Concrete Added with Manufactured Sand, Coconut Shell, Steel and Sisal Fibres

J.Parvesh
PG Scholar,
Department of Civil Engineering,
Prist University,
Trichy Thanjavur Highway, Vallam, Thanjavur 613403. Tamilnadu, India.

Abstract : In this paper the experimental study have been carried out to find the combined effect of 50% manufacturing sand as fine aggregate replacement, coarse aggregate with 50% coconut shell and steel, sisal fibres as reinforcement. Here the compressive strength test on cube specimens and split tensile strength test on cylinder specimens at 28 days were carried out. Because of increase in fibre content in all the mixes the strength increases gradually.

1. INTRODUCTION

In construction sector there is always a growing demand for finding a suitable material which could effectively replace cement and fine aggregate since manufacture of cement causes environmental pollution and lacking of natural resources to a greater extent. Almost, all over the world have now introduced various measures aimed at reducing the use of primary aggregates and increasing reuse and recycling, where it is technically, economically, or environmentally acceptable. As a result, in developing countries like India, the informal sector and secondary industries recycle 15–20% of solid wastes in various building materials and components, Mathur (2006). Presently in India, about 960 million tones of solid wastes are being generated annually as by - products during industrial, mining, municipal, agricultural and other process. Of this 350 million tonnes are inorganic waste of industrial and mining sectors. However, it is reported that about 600 MT wastes have been generated in India from agricultural sources alone, Asokan Pappu (2007). (Okan.K et.al, 2007) have studied about concrete containing fly ash of 0%, 15% and 30% and steel fibres of volume fraction 0%, 0.25%, 0.5%, 1% and 1.5% found steel fibre improves the tensile strength, drying shrinkage, freeze – thaw resistance and reduce the workability. The addition of fly ash increase workability reduces unit weight of concrete. They finally concluded addition of 1% volume fraction of fibre increases in compressive strength 15%, tensile strength 30%. (Ribakov et.al, 2009) have studied with utilising three different fibres. From experimental study they found that combination of all different fibres have increase in ductility. The fibres hold the matrix together even after extensive cracking. (Jadhav et.al, 2012) have studied the effect of M sand in M 20 grade concrete containing cement 53 grade , manufacturing sand , river sand and coarse aggregate with w / c 0.45. M sand and river sand under zone II according to sieve analysis. The compressive, split tensile, flexural strength of concrete with 60% replacement of natural sand reveals higher strength as compared to reference mix. The overall strength of concrete linearly increases from 0%, 20%, 40% and 60% replacement of natural sand by manufactured sand as compared with reference mix. M sand qualifies itself as suitable substitute for river sand and reasonable cost ,good gradation and nice finish. Kabiru Usman Rogo et al (2010) have studied "Exploratory Study of Coconut Shell as Coarse Aggregate in Concrete". They have concluded that, coconut shell as full replacement of coarse aggregate in concrete for nominal mix of M20 (1:1.5:3) achieve 55% compressive strength of control concrete and which can be used for plain cement concrete. The flakiness index is six times greater for coconut shell when compared with gravel.

K.Gunasekaran et al (2011) have studied "Mechanical and Bond Properties of Coconut Shell Concrete". They have concluded that, the impact resistance of coconut shell aggregate concrete is high when compared with conventional concrete. So it can be used as flexural members. The experimental bond strength of coconut shell aggregate concrete is much higher compared to the theoretical bond strength as stipulated by IS 456:2000 and BS8110. Coconut shell concrete has better workability because of the smooth surface on one side of the shells and also the size of coconut shell used between 10mm to12mm.The splitting tensile strength of coconut shell concrete is 9 to 10% of its compressive strength. The coconut shell aggregate concrete achieve a compressive strength of 26.70 N/mm^2 for M20 grade by trial mixes. Abdulfatah Abubakar et al (2011) have studied "Exploratory Study of Coconut Shell as Coarse Aggregate in Concrete". They have concluded that, coconut shell aggregate concrete achieve compressive strength of 16.5 N/mm^2 for nominal mix (1: 1.5: 3) at 28 days. The cost of coconut shell aggregate concrete is 48% lesser than the cost of gravel used concrete. The specific gravity of coconut shell is lesser than the conventional coarse aggregate. From the results of compressive strength coconut shell concrete can be used as a plain concrete.

II. MATERIALS AND METHODOLOGY

2.1 Materials

Ordinary Portland cement as per IS 12269-1987 standard has been used for making the concrete mixtures. Fine aggregate passing through 4.75mm sieve have been used with partially replaced using manufactured Sand and the crushed granite as coarse aggregate has been partially replaced with coconut shell of size 12 to 20mm. The fibres used in the study were hooked steel, and sisal fibres.

Fiber	Properties						
	Average fibre length	Diameter	Aspect ratio	Tensile strength (Mpa)	Specific gravity	Water Absorption (%)	Density in kg/m^3
Sisal Fibre	60	0.75	80				
hooked steel	50	1	50	532	7.85	33.33	7850

In this project coconut shell is used as coarse aggregate. Coconut shell has a surface texture of rough on convex side and smooth on concave side. The thickness of coconut shell is about 1.2mm to 3mm. Coconut shell is crushed manually to a required shape. The crushed coconut shell is flaky in nature and its edges are sharp and spiky. The water absorption of coconut shell is relatively high when compared to the normal natural aggregate so it should be used in Saturate Surface Dry condition. That is coconut shell is soaked in water for 24hours and taken out from water then place it in a dry surface for 3hours at room temperature before the casting of the concrete to avoid absorption of water from the concrete.

2.2 Casting of Specimens Details

Ingredients such as cement, sand, manufactured sand coarse aggregate and coconut shell were mixed together in dry condition in a pan mixer for a period of 2 min. water reducing admixtures were mixed thoroughly with the mixing water and added to the mixer. Finally, fibres were added to the mixer by dispersing it and then allowed to thoroughly mix with all the ingredients of concrete in the mixer itself for a period of at least 5 min thereby uniform dispersion of fibres were ensured.

2.3 Mix Proportion (kg/m^3)

S.No.	Cement	Fine Aggregate	M.Sand	Coarse Aggregate	Coconut Shell	Steel (%)	Sisal (%)
MC0	**380**	**570**	**-**	**1140**	**-**	**-**	**-**
MC1	**380**	**285**	**285**	**570**	**570**	**1.00**	**0.25**
MC2	**380**	**285**	**285**	**570**	**570**	**1.10**	**0.5**
MC3	**380**	**285**	**285**	**570**	**570**	**1.20**	**0.75**
MC4	**380**	**285**	**285**	**570**	**570**	**1.30**	**1.00**
MC5	**380**	**285**	**285**	**570**	**570**	**1.40**	**1.25**
MC6	**380**	**285**	**285**	**570**	**570**	**1.50**	**1.50**
MC7	**380**	**285**	**285**	**570**	**570**	**1.60**	**1.75**
MC8	**380**	**285**	**285**	**570**	**570**	**1.70**	**2.00**

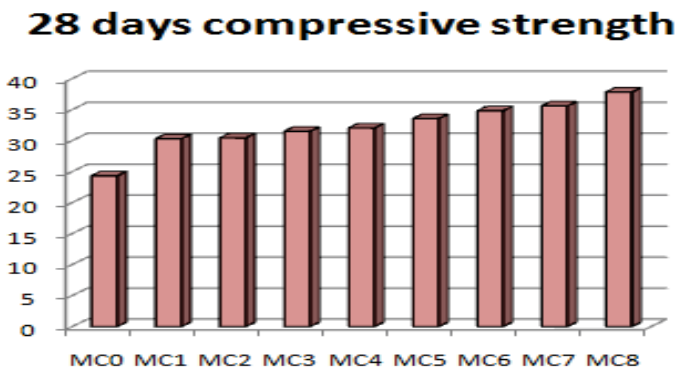
2.4 Testing Procedure

The compressive strength test on cube (150mm) specimens and split tensile strength test on cylinder (150mm diameter and 300mm length) specimens at 28 days were carried out using universal testing machine.

III. RESULTS AND DISCUSSION

3.1 Compressive Strength

The results of 28 days cured compressive strength is shown below.

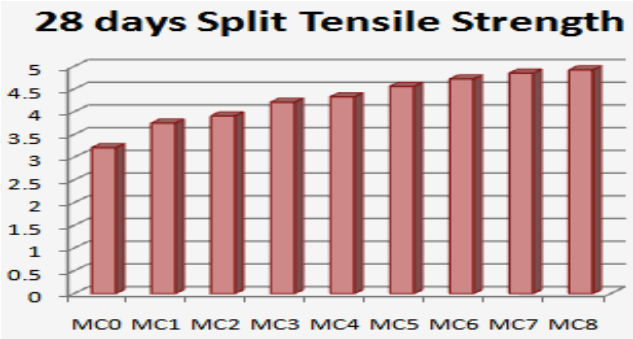


From the 28 days compressive strength results it is found that partial replacement of M.Sand content 50% for fine aggregate and 50% of 20mm aggregate using coconut shell as partial replacement for coarse aggregate. The compressive strength increases due to increase in fibre content gradually.

3.2 Split tensile strength

The results of 28 days cured Split Tensile strength is shown below.

From the 28 days Split tensile strength results it is found that due to steel and sisal fibres which reduces the crack development at earlier stage which increases the split tensile strength.



IV. CONCLUSION

From the result it was found that the manufacture sand can be used as partial replacement for fine aggregate which will reduce the cost and also the scar of natural resources. Hence the partial replacement of fine aggregate with 50% manufacturing sand and 50% coarse aggregate with coconut shell. Due to the presence of higher and lower modulus fibre the split tensile strength also increases with the partial replacement of aggregates.

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