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A Review on Comparison of Different Types of Fibre Used In Concrete

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ABSTRACT

Plain concrete is a brittle material. Concrete without any Fibres will develop cracks due to plastic shrinkage, and changes in the volume of concrete. The development of these micro cracks causes elastic deformation of concrete. To meet the required values if flexural strength Fibre are used in normal concrete. The addition of fibre in a plain concrete will control the cracking due to shrinkage and also reduced the bleeding of the bleeding of water. Not much importance is given to the use of coir Fibre in concrete.

Keyword: Coir Fibre (CFRC), Steel fibre, Plastic Fibre Plain cement concrete (PCC)

I. INTRODUCTION

Concrete is one of the most widely and commonly used building material in civil engineering around the world. Concrete is strong in compression, however, is a very brittle material, and has low strain capacity in tension and consequently low toughness. As a result, cracks develop whenever loads give rise to tensile stresses exceeding the tensile strength of concrete. Adding fibres to the concrete matrix has been long recognized as a way to enhance the energy absorption capacity and crack resistance of plain concrete.

In fibre reinforced concrete (FRC), by bridging fibres across the cracks a post-cracking ductility is provided, and consequently, the toughness of concrete is considerably enhanced. Consideration of toughness and the fracture energy is important since it determines the ductility and cracks resistance of the structure assuring the safety and integrity of the structural elements before its complete failure.

Concrete is typically reinforced with steel or synthetic fibres like carbon, glass, or aramid. Despite their advantages, the high material costs, the high energy-consuming process by the production and their adverse environmental impact has initiated the search for new environmentally friendly and sustainable alternatives. In the framework of international research, a considerable effort is going on in the exploitation of fast- growing, annually renewable, cheap crops and crop residues as possible fibre reinforcement in concrete.

The basic advantage of natural fibres is that they are a low cost and widely available resource in many agricultural areas. They are biodegradable, non-abrasive and there is no concern with health and safety during handling. Natural fibre reinforced materials are environmentally friendly materials producing less greenhouse gas emissions and pollutants. The use of natural fibres as reinforcement is a way to recycle these fibres and to produce a high-performance material. Coir derived from the Tamil word "kayiru" is a natural fibre obtained from the husk of the coconut. Coir possesses about 48% of lignin increasing strength and elasticity of fibre; it also reduced the biological degradation with average life of nearly 20 years. Coir is produced in India on a large scale, references say more than 90% of the world coir production is from India. Kerala leads in

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India with producing more than 60% of the Indian production alone.

II. TYPES OF MIXES

a) Nominal Mixes

In the past, the specifications for concrete prescribed the proportions of cement, fine and coarse aggregates. These mixes of fixed cement-aggregate ratio which ensures adequate strength are termed nominal mixes. These offer simplicity and under normal circumstances, have a margin of strength above that specified. However, due to the variability of mixed ingredients the nominal concrete for given workability varies widely in strength.

b) Standard Mixes

The nominal mixes of fixed cement-aggregate ratio (by volume) vary widely instrength and may result in under- or over-rich mixes. For this reason, the minimum compressive strength has been included in many specifications. These mixes are termed as standard mixes.

IS456 2000 has designated the concrete mixes into several grades as M10, M15, M20, M25, M30, M35 and M40. In this designation, the letter M refers to the mix and the number to the specified 28-day cube strength of mix in N/mm^2. The mixes of gradesM10, M15, M20 and M25 correspond approximately to the mix proportions (1:3:6),(1:2:4), (1:1.5:3) and (1:1:2) respectively.

c) Designed Mixes

In these mixes, the performance of the concrete is specified by the designer but the mix proportions are determined by the producer of concrete, except that the minimum cement content can be laid down. This is the most rational approach to the selection of mixed proportions with specific materials in mind possessing more or less unique characteristics. The approach results in the production of concrete with the appropriate properties most economically.

III. FACTORS AFFECTING CHOICE OF MIX PROPORTION

1. Compressive strength

It is one of the most important properties of concrete and influences many other describable properties of hardened concrete. The mean compressive strength required at a specific age, usually 28 days, determines the nominal water-cement ratio of the mix. The other factor affecting the strength of concrete at a given age and cured at a prescribed temperature is the degree of compaction. According to Abraham’s law, the strength of fully compacted concrete is inversely proportional to the water-cement ratio.

2. Workability

The degree of workability required depends on three factors. These are the size of the section to be concreted, the amount of reinforcement, and the method of compaction to be used. For the narrow and complicated section with numerous corners or inaccessible parts, the concrete must have high workability so that full compaction can be achieved with a reasonable amount of effort. This also applies to the embedded steel sections. The desired workability depends on the compacting equipment available at the site.

3.Durability

The durability of concrete is its resistance to aggressive environmental conditions. High strength concrete is generally more durable than low strength concrete. In situations when the high strength is not necessary but the conditions of exposure are such that high durability is vital, the durability requirement will determine the water- cement ratio to be used.

4.Maximum nominal size of aggregate

In general, the larger the maximum size of aggregate, the smaller is the cement requirement for a particular water-cement ratio, because of the workability of concrete increases with an increase in the maximum size of the aggregate. However, the compressive strength tends to increase with the decrease in the size of aggregate.

5.Grading and type of aggregate

The grading of aggregate influences the mix proportions for specified workability and water-cement ratio. Coarser the grading leaner will be mix which can be used. A very lean mix is not desirable since it does not contain enough finer material to make the concrete cohesive.

The type of aggregate influences strongly the aggregate-cement ratio for the desired workability and stipulated water-cement ratio. An important feature of a satisfactory aggregate is the uniformity of the grading which can be achieved by mixing different size fractions.

6.Quality Control

The degree of control can be estimated statistically by the variations in test results. The variation in strength results from the variations in the properties of the mixed ingredients and lack of control of accuracy in batching, mixing, placing, curing and testing. The lower the difference between the mean and minimum strengths of the mix lower will be the cement content required. The factor controlling this difference is termed quality control.

IV. LITERATURE REVIEW

Various studies were carried out by renowned experts from around the country on Compression of different types of used in concrete.

Jagmohan Meena and Dr Baharat nagar (2020) have done study on an experimental study on M35 grade of concrete with partial replacement of cement with coconut fibre. They have used material of coir fibre in a specific quantity of 0%, 0.5%, 1.0%, 1.5%, and 2.0%. They concluded that compressive strength is highly increased by 12.61% by adding 1.5% of coconut fibre and split tensile strength is increase up to 23.72% and flexural strength increase up to 25.18% after the 28 days curing.

Hadj mostofa adda et al (2019) have done study on concrete reinforced by plastic fibre based on local material. In this work polyethylene terephthalate are used in a diameter of 2 mm and length 50 mm and fibre is used as 0.5%, 1%, 1.5%, and 2.5%. From this study they found that the compressive strength is increases about 15.57% when the fibre added less than 1.5% at 28 days curing. Along with compressive strength, split tensile strength increased by 24.30% and flexural strength increased by 33%.

N. Santhosh Kumar et al (2019) carried out experimental study on concrete using coconut shell and coir fibre by partial replacement method. In this work the material used was coconut shell and a coir fibre. Coconut shell is used as a course aggregate and coir fibre as a fine aggregate in a percentage of 5, 10, 15 and 20. The use of coconut shell as partial replacement of course aggregate and fine aggregate causes the increase in compressive strength, split tensile strength after 28 days.

Neeraj Agarwal (2018) carried out study on research on Coir fibre reinforced concrete. In this study they used material of coir fibre in a percentage of 0.2, 0.3 percent by weight of cement concrete. They found that coir fibre reinforced concrete has properties as, non-corrosiveness, light weight, high strength and low thermal conductivity.

Irem sanal (2018) carried out study on performance of macro synthetic and steel fibre reinforced concrete emphasizing mineral admixture addition. Steel fibre used for concrete mixtures was 7.8 gm/cm3 to different length of the steel fibres were used (35 and 50mm). The properties of hooked end steel fibre are also considered. It is found that the addition of steel fibre to concrete seems to preserve or increase the absorption of water as expected due to the increases amount of pours along with the increase in fibre quantity. Instead of 1% steel fibres, a smaller amount of 0.8% macro synthetic fibres proved to cause nearly the same enhancement in term of compression strength.

Balte sanjaykumar and S. N. Daule (2017) carried out study on use of plastic fibre in a concrete. In this work polyethylene terephthalate (e.g. coco cola, bislery bottles) are used in percentage. The study shows that slump and compaction factors are reduced. The plastic fibre is used in the form of pieces in 3.5 length and 1mm breadth. The study concludes that up to the concrete was good enough workable up to 1.5 to 2 percent addition of fibre.

A. Ananthi et al (2017) investigated the utilization of waste plastic fibre in concrete. In this work M_{20} grade is used. The study revealed that plastic fibre increases the compressive strength of concrete by 3.84% when 0.5% of polythene fibres are used. Also 1.63% split tensile increase in 28 days. In this study 0.5% of polythene fibre in the form of specific piece of measurement that is length=12.7 mm and breadth=2.8 mm are used. The study conclude that when 0.9% fibre is added in concrete there is 40.3% increase in compressive strength after 7 days and 28.5 % increases after 28 days. The split strength increased by 54.8% after 7 days and 24.4% increased after 28 days.

Prasad kar unakaran.r et al (2017) carried out study on experimental study on behaviour of steel fibre reinforced concrete. In this work, M_{20} grade having mix proportion of 1:1.5:3 with 0.44 water cement was used. In this work, Compressive strength, Split tensile strength and flexural strength of steel fibre reinforced concrete (SRFC) containing fibre of 0.5% by volume are found out. A result data obtained has been analysed and relationship between compressive strength, split tensile strength and flexural strength vs. Days represented graphically. Compressive strength, split tensile strength and flexural strength found to be increased by the addition of fibres.

Anoop Singh Chandel et al (2016) Studied the comparative strength study of coir fibre reinforced concrete (CFRC) over plain cement concrete (PCC). In this paper they analysed that plain cement concrete is good in compression but weak in tensile. It is need of concrete to composite it with different fibres, so that, coir fibre is added in concrete in the form of 2mm pieces, with percentage as 1%, 3%, 5%. They found that there is increase in strength as 13% compressive strength, 40% tensile strength and 50% flexural strength. This study made us adopt natural fibres which are abundantly available and cheap.

kumar G et al (2015) carried out a study on investigation of waste plastic fibre reinforced concrete using manufactured sand as a fine aggregate. For this analysis natural sand is replaced by manufactures sand with the different percentage as 0, 20, 60, 80, 100 and fix percent of plastic fibre is used. They reported that 1% of plastic in concrete produces 2.5%

incremental strength compared to conventional concrete.

V. CONCLUSION

Concrete is the second-most-used substance in the world after water, and is the most widely used building material. Its usage worldwide is twice that of steel, wood, plastics, and aluminium combined. Globally, the ready-mix concrete industry, the largest segment of the concrete market, is projected to exceed $600 billion in revenue by 2025. From this review study it has been observed that various research works were carried out and efforts have been taken by various authors and researchers to find newer and economical composition of concrete to serve better to society.

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