EXPERIMENTAL STUDY OF HYBRID FIBRE REINFORCED CONCRETE

ABSTRACT

Concrete is the most widely used construction material across the world. Due to the persistent and continuous demands made on concrete to meet the various difficult requirements, extensive and wide spread research work is being carried out in the area of concrete technology. Researchers have developed variants of concrete composites like Admixture Concrete, Fiber Reinforced Concrete (FRC), Polymer Impregnated Concrete (PIC), High Performance Concrete (HPC), Self-Compacting Concrete (SCC), Geopolymer Concrete etc. But certain inherent properties like low ductility, formation of shrinkage cracks etc. cannot be rectified. Formation of cracks is a major problem, these cracks propagate in all direction causes corrosion of reinforcement in structures.

The introduction of different types of fibres to the concrete mix helps to improve the different mechanical properties of concrete and also helps to reduce the cracks formation to a great extent. The present study is steel and polyester hybrid fibre concrete and a comparison of which with conventional concrete mix and also find out the optimum dosage of steel fibre in the hybrid reinforced concrete. Presently, concrete includes the use of steel fibre and polyster hybrid fibre, etc. The strength properties are studied for the conventional concrete.

In the present experimental investigation, Concrete grade of M30 has been designed. A combination of mineral admixtures like steel fibre, Recron 3S Polyster fibre OPC is used. The influence of HYBRID fibre has been studied in different proportioning (0%, 1%, 1.5% & 3%) of fibre lengths to improve the performance characteristics of concrete. Hardened concrete properties such as compressive
strength split tensile strength and flexural strength of the concrete on 7, 14, & 28 days has been achieved.

**KEYWORDS:** steel fibre, polyester fibre. OPC, compressive strength, split tensile strength and flexural strength.

**INTRODUCTION:**

Hybrid Fibre Reinforced Concrete is a composite material consisting of hydraulic cement, sand, coarse aggregate water and more than one type of fibres. Fibres helps to improve post peak ductility performance pre-crack tensile strength fatigue strength and eliminate temperate and shrinkage cracks. The amount of fibres added to the concrete mix is measured as a percentage of the total volume o composite termed volume fraction, typically range from 0.1 to 3%. One of the major problems the construction industry faces is the failure of concrete by the corrosion of reinforcement bars due to the development of micro cracks that are invisible to naked eye These cracks are formed due to stress is developed during shrinkage Hybrid concrete has wide applications as secondary reinforcement in recent years because of their property to resist these micro cracks. There are a number of different type of steel fibres with different commercial names.

The main advantage of steel fibres are it increases the ductility toughness strength fatigue resistance etc. Polyester is a category of polymers which contain the ester functional group in their main chain. Although there are many types of polyester, the term “polyester” as a specific material most commonly refers to polyethylene terephthalate (PET). Polyesters include naturally-occurring chemicals, such as in the cutting of plant cuticles, as well as synthetics through step growth polymerization such as polycarbonate and polybutyrate. Natural polyesters and a
few synthetic ones are biodegradable, but most synthetic polyesters are not. The other major inherent factor that affects the properties of the fibre reinforced is the bond strength of the fibre with cement composite. The bundles of polyester fibres added to concrete are separated into millions of individual strands due to the abrasive action of the aggregates. The fibres provide support to concrete in all possible directions by getting evenly distributed throughout the matrix.

**OBJECTIVE FOR THE STUDY:**

- To reduce crack widths and control the crack width, thus improving durability especially in water retaining structures.
- To improve tensile strength without increasing the steel reinforcement.
- To increase the compressive strength, flexural strength and split tensile strength of the concrete.

**NEED FOR THE STUDY:**

- To study the characteristic strength and performance of high strength concrete using Hybrid fibre proportioning of 0%, 1%, 1.5% and 3% with various sizes of aggregates.
- To improve the tensile strength, durability, ductility using Hybrid fibre as an alternative for steel reinforcement.
- To compare the experimental results to predict the performance characteristics of fibre reinforced concrete with the conventional concrete.
ADVANTAGES OF CONCRETE WITH HYBRID FIBRE:

Steel and Polyester HFRC exhibits the following improvement in properties over any other same mix design control concrete.

- Drying Shrinkage (Reduces from 80%-100%)
- Water permeability / Penetration (Reduces from 40% to 50%)
- Compressive Strength (Increases from 10% to 20%)
- Tensile Strengths (Increases from min of 6% -10%)
- Abrasions Resistance (Increases from 20% to 40%)
- Impact Resistance (Increases from 80% to 120%)
- Improves Resistance of Structures to Earthquake.
- It has a larger surface area, thus ensuring a wider area for concrete and mortar aggregates to bind more securely
- It can be used for wide and varied applications of concrete and mortar due to wide range of cut lengths available.

APPLICATIONS OF HYBRID FIBRE:

Several manufactures currently produce steel and polyesters fibres for the use in concrete as a form of secondary reinforcement and in cement mortar. Different applications of these hybrid fibres are,

- Mortar (Internal plaster, external plaster, tunnel linings) In exposed unreinforced concrete surfaces (Runways, taxiways, road pavements, canal linings, railways platforms, parking decks etc.)
- In reinforced cement concrete (Reduces amalgamation of cracks at joints, increases durability of the structure due to its corrosion resistance)
- Blast resistant structures
• Structures subjected to dynamic loading
• In water retaining structures (Dams, swimming pools, aqua ducts, spillways, intake structures, etc.)
• In precast concrete products (Paver tiles and blocks, pipes)
• In repairs and restoration (Saves repair and restoration costs as it extends corrosion-free life to structural steel reinforcement thereby increasing useful life span of the structure)