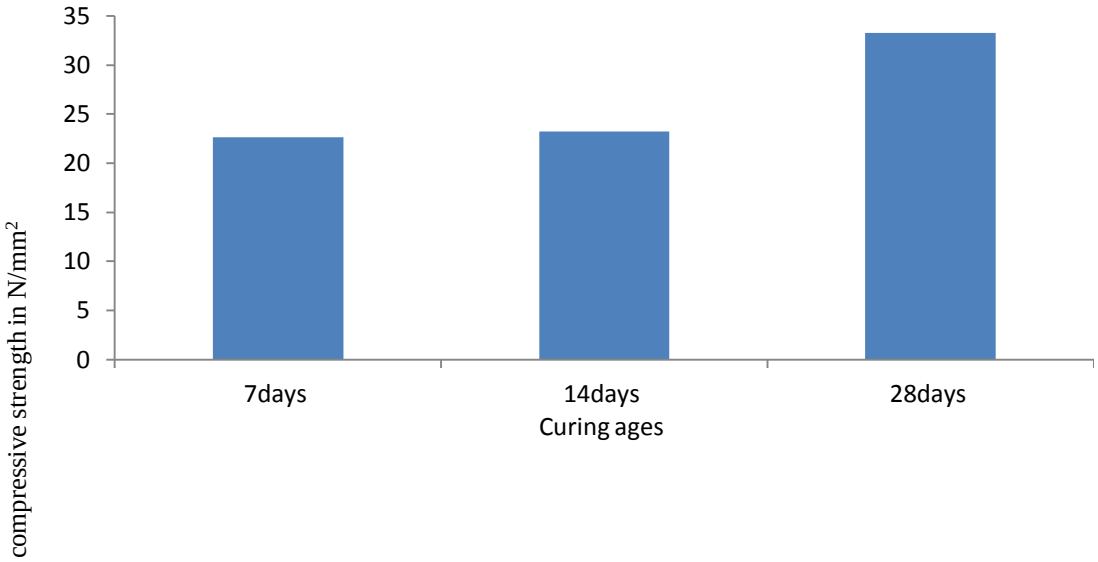

Fig 02 Compressive strength V/s curing ages for Mix M1

2) Average Compressive strength of concrete (Treated waste water as mixing and curing water) for Mix M2:-
The concrete cubes of M20 grade were prepared by using treated domestic waste water and curing is carried out by using treated domestic waste water. The compressive strength test is carried out on each specimen and the results is depicted in Fig-05

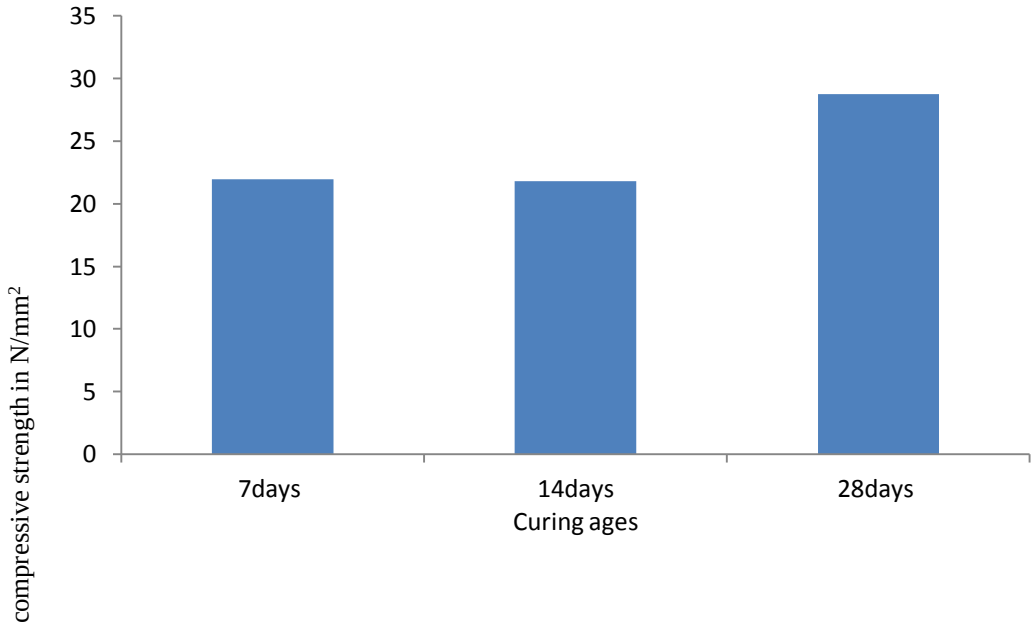

Fig 05 Compressive strength V/s curing ages for Mix M2

M40 Grade concrete:-

3) Average Compressive strength of concrete (Tap water as mixing and curing water) for Mix M3:-
The concrete cubes of M40 grade were prepared by using laboratory tap water and curing is carried out by using laboratory tap water. The compressive strength test is carried out on each specimen and the results is depicted in Fig-06

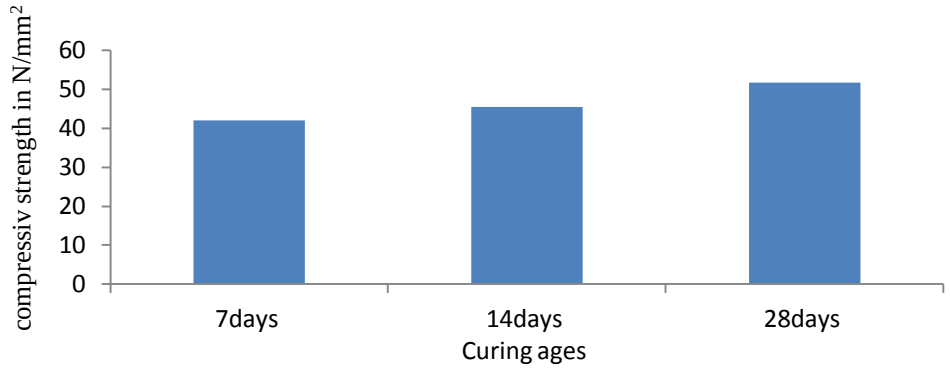

Fig 06 Compressive strength V/s curing ages for Mix M3

4) Average Compressive strength of concrete (Treated waste water as mixing and curing water) for Mix M4 :-
The concrete cubes of M40 grade were prepared by using 100% treated domestic waste water and curing is carried out by using treated domestic waste water. The compressive strength test is carried out on each specimen and the result is depicted in Fig-09.

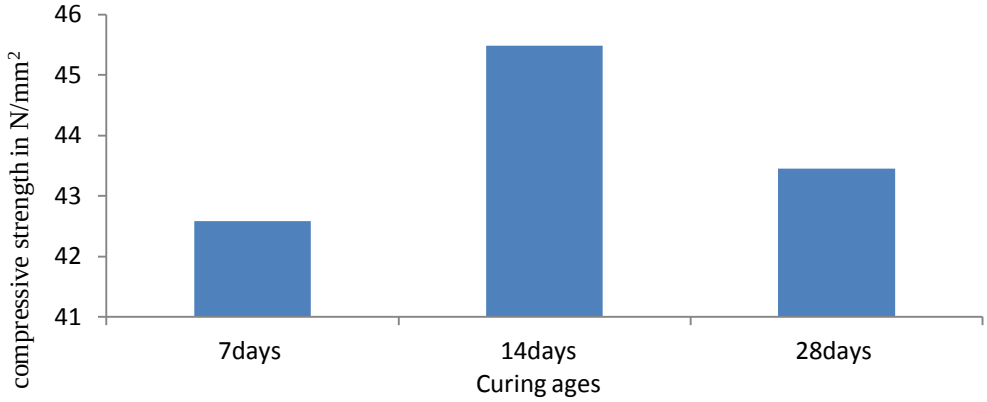

Fig 09 Compressive strength V/s curing ages for Mix M4

Effect of mixing water on compressive strength of M20 grade concrete is depicted in Fig 10 of age v/s compressive strength:-

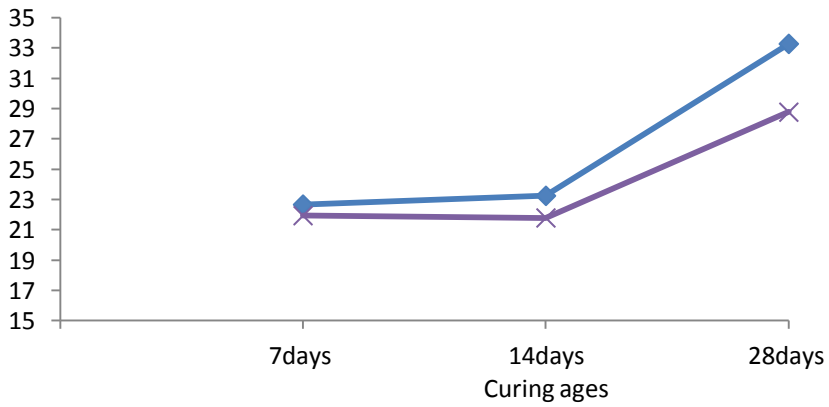

Fig 10:- age v/s compressive strength for M20 grade concrete

Effect of mixing water on compressive strength of M40 grade concrete is depicted in Fig 11 of age v/s compressive strength:-

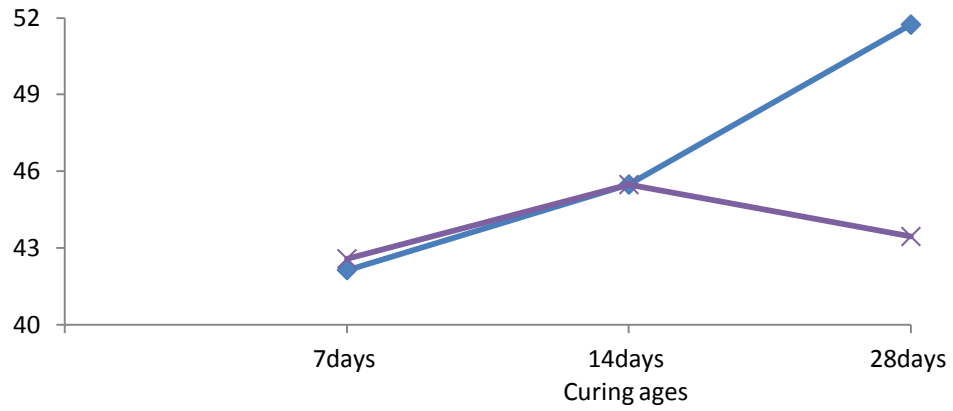

Fig 11:- age v/s compressive strength for M40 grade concrete.

4. DISCUSSION OF RESULTS AND CONCLUSION

1) Fig 10 indicates age v/s compressive strength for M20 grade concrete. It is observed from the fig that, 7 days compressive strength for the 2 mixes is nearly same. At the age of 14days marginal increase in strength is observed. Increase in compressive strength is observed at the age of 28days for all the 2 mixes. All the 2mixes have resulted in compressive strength higher than the target mean strength. At 28days curing age decrease in compressive strength was observed from mix M1 to M2. This decrease in compressive strength may be due the use of treated domestic waste water for mixing and curing.
2) Fig 11 indicates age v/s compressive strength for M40 grade concrete. It is observed from the fig that, 7 days compressive strength for all the 2 mixes is nearly same. At the age of 14days marginal increase in compressive strength is observed for all the 2 mixes. Increase in compressive strength is observed at the age of 28days for mix M3 but in case of mix M4 compressive strength decreases as compared to 14days compressive strength results.
3) The mix M3 resulted in compressive strength higher than the target mean strength but the mix M4 resulted in compressive strength lower than the target mean strength, this decrease in strength may be due to the use of treated domestic waste water for mixing or curing. Lowest strength is exhibited by mix M4 i.e. 43.45Mpa is less than the target mean strength of 48.25Mpa.
4) From this study it is observed that decrease in compressive strength may be due to the presence of bicarbonates content (647mg/l) higher than the permissible limit compared to the allowable limits (400mg/l) from Table 8 section 3.2.8.

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