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Fiber Reinforced concrete using waste material: A review

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Abstract - *A Fiber Reinforced Concrete (FRC) is a composite material consisting of cement based matrix with an ordered or random distribution of fiber which can be steel, nylon, polythene etc. Development in technology enhances not only human comforts but also destroy the eco-system. Fiber Reinforced Concrete is generally made with high cement content & low water content. Plain concrete fails suddenly once the deflection corresponding to ultimate flexural strength is exceeded, on the other hand, fiber reinforced concrete continue to sustain considerable loads ever at deflection considerably in excess of the fracture deflection of plain concrete. Use of metals as containers has become popular and safe now, especially to carry the liquids, In spite of the inherent advantages and disadvantages existent in its disposal. Today the construction industry is in need of finding cost effective materials for increasing the strength of concrete structures. Hence an attempt has been made in the present investigations to study the influence of addition of waste materials like waste steel powder & soft drink bottle caps, empty waste tin from workshop at a dosage of 1% of total weight of concrete as fibers. The present paper reviews the literature related to the utilization of waste material and its various effects on compressive strength, split tensile strength, flexural strength and workability of concrete. The steel powder, empty tins, soft drink bottle caps were deformed into the rectangular strips of 3mm width and 10mm length. The present paper reviews the literature related to the*

Key Words: Fibre, fibre reinforcement, metal wastes, waste disposal, workability, compressive strength, flexural strength, split tensile strength

1. INTRODUCTION

Use of admixtures to concrete has long been practiced since 1900. In the early 1900s, asbestos fibers were used in concrete, and in the 1950s the concept of composite materials came into being and fiber reinforced concrete was one of the topics of interest. There was a need to find replacement for the asbestos used in concrete. By the 1960s, steel, glass (GFRC) and synthetic fibers such as polypropylene fibers were used in concrete, and research into new fiber reinforced concrete continues today. Concrete in general is weak in tensile strength and strong in compressive strength. The main aim of researchers or concrete technologists is to improve the tensile strength of concrete. To overcome this serious defect, partial incorporation of fibers is practiced. Great quantities of steel waste fibers are generated from industries related to lathes, empty beverage metal cans and soft drink bottle caps. This is an environmental issue as steel waste fibers are difficult to biodegrade and involves processes either to recycle or reuse. Fiber reinforced concrete is an interesting topic discussed by numerous researchers in the last two decade.

2. Literature Review

Amit Rai and Dr. Y.P Joshi [1] reported that FRC is an effective way to increase toughness, shock resistance and resistance to plastic shrinkage cracking of the mortar. These fibers have many benefits. Steel fibers can improve the structural strength to reduce the heavy steel reinforcement requirement. Freeze thaw resistance of the concrete is improved. Durability of the concrete is improved to reduce in the crack widths. Polypropylene and Nylon fibers are used to improve the impact resistance. Many developments have been made in the fiber reinforced concrete and Fiber addition improves ductility of concrete and its post-cracking load-carrying capacity.

A.M. Shende et. al. [2] introduced Steel fibres of 50, 60 and 67 aspect ratio. Result data obtained has been analyzed and compared with a control specimen (0% fibre). A relationship between aspect ratio vs. Compressive strength, aspect ratio vs. flexural strength, aspect ratio vs. Split tensile strength represented graphically. It is observed that compressive strength, split tensile strength and flexural strength are on higher side for 3% fibres as compared to that produced from 0%, 1% and 2% fibres. All the strength properties are observed to be on higher side for aspect ratio of 50 as compared to those for aspect ratio 60 and 67. It is observed that compressive strength increases from 11 to 24% with addition of steel fibres.

G. Murali et. al. [3] studied the influence of addition of waste materials like lathe waste, soft drink bottle caps, empty waste tins, waste steel powder from workshop at a dosage of 1% of total weight of concrete as fibres. The lathe waste, empty tins, soft drink bottle caps were deformed into the rectangular strips of 3mm width and 10mm length. Experimental investigation was done using M25 mix and tests were carried out as per recommended procedures by relevant codes. The results were compared with conventional concrete and it was observed that concrete

blocks incorporated with steel powder increased its compressive strength by 41.25% and tensile strength by 40.81%. Soft drink bottle caps reinforced blocks exhibited an increase in flexural strength of concrete by 25.88%. The specimen with steel powder as waste material was found to be good in compression which had the compressive strength of 41.25% more than the conventional concrete.

Fig-1: Variours type of wastes

R. Kandasamy and R. Murugesan [4] studied the influence of addition of polythene fibbers (domestic waste plastics) at a dosage of 0.5% by weight of cement. The properties studied include compressive strength and flexural strength. The studies were conducted on a M20 mix and tests have been carried out as per recommended procedures of relevant codes It was concluded that it increases the cube compressive strength of concrete in 7 days to an extent of 0.68%, increases the cube compressive strength of concrete in 28 days to an extent of 5.12%, increases the cylinder compressive strength of concrete in 28 days to an extent of 3.84% increases the split tensile strength to an extent of 1.63% and the increase in the various mechanical properties of the concrete mixes with polythene fibers is not in same league as that of the steel fibres.

Table -1: Different strength values

Different strength value after 28 days of curing			
S. No.	Notation	Compressive strength	No. of cubes
1	Conventional	28	9
2	Steel Powder	39.55	9
3	Soft drink bottle cap	33.33	9
4	Beverage tins	31.11	9

3. CONCLUSIONS

1. Fiber addition improves ductility of concrete & its post-cracking load carrying capacity.
2. Increases the cube compressive strength of concrete in 7 days to an extent of 0.68%
3. The most important contribution of fibre reinforcement in concrete is not to strength but to the flexural toughness of materials.
4. The increase in the various mechanical properties of the concrete mixes with polythene fiber is not in same league as that of the steel fiber.
5. Increases the cube compressive strength of concrete in 28 days to an extent of 5.12%
6. Increases the cylinder compressive strength of concrete in 28 days to an extent of 3.84%.Increases the split tensile strength to an extent of 1.63%
7. The increase in the various mechanical properties of the concrete mixes with polythene fibers is not in same league as that of the steel fibers.

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