EFFECT OF STEAM CURING ON THE CONCRETE WITH REPLACEMENT OF FINE AGGREGATE BY M-SAND

Chandrashekar V C [1], Sindhoora.C[2] , Shailesh Hundekar[3] ,Rahul M[4]
[1]Assistant Professor, [2,3,4]Assistant Professor,
Dept. of Civil Engineering, Dayananda Sagar College of engineering Bangalore, Karnataka, India

ABSTRACT *- Common river sand is expensive due to excessive cost of transportation from natural sources. Also large-scale depletion of these sources creates environmental problems. In such a situation the m-sand can be an economic alternative to the river sand. This project presents the feasibility of the usage of m-sand as substitutes for Natural Sand in concrete. It is also to he noted that temperature also plays a vital role in rate of strength gain. Hence in this project an attempt has been made to study the effect of steam curing on strength characteristics of m-sand based concrete. Concrete with characteristic compressive strength of 20 MPa was designed for the present study. Concrete specimens were cast with 0%, 25%, 50%, 75% and 100% replacement of sand with m-sand and were cured under different curing Temperatures. The specimens were exposed to two different temperatures, namely 60°C, 80°C and I 00°C for 4 & 6 hours in steam curing respectively. The structural properties like Compressive strength test, Flexural strength test and split tensile strength test were conducted on concrete cubes, Beams and cylinders respectively. From the results it was inferred that higher percentage replacement of sand with m-sand yielded considerable increase in both tensile and compressive strength of the resulting concrete. It was found that replacement of sand with 50% of m-sand under steam curing at 60°C temperature with 6 hours curing has yielded maximum compressive strength.*

Key Words**:** *steam curing, compressive strength, Flexural strength test, split tensile strength , curing temperature, curing time.*

1. INTRODUCTION

Concrete is a widely used construction material consisting of cementing materiel, fine aggregate, coarse aggregate and required quantity of water, where the fine aggregate is usually natural sand. Natural sand takes millions of years to form and it is not replenish able. Some of the industrial wastes like fly ash, quarry dust, rice husk ash and blast furnace slag ash are being used in concrete now a day. Their proportion varies depending of the type of cement. In this project m-sand was used as a replacement of fine aggregate. Normal concrete subjected to high curing temperature during early hours and days causes rapid precipitation of hydration products. This phenomenon is responsible for the observed early strength development. In this project we used current trend in concrete technology and practice of replacing fine aggregate partially by M sand, we as modified materials and it is very important to understand the behavior of these !modified materials

2. METHODOLOGY

The basic concrete mix design will be done to find the most economical proportions (optimization) to achieve the desired end results (strength, cohesion, workability and durability). According to the concrete mix design different cubes, beams and cylinders will be casted with replacement of fine aggregate by M-sand (0%, 25, 50%, 75% and 100%) and respective compressive strength, flexural strength and split tensile strength will be determined after curing under different curing temperatures.

3. RESULTS AND DISCUSSION

Table 1 : Variation in compressive strength of M20 concrete made of different of M-sand with age of concrete

SL NO	Age of concrete in Days	% of M-sand	Average compressive strength in m/mm2
1	0 7 28	0% 0% 0%	0 19.28 22.26
2	0 7 28	25% 25% 25%	0 23.35 24.01
3	0 7 28	50% 50% 50%	0 20.89 25.33
4	0 7 28	75% 75% 75%	0 20.89 25.03
5	0 7 28	100% 100% 100%	0 19.83 24.87

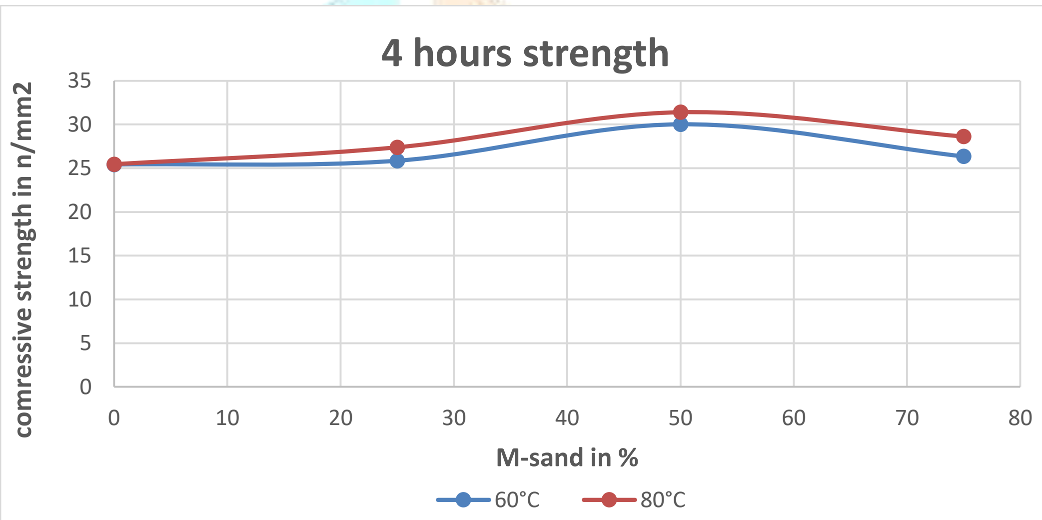
Table 2: compressive strength for 60°C temperature

SL NO	Age of concrete in hourse	% of M-sand	Average compressive strength in m/mm2
1	0 4 6	0% 0% 0%	0 25.42 28.75
2	0 4 6	25% 25% 25%	0 28.58 30.29
3	0 4 6	50% 50% 50%	0 30.02 35.25
4	0 4 6	75% 75% 75%	0 26.35 31.05
5	0 4 6	100% 100% 100%	**0** **25.04** **26.59**

Table 3: compressive strength for 80 °C temperature

SL NO	Age of concrete in	% of M-sand	Average compressive

	hours		strength in m/mm2
1	0 4 6	0% 0% 0%	0 25.46 29.33
2	0 4 6	25% 25% 25%	0 27.40 32.53
3	0 4 6	50% 50% 50%	0 27.42 35.86
4	0 4 6	75% 75% 75%	0 28.63 33.63
5	0 4 6	100% 100% 100%	0 27.32 31.76



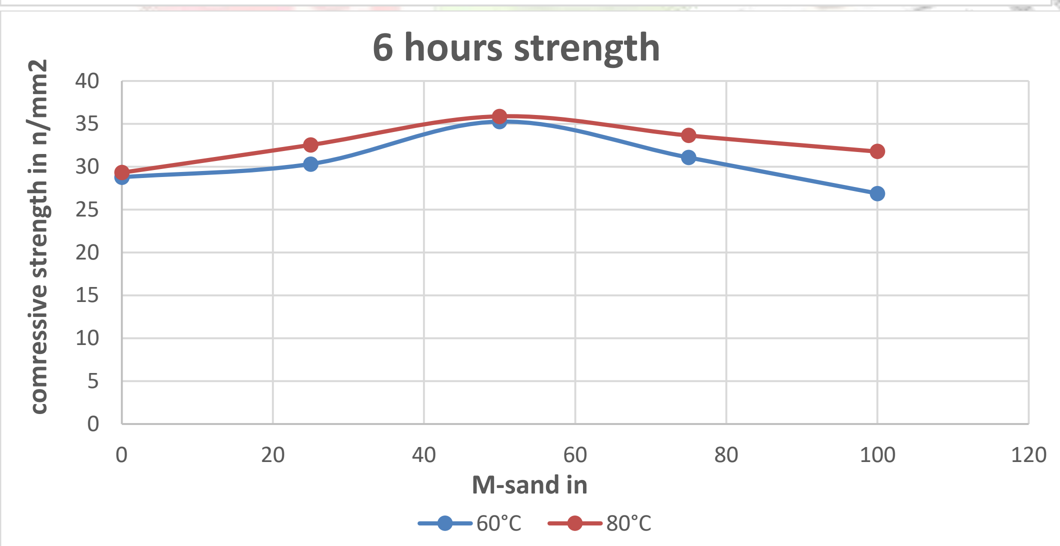
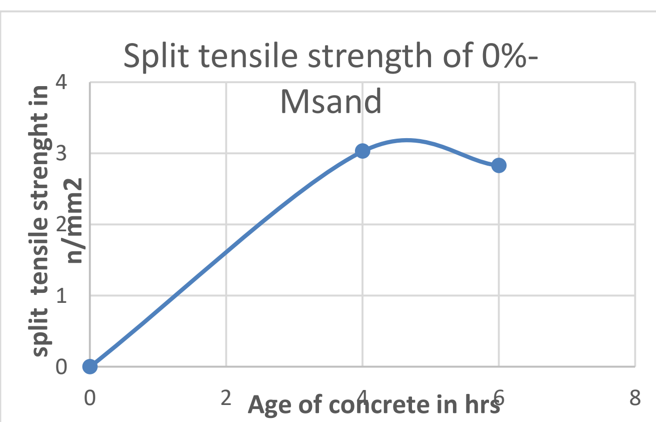


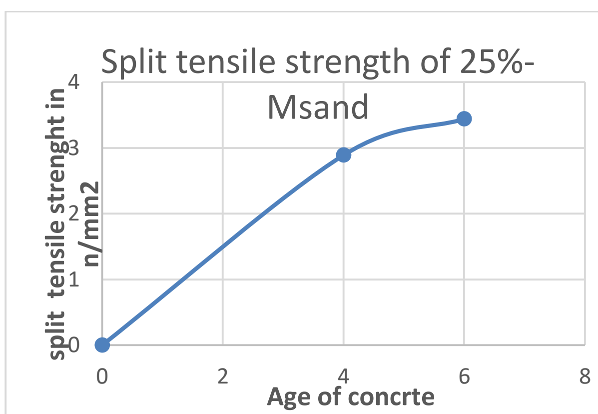
Table 4: variation in split Tensile strength of M20 concrete made of different % of M-sand.

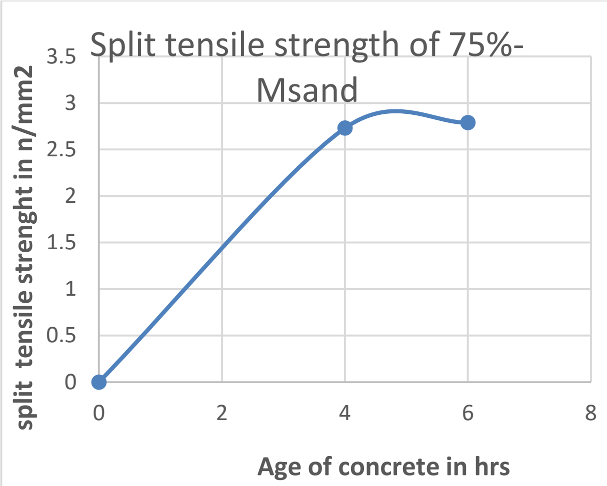
Age of concrete	Split tensile strength of 0%-Msand	Split tensile strength of 25%-Msand	Split tensile strength of 50%-Msand	Split tensile strength of 75%-Msand	Split tensile strength of 100%-Msand
0	0	0	0	0	0
28 days	3.37	3.08	3.29	2.45	2.426
4 hours	3.03	2.89	3.18	2.73	2.66
6 hours	2.83	3.44	3.35	2.79	2.86

Table 5: variation in Flexural strength of M20 concrete made of different % of M-sand.

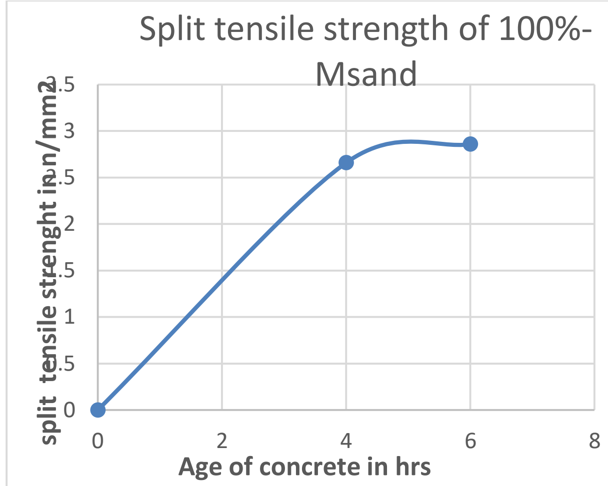
Age of concrete	flexural strength of 0%-Msand	flexural strength of 25%-Msand	flexural strength of 50%-Msand	flexural strength of 75%-Msand	flexural strength of 100%-Msand
0	0	0	0	0	0
28 days	5.21	4.94	4.55	2.58	2.62
4 hours	3.78	4.33	4.48	3.37	2.89
6 hours	4.94	5.29	4.873	3.03	2.826



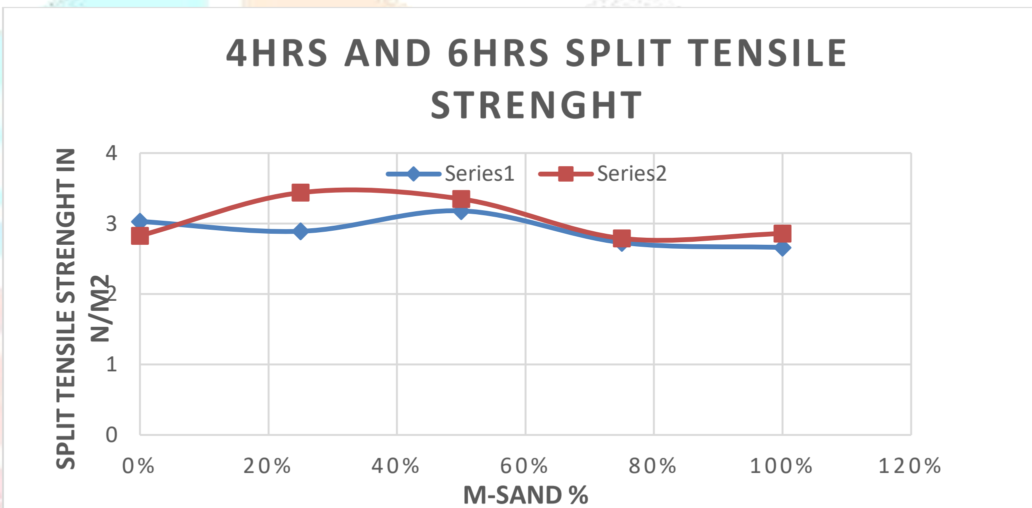




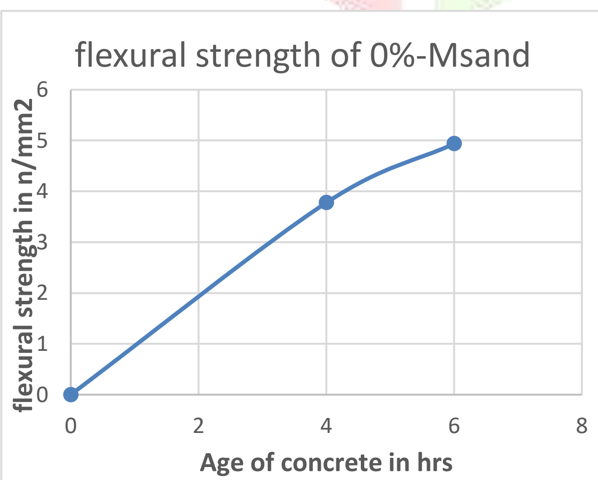
Split tensile strength of 75%-Msand
split tensile strenght in n/mm2
Age of concrete in hrs



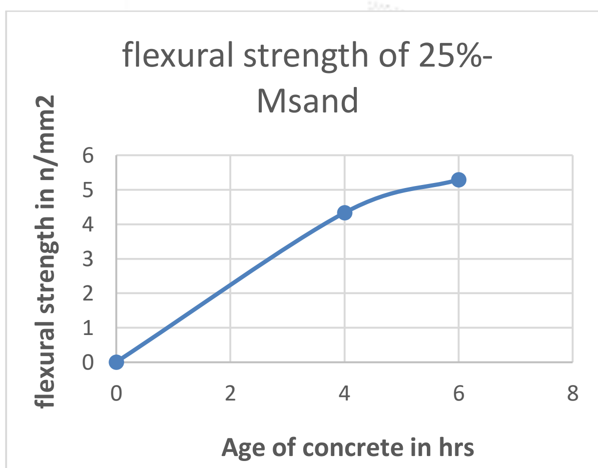
Split tensile strength of 100%-Msand
split tensile strenght in n/mm2
Age of concrete in hrs



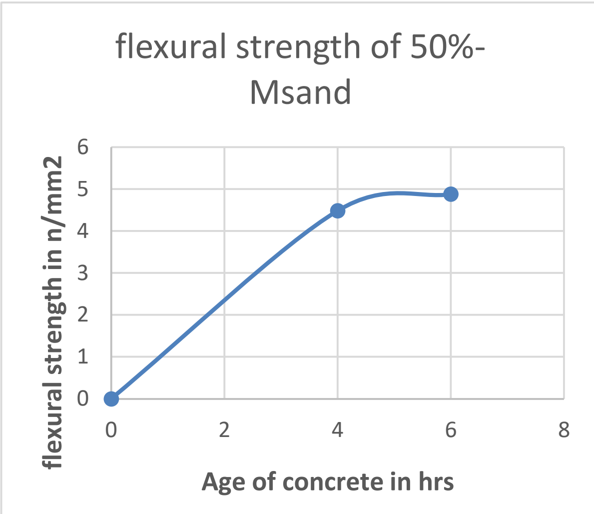
4HRS AND 6HRS SPLIT TENSILE STRENGHT
SPLIT TENSILE STRENGHT IN N/M2
Series1
Series2
M-SAND %

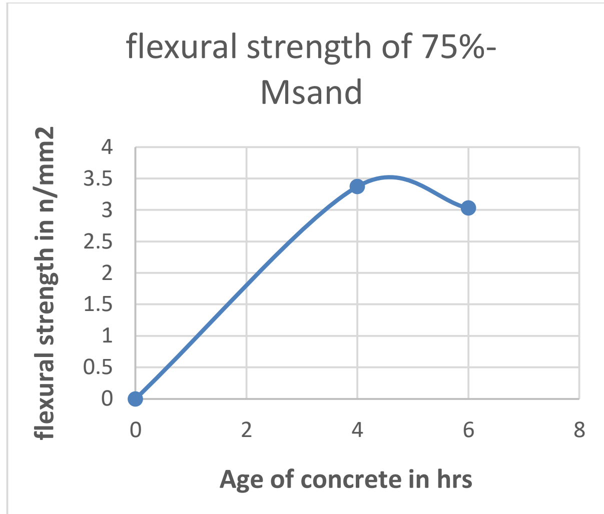


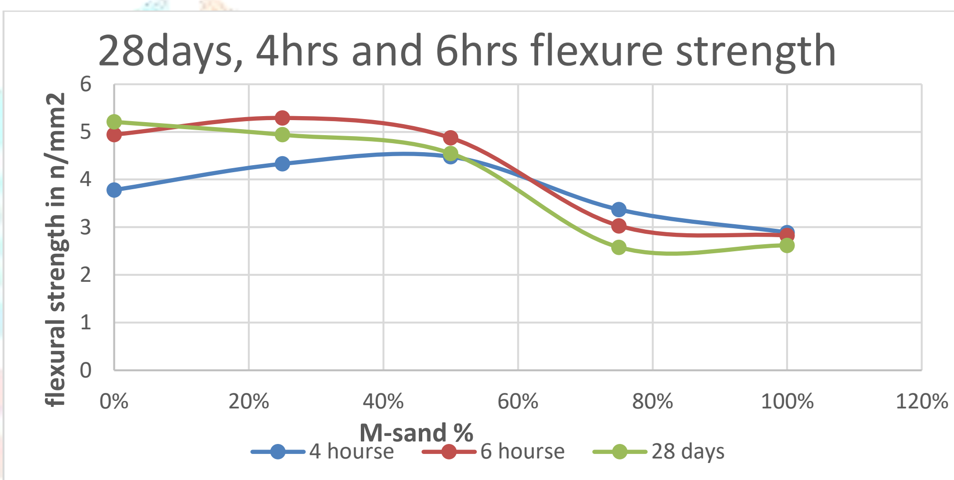
flexural strength of 0%-Msand
flexural strength in n/mm2
Age of concrete in hrs



flexural strength of 25%-Msand
flexural strength in n/mm2
Age of concrete in hrs







BASED ON EXPERIMENTAL WORK THE FOLLOWING CONCLUSIONS ARC DRAWN:

- The slump of fresh concrete i.e., workability is found to decrease gradually with the addition of m-sand.
- The temperature activates hydration process as the same manner like chemical reaction.
- Steam curing gives the more compressive strength within three days comparing to the normal water curing in 28 days.
- All the three temperatures curing (50.c with 7hours, 60.c with 6hours and 100.c with 3hours) with optimized curing time gives almost similar strength in concrete. • 7 days compressive strength of steam curing concrete is 45% to 80% increased as compared to normal water curing concrete.
- Among the three different temperatures with three different curing times, The 60.c with 6 hours curing gives relatively high compressive strength.
- The split tensile strength of concrete mix decreases with increase in m-sand percentage replacement.
- The flexural strength of concrete mix also decreases with increase in quarry dust percentage replacement.

REFERENCES

- Pratik Deogekar. Asshwini Jain, Sudhanshu and Prakash Nanthagopalan “Influence of Steam Curing Cycle on Compressive strength concrete" Department of Civil Engineering IIT Bombay.

- Effects of Curing Condition and Curing Period on the Compressive Strength Development of Plain Concrete: Akinwumi, I.I.*, Gbadamosi, Z.O. Department of Civil Engineering, Covenant University, P. M. B. 1023, Ota, Nigeria.
- IS: 5816-099.Method of test for splitting tensile strength of concrete. Bureau of Indian Standard, New Delhi
- IS: 516-1959 (Reaffirmed 2004). Method of test for strength of concrete. Bureau of Indian Standards, New Delhi
- Effectiveness of Curing Compound on Concrete: Dinesh W.Gawatre1, Komal Sawant2,Rupali Mule2, Neha Waydande2, Dhanashri Randeve2 , Trupti Shirsath2 .