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Experimental Analysis on Comparison of Compressive Strength Prepared with Steel Tin Cans and Steel Fibre

Kamal Kishore[1], Nakul Gupta[2]
[1]M. Tech. Student, [2]Asst. Professor, Dept. of Civil Engineering, GLA University, Mathura, India

Abstract: Sustainable development of structure starts with an alternative to available natural resources; improving the capacity of structural building framework in withholding the ultimate effects due to natural causes and it will turn in lower casting and better utilization of waste materials. In this series, the use of steel fibre can be made to incorporate the additional strength and reducing the carbon di oxide emission effect during manufacturing by replacing a certain part of steel fibre with aggregates. In this research paper, comparison of compressive strength is made on the use of steel fibre. Steel fibres in the form of waste such as lathe waste, empty tin, soft drink bottle caps are deformed in desired shape and are used in the fractions of 0%, 0.50%, 0.75%, 1.0% & 1.5% in the preparation of concrete specimen and samples were observed for compressive strength and split tensile strength for 7, 14 and 28 days. A result data obtained has been analysed and compared with a control specimen of 0% fibre. The study shows steel fibre enhances the quality of concrete and hence increase the compressive strength.
Keywords: Steel Fibre, Lathe Waste, Empty Tins, Soft Drink Bottles, Compressive Strength, Split Tensile Strength.

I. INTRODUCTION

The advancement and latest development of major construction is largely associated with improving the efficiency of the building under seismic effect, reducing cost and economic utilization etc. Concrete is used from many decades with addition of different fibres to enhance the capacities of hardened concrete[1].

Different steel fibre confirming to the different grain distribution, shape, morphology having different anchorage and different strength. The addition of steel fibre to concrete considerably improves the properties in hardened stage such as impact resistance, flexural strength, tensile strength, ductility and toughness etc.[2]–[4]. These fibres have been used in many projects involving the construction of industrial floors, pavements, highways overlays etc. in India. The inclusion of fibre reinforcement found to be better in strain hardening, high energy due fracture, greater resistance to damages and ultimate peak loads[5]–[9].Fibre reinforced cement material from hydraulic cement and discrete, discontinuous fibres made with various sizes of aggregates, confirming to a new construction material. In this research paper, the application of steel fibre and tin chip were employed as a ductile material for improving the strength of the specimen.

II. LITERATURE REVIEW

A. Waheeb ahmad Al-Khaja studied the mechanical properties and time dependent deformation of polypropylene fibre concrete. This investigation conducted to study the effect of PPF used for reinforcing concrete mixes by performing compressive, tensile and flexural tests, changing fibre from 0.1% to 3% of cement content, showing 0.5% of PPF gives maximum compressive strength.

B. K.Anbuvelen, M. M. Khadar studied on the properties of concrete containing polypropylene, steel and re-engineered plastic shared fibre with 0.1%, 0.5% and .5% by volume of concrete mix observed that addition of steel fibre in plain concrete result in improvement in strength, wear and impact resistance by 30%-45%, 40%-50% and 34-38% respectively[10].

C. Mohammad and Kaushik investigated the influence of mixed aspect ratio of fibres on compressive strength, split tensile strength, flexural strength, impact strength and ductility of SFRC. They tried different mixed aspect ratio of fibres with a total volume fraction of 1.0%, concluding that the use of 65% long fibre and 35% short fiber gave optimum mechanical properties.

D. Maalej and paramsivam studied the effectiveness of ductile fiber reinforced cementious composites (DFRCC) in retarding the corrosion of steel in reinforced concrete beams. A fiber content of 1.5% PVA & 1.0% steel fiber was used in a DFRCC and a layer of DFRCC was used around the main longitudinal reinforcement (FRC). The author conclude that the FRC concept using DFRCC material was very effective in preventing corrosion, minimizing the deflection capacity and higher resistance against cracking compared with conventional reinforced concrete.

[1] M. Tech. Student (Structure engineering), Dept. of Civil Engineering, GLA University, Mathura, India
[2] Asst. Professor, Dept. of Civil Engineering, GLA University, Mathura, India

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III. METHODOLOGY

1) *Cement:* 43 grade ordinary Portland cement was used in the experiment confirming to the IS 8112:1989.

Table 1: Chemical Status of Portland cement

SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	Na_2O_3	K_2O
19.96%	3.13%	3.50%	62.65%	3.15%	0.06%	0.7%

2) *Fine Aggregate:* The sample of fine aggregate was belonging to **zone II** to be used in the study.

Table 2: Test results on Cement

S. No.	Test	Result
1	Specific Gravity	3.10
2	Normal consistency	31%
3	Initial Setting time	65 min
4	Final initial time	270 min

Table 3: Numbering of Specimen as per Requirement

S. No.	Test	Dosage of Fiber			
		0%	0.5%	1.0%	1.5%
1	Compression	3	3	3	3
2	Split tensile Strength	3	3	3	3

3) *Water:* Potable water free from salts used for casting and curing of concrete as per IS 456-2000 recommendations however the ph of water was maintained above 6[11].

Table 4: for 1 m3 volume of concrete, the material were used as following

S. No.	Cement	Fine Aggregate	Water	Coarse Aggregate	W/C ratio	Mix Proportions
1	437.77Kg.	709.55Kg.	197 litre	1109 Kg.	0.45	1:1.63:2.52

IV. PREPARATIONS AND CASTING OF CONCRETE

All the moulds were kept ready by applying the lubricant on all sides and tighten the bolts of the moulds as it loose state may cause slurry to get out of the moulds during mechanical vibrations. The fully compacted and prepared concrete were filled into the respective moulds of sides 150mm in three different layers by compacting it by tempering rods and then followed by mechanical vibrator for desired compactness. Over vibration was avoided due to segregation point of view and hence optimum vibration done till no more bubbles appear on the top surface. The upper top level of concrete was made plane with the help of trowel for uniform level of surface.

150mm*150mm*150mm size of cube and 300mm*150mm were used for estimating compressive strength and split ensile strength of the concrete. Each mould were filled with alternative three layer and was compacted fully using a compacting rod with 25 blows per layer on one time. After compaction of three layers, sides were taped by using hammer to remove tapped air in the concrete and then allowed for mechanical vibrations to ensure fully release of air bubbles.

After compaction, the specimen were kept alone in the environment for 24 hours and then specimen were removed from the mould and then brought for curing .the specimen were cured for 7, 14, 28 days.

V. MIXING OF STEEL FIBER

To ensure the complete distribution of steel fiber, the steel fiber was spread on the aggregate in drum mixer in a uniform manner. Then the mixer drum was allowed to rotate for five revolutions after each addition for about three minutes. Finally a complete distribution of fiber throughout the concrete mix was achieved. This mix concrete was filled in the cubes and cylinders.

A. Test Results

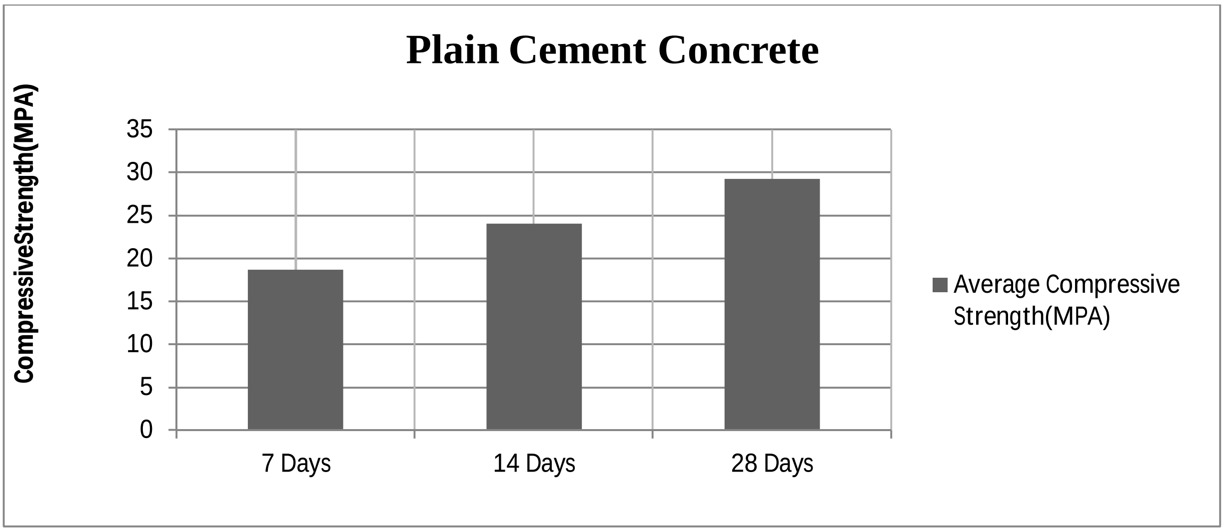

Figure 1: Average compressive Strength of Conventional Concrete

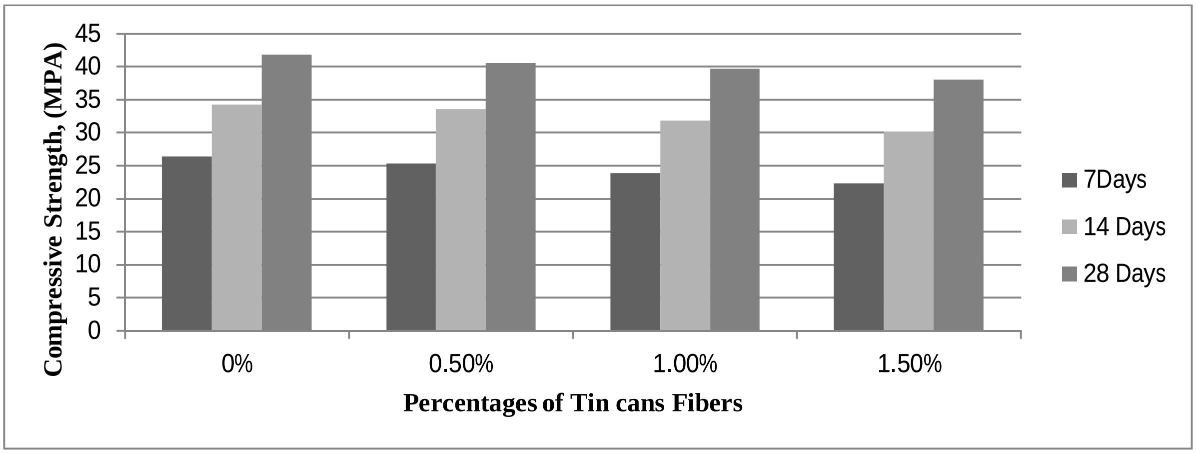

Figure 2: Average Compressive Strength of Tin

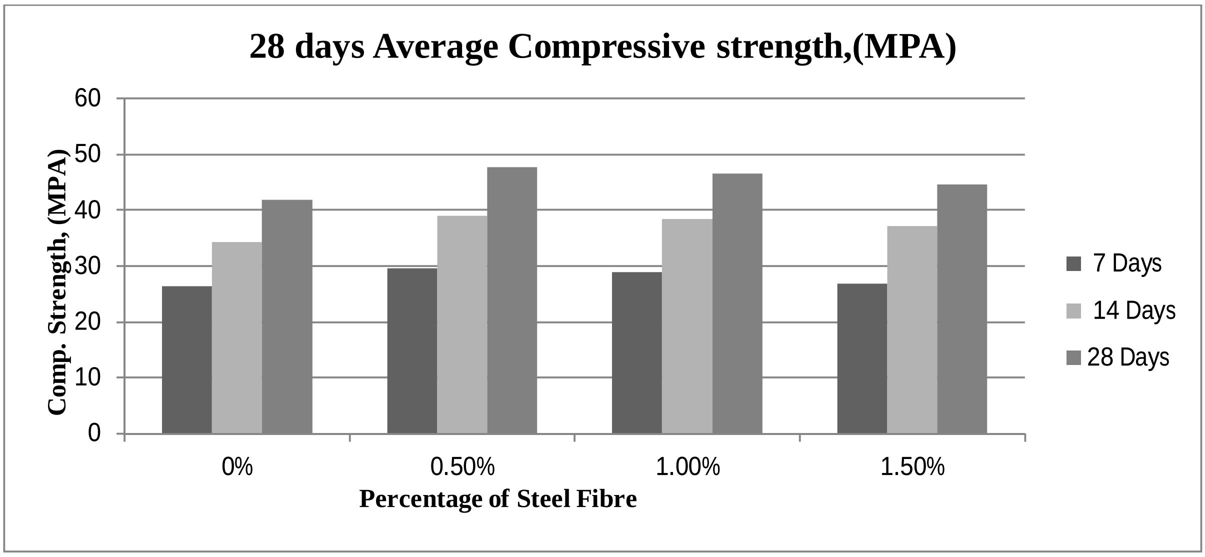

Figure 3: Average Compressive Strength of Steel Fiber

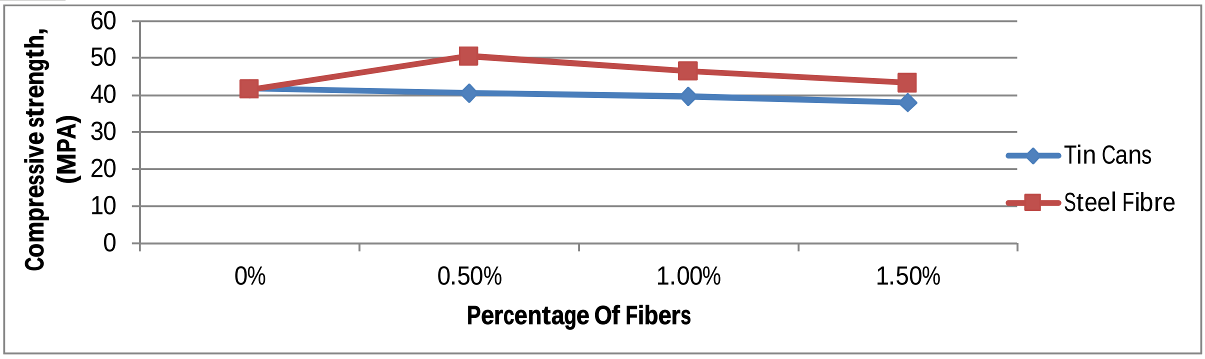

Figure 5: Comparison of Compressive Strength

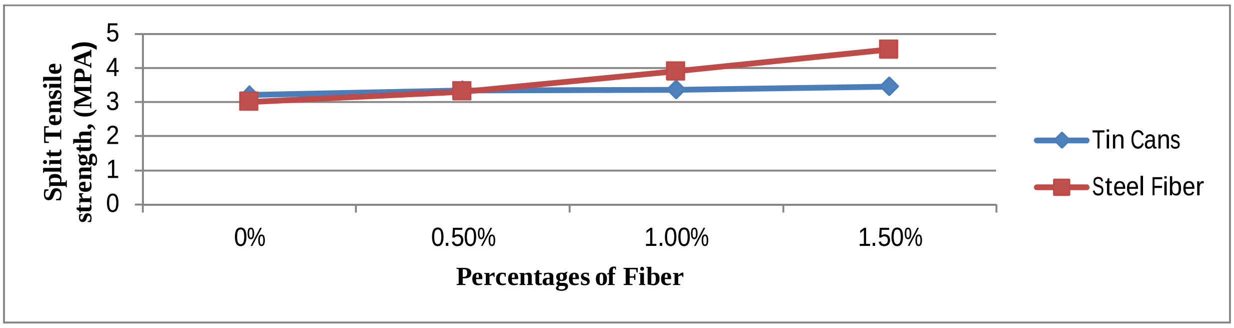

Figure 6: Comparison of Split tensile Strength at 28 days

VI. CONCLUSION AND DISCUSSION

Fiber is important from strength and improvement over existing traditional approach and its share depends upon its morphology, texture, density, gradation, and allocation of fiber particles inside the specimen etc. The study reaches to the following results

A. Concrete casted using tin cans shows poor results giving reduction in the strengths however the split tensile strength of tin cans has better results.
B. Steel fiber has maximum compressive strength at 0.5% fraction afterward the strength decreases gradually.
C. Split tensile strength of steel fiber has better result as compared to the tin cans chips. An improvement of 23% of split tensile strength is achieved when dealing with steel fiber.
D. With an increase of fiber content, compressive strength of steel fiber first increases after that decreases however the compressive strength of tin can chips decreases from starting stage.
E. Split tensile strength of tin chips fiber has no significant changes while split strength of steel fiber increases gradually from 0.5% steel fiber fractions.

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