STUDY ON USE OF STEEL FIBRE AS REINFORCEMENT MATERIAL WITH CONCRETE: A REVIEW

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ABSTRACT: The purpose of the research is to investigate the use of steel fibres in concrete in different proportion and determine their strength and different properties and compare with the ordinary concrete. The test required for investigation is workability test, compressive strength test, indirect tensile strength test and flexural test. Fibres are the material which is used in concrete to improve its many properties like strength, resistance to cracking shrinkage reduction, increase toughness and reduction in maintenance and repair cost. Steel fibres are distributed throughout the cross section because steel fibres are short and closely spaced as compare to reinforcing bars. Steel fibres typically added to concrete in low volume dosage less than 1%. These are effective in reducing plastic shrinkage cracking and at high enough dosage they can increase the resistance to cracking and decrease crack width. Steel fibres reinforced concrete is a composite material with fibres as additional ingredients at small percentages between 0.3% to 2.5% by volume in plain concrete. According to study of various research paper, it is found that steel fibres have maximum strength than other fibres. SFRC is used in manufacturing of wide varieties of precast products like manhole covers, slab element for bridge decks, highway runways, tunnel linings, machine foundation blocks, door and window frames, piles and coal storage bunkers etc. Fibres are comparatively expensive and this has limited their use to some extent. Many types of steel fibres are used for reinforced like round fibres, rectangular fibres and deformed fibres.

Keywords: Compressive strength, indirect tensile strength, workability, flexural strength, Steel Fibre Reinforced Concrete (SFRC).

I. INTRODUCTION

Fibres are the material which is used in concrete to improve its many properties like strength, resistance to cracking shrinkage reduction, increase toughness and reduction in maintenance and repair cost. Fibre reinforced concrete is a composite material with cement , aggregate and discontinues, discrete, uniformly dispersed suitable fibres. Plain concrete is a brittle material with limited ductility and low tensile strength and strain capacity. Internal micro cracks are present in plain concrete thus in plain concrete heavy brittle fracture occur.The role of randomly distributed fibres is to provide bond and some post cracking ductility. If fibres are sufficiently strong and properly bonded to material then it carries significant stress over a large strain capacity in post cracking stage. The steel fibres are described by a convenient parameter which is called "Aspect Ratio". The aspect ratio is determined by length to diameter ratio. It varies from 20 to 100. fibres should have the property of surface roughness to enhance bonding with the matrix. The main disadvantage of steel fibres is that it is effected by corrosion, so fibres should be protected from corrosion by the alkaline environment of the cementations matrix. The compressive strength of concrete with steel fibres increase from 0 to 15% for up to 2 % of volume of fibres. And the increase in tensile strength from 30% to 40% for 2 % of volume of fibres. Increase in flexural strength of SFRC is much greater than in tension or compression. Because of ductile behaviour. Steel fibres are not cost effective due to addition of 1% steel fibres of total volume, there will be a massive change in cost of the construction. SFRC has been used in road pavement, industrial flooring, bridge decks, canal lining, refractory linings, fabrication of precast products etc.

II. LITERATURE REVIEW:

1. **Kukreja (1980)** conducted some experiment and reported short steel fibres increase the tensile strength even in low volume fractions. Optimum aspect ratio is 80 and maximum increase in tensile strength 33.15% at fibre content of 0.7% by volume.

2. **Faisal F Wafa and Samir A. Ashour (1992)** they tested 504 test specimens for different mechanical properties such as compressive strength , split tensile strength, flexural toughness. The mix was designed to achieve compressive strength of 94 N/mm^2. Three volume fractions of steel fibres such as 0.5%, 1% and 1.5% were selected. It was found that no workability problem was occur when volume fraction of 1.5% added to concrete. Steel fibres enhanced the ductility and load carrying capacity of concrete.

3. **Semsi Yazici (2007)** presented effect of aspect ratio and volume fractions of steel fibre on mechanical properties of SFRC. Three aspect ratio of 45, 65, 80 and three volume fractions of 0.5%, 1%, 1.5% were taken to study. As a result showed that increase in aspect ratio decreased the workability; increase in

compressive strength 4 to 19%, increase in split tensile strength 11 to 54% and increase in flexural strength 3 to 19%were obtained.

4. **Vikrant Variegate (2012)** presented the compressive strength and tensile strength of concrete with steel fibres. Compressive strength test is performed on cube size 150mmx150mmx150mm. Compressive strength of M20 grade of concrete with different proportion of steel fibres on 7 days and 28 days are tabulated below.

Table 1 Compressive strength of M20 grade concrete cubes

Fibre content (%)	7th Day		28th Day	
	Mean Load (kN)	Compressive strength (N/mm^2)	Mean Load (kN)	Compressive strength (N/mm^2)
0%	515.6	22.91	585.28	26.01
0.25%	445.8	19.81	461.36	20.50
0.5%	470.5	20.91	568.58	25.27
0.75%	485.6	21.58	550.98	24.48

Tensile strength of M20 grade of concrete with different proportion of steel fibres on 7 days and 28 days are tabulated below.

Fibre content (%)	**7th Day**		**28th Day**	
	Mean Load (kN)	**Split Tensile strength (N/mm^2)**	**Mean Load (kN)**	**Split Tensile strength (N/mm^2)**
0%	72.3	1.022	163.4	2.310
0.25%	124.3	1.758	178	2.517
0.5%	156.6	2.214	207	2.927
0.75%	107.8	1.524	192.2	2.718

5. **Prof. Ram Meghan (2014)** presented the experimental study on split tensile strength of fibre reinforced concrete. As result shows that the split tensile strength is increased by 1.75% when fibre content is 0.5%. The compressive strength and the flexural strength also increased as percentage of steel fibre is increased in concrete.

6. **Nitin Kumar (2015)** presented the experimental study on strength characteristics of M40 concrete. Concrete having mix proportion of 1:4:3 with water cement ratio of 0.34% with different fibre content. As a result the values of strength is greater for the fibre reinforced concrete than ordinary concrete. Fibre content of 0.5% by volume gives maximum values of strength.

III. CONCLUSIONS:

SFRC improves many properties of concrete like strength, resistance to cracking shrinkage reduction, increase toughness and reduction in maintenance and repair cost. Addition of steel fibres on concrete makes concrete less workable. Fibres are very expensive, 1% steel fibre addition will approximately doubles the material cost. it is found that steel fibres have maximum strength than other fibres. SFRC is used in manufacturing of wide varieties of precast products like manhole covers, slab element for bridge decks, highway runways, tunnel linings, machine foundation blocks etc. The splitting tensile strength was increased by 20-22% for concrete cylinder samples with 0.5% fibre content

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