

Experimental Study of Coir Fiber as Concrete Reinforcement Material incement Based Composites

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ABSTRACT

The overall goal of this research is to investigate the behavioural study of natural fibre in concrete structure. The coir fibre recently attracted an interest as a sustainable fibre composite material, due to some specific mechanical property which can be compared to artificial fibre. The Coir fibre is treated using natural latex before using in concrete, so that it is not be affected by moisture content presented in concrete. In this experimental study of 28 days the compressive strength and split tensile strength are carried out using different coir fibre length of 20mm, 25mm and 30mm respectively of different percentage as 0.5%, 0.75% and 1%. Encouragement should be given for the use of natural fibres which are locally available materials, in the field of civil engineering.

KEY WORDS: Coir Fibre, Composite Materials, Mechanical Properties, Natural Fibres

I. INTRODUCTION

The indiscriminate infrastructural growth is leading to rapid environmental degradation. Steel, cement, synthetic polymers and metal alloys used for construction activities are energy intensive as well as cause environmental pollution during their entire life cycle. We have enough natural resources and we must keep on researching on these natural resources. Development of natural fibre composite has started to begin recently. Among the various natural fibressisal fibres, bamboo fibres, coir fibres and jute fibres are of particular interest. These composites have high impact strength besides having moderate tensile and flexural properties and it can be regarded as an environment friendly material.

There has been growing interest in recent year in utilizing coir fibre as low cost building materials. Investigations are carried out on the use of coir fibre in cement paste, mortar and concrete. Incorporation of the fibre improves the ductility, flexural and tensile strengths, fracture roughness and crack inhibiting properties of the matrix. In this investigation the different size of short coir fibre is treated with natural rubber latex. The effect of fibre content, different fibre length, physical and mechanical properties of these composite have been analysed.

II. MATERIALS AND METHODS

Coir is an inexpensive fiber among the natural fibers available in the world. Furthermore, it possesses the advantages of a lignocelluloses fiber. In the present study brown coir fiber is used. The

important properties of the natural rubber and fiber are listed in the table1 and table2. In this experiment M₂₅ grade concrete is used. Concrete was made with 43 Grade cement with river sand and 20mm and down coarse aggregate. The quantity of materials used as per mix design as follows. Cement = 383 Kg/m³, fine aggregate = 571Kg/m³, coarse aggregate = 1241Kg/m³, Water = 191.6 Kg/m³, water/cement ratio = 0.45

Table1. Typical Properties of coir fibre

Colour	Brown
Fibre length, mm	10-200
Fibre diameter, mm	0.2-0.35
Bulk Density, kg/m ³	140-150
Ultimate tensile strength, N/mm ²	80-120
Modulus of elasticity, N/mm ²	18-25
Water absorption, %	30-40

Preparation of Composites

Coir pith and other undesirable materials are separated from the coir fibre. It is then chopped to about different length of 20mm, 25mm and 30mm and subjected to chemical treatments. Coir fibres are soaked in sodium hydroxide solution for 48 hours. Fibre were taken out, repeatedly washed with water and dried in the air. Latex compound is prepared by mixing 70% of natural rubber latex and 10% of sodium hydroxide solution and 20% of water. The latex compound and the resin solution were agitated to achieve homogenization. Then the coir fibre is dipped in the mixture about 15 minutes and dried.



Fig.1. Coir Fiber



Fig.2. Treatment with Latex



Fig.3. 20mm coir Fibre



Fig.4. 25mm coir Fibre



Fig.5. 30mm coir Fibre

III. CASTING OF SPECIMEN AND TESTING

Cubes that have a size of 150mm x150mm x150mm are casted with M₂₅ grade concrete as a control specimen. Then different percentage of coir fibre is added to the concrete. First 0.5% of 20mm coir fibre is added with concrete and specimens are casted. Then 0.75% and finally 1% of 20mm coir is added with concrete for making specimens. Also the

same procedure is repeated for the 25mm and 30mm fibres. After 24 hours the specimens are removed from the mould. For curing the specimens were kept in the water. After curing Compressive Strength of Concrete Specimens is tested in the 7th, 14th and 28th days using compression testing machine.



Fig.6. Testing setup

IV. RESULT AND DISCUSSION

The result shows that the addition of latex treated coir fibre increase the compressive strength up to certain level. Addition of coir fibre also arrest the micro cracks present in the concrete. Strength properties like compressive strength are shown in the following graph.

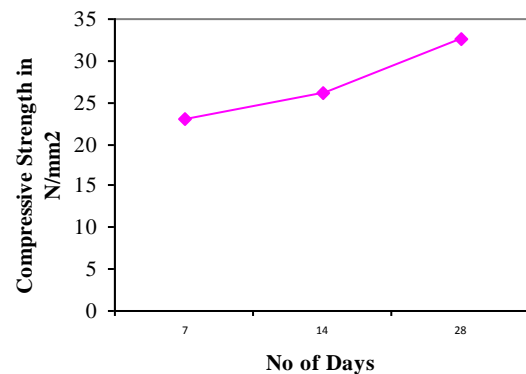


Fig. 7. Compressive Strength of Control Specimen

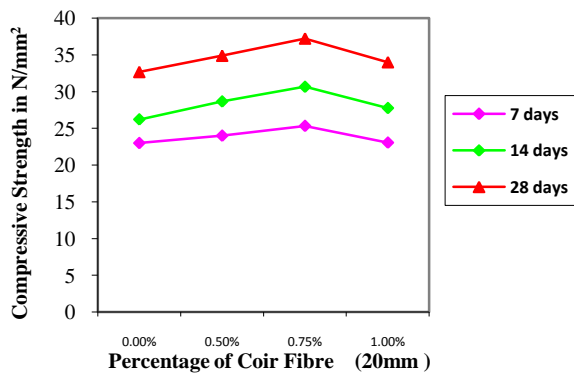


Fig. 8. Compressive Strength of Cubes using 20mm coir fibre

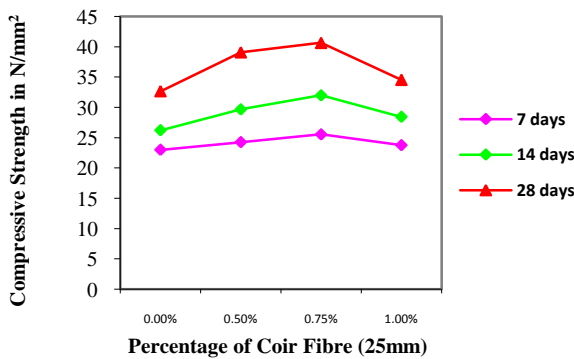


Fig. 9. Compressive Strength of Cubes using 25mm coir fibre

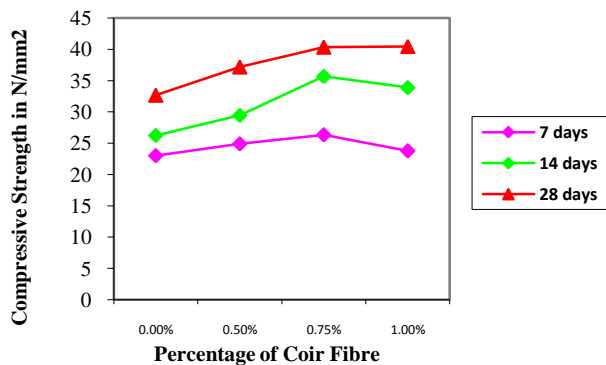


Fig. 10. Compressive Strength of Cubes using 30 mm Coir fibre

The above graphs show that the different percentage of coir fibre with different length gives different strength value. Initially the strength gradually increased up to 0.75% of coir fibre then the strength is decreased. The maximum compressive

strength is achieved using 25mm length fibre with 0.75% addition of coir fibre.

V. CONCLUSION

Using coir fibre in civil construction reduces environmental pollution factors and may also bring several improvements in concrete characteristics. Coir fibre used in cement improves the resistance of concrete from sulphate attack. Compressive strength is also improved up to certain percentage. Addition of coir fibre also arrests the micro cracks present in the concrete.

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