

Recent innovations in Natural Fibre Reinforced Concrete: A Review

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Abstract - This research work describes mainly with fibre-reinforcement i.e. with jute as a fibre reinforcing material in concrete. Usage of natural fibres in a relatively brittle cement matrix has attained significant toughness and strength of the composite. Effective modifications are to be done for such fibres to attain durability in a highly alkaline cement matrix. An explicit chemical composition has to be preferred that can transform the fibre surface as well reinforce the cement composite. This paper discusses the uses of jute fibre in concrete and the effect on properties of concrete produced, for this an effort has been made to review the work recently done in the field and to provide the platform for further research in this regards.

Key Words: jute fiber, JFRC, plain concrete, Mechanical strength, compressive strength.

1. INTRODUCTION

In general both developing and developed countries it has been a technological challenge in the field of the design of low cost and durable fiber reinforced cement concrete. The type of fiber currently been used include steel carbon polymer glass and natural fibers. Cost effective consideration have limited usage of carbon fibers in cementitious composites on a marketable level for their non ecological performance. Natural fibers have the potential to be used as reinforcement to skeptical the innate scarcities in cementitious materials.

Today, we need to control the rapid used of admixture and chemical used in concrete and use of natural fiber like jute and all other fiber reinforcement. Use of admixture they get polluted the environment and they are more costly so this type of problem to overcome by natural fiber reinforced concrete they are eco-friendly and low cost composite.

2. EARLIER INVESTGATION & SCOPE OF THE STUDY

The scope of natural fiber can be effective material to reinforce concrete strength which will not only explore a way to improve the properties of concrete. It will also explore the use of jute and restrict the utilization of polymer which is environmentally detrimental. The currently scope and research of jute fiber reinforced concrete is limited only in experiment study but these can be introduce jute fiber varying ratio of the ingredients in concrete, water cement

ratio, and length and volume of fiber to know the effect of parameter as mentioned. The large cut length and higher content of reinforcing material (jute fiber) result to the unfortunate tendency of balling formation and high porosity of composite followed by the degrading of mechanical properties of JFRC in references to plain concrete. But in the incorporation of short and low fiber content, an intact structure develops which enhances the mechanical property of the same composite. it was also noted that all the remarkable increment values were found mostly in the presences of higher content so it can be concluded that the presence of jute fiber with more cement content strengthen the concrete in greater.

3. NOTEWORTHY CONTRIBUTIONS IN THE FIELD OF JUTE FIBRE REINFORCED CONCRETE (JFRC)

Application of jute fibre in mortar and concrete is recent trend and many studies have been conducted to evaluate the performance characteristic of concrete reinforced with jute fibre. The brief literature reviews of the latest studies are as follows.

BACK STUDY ON JFRC

Soroushian and Marikunte (1992) stated that different types of fibers have been considered as part of concrete making materials natural fibers, synthetic fibers and Ferro-cementitious fibres. Peculiarities in using natural fiber reinforced concrete could be its economic benefits attributed to the ease of production with least energy, being environmentally friendly, high strength-to-weight ratio and allow insulation properties higher than current materials.

The debating issue, apart from the advantages, is that natural fibers are biodegradable imparting negative effects on the performance of concrete. This special concern of durability limits the range of applications of natural fiber-reinforced concrete to an extent dictated by engineering analysis.

Balaguru and shah (1992)- has studied that the jute fibres influence the quality of concrete and strength. Author has observed the how the aspect ratio, volume fraction and shape of jute fiber effect the strength of concrete. This studied a card out the length parameter of fiber and what are the effect of fiber length in strength and other physical property of concrete. In this study jute fiber length initially

started below range is less than 10mm. Author found that there is no significant change in property of concrete but strength increases in a significantly manner if content of jute fiber increases in these range no effect of workability and durability.

Reza et al. (2003) have shown that under compressive loading the micro cracks in the solids come under a local tension at their tips causing wide and unstable crack propagation due to the interaction between other micro-cracks. When fibers are present in such a body, this phenomenon signifies that fibers can be exploited to increase the compressive strength in a manner analogous to the tensile crack-bridging and in consequence provide a passive confining pressure.

JUTE FIBRE REINFORCED AS CONCRETE COMPOSITES

Bhupandre kumar (2005) - This Research paper discusses the comparative study between Fly ash base coconut fibre concrete by plain cement concrete of M40 grade. This research paper deals with the use of agricultural and industrialized waste material in concrete, which improved the properties of concrete and made environment green. The fly ash replaces the cement by 10, 20, and 30% and coconut fibres are added additionally by weight of cement in the proportions of 1%. The diameter of coconut fibre varies between 0.25 to 1.0 cm and length is taken as 4 cm. The outcome shows an increase in compressive strength of concrete by adding fly ash and coconut fibre together into concrete.

Baruah and Talukdar (2007) Investigated coir fibre reinforced concrete with the volume fraction 0%, 0.5%, 1.0%, 1.5%, 2.0% by the volume fraction of concrete shows compressive strength, split tensile strength, modulus of rupture, shear strength and toughness continuously increases up to 2% volume fraction of concrete.

Ali Majid (2010) has concluded in his research the versatility and applications of coconut fibres as well as jute fiber in different fields is discussed in detail under the research. Jute fibres are reported as most ductile and energy absorbent material. It is concluded that jute fibres have the possibility to be used in composite for different purposes. Jute fibre is used as reinforcement is discussed in this work. Physical and chemical properties of fibre are discussed.

Kim et al. (2012) described the effect of volume fraction on the compressive strength of jute fiber concrete. The author concluded that jute fibers do not affect the workability and the compressive strength of the jute fiber concrete improved by 40% when compared to the one without fiber.

Prof. Shriram H. Mahure (2014)[1] had studied about the fresh and hardened properties of jute fiber reinforced concrete using Fly ash as partial replacement of cement in different percentages in addition to filler. The fresh properties have been determined by computing the Slump value, V-funnel value and L-box value and the hardened properties are determined by computing the Compressive strength, Flexural strength and Split tensile strength of the specimens. It is observed that the fresh properties of concrete show an acceptable value up to 30% increase and also the hardened properties of concrete are significantly improved when compared to the conventional mix.

Vipul kumar (Aug 2015) brought out a solution for waste management problem. On adding natural jute fibre to the concrete mix the outcome is workability of fibre reinforced concrete decreases because of the water absorbing property of jute fibre. Mix design is carried out as per Indian standard 456-2000. And fiber cement ratio is taken as 0.5%, 1%, 1.5% and fiber length was taken as 5mm-10mm. Observed decrease in slump values from 0.5% to 1.5% due to the water absorption capacity of fiber.

Author found that the compressive strength of experimental cubes comes out to be higher than that of plain concrete with an average value of 46N/mm². Observed that the difference in initial setting and final setting time of mix increased with increased ratio of fiber - cement. The standard consistency or water cement ratio increases with an increase in fiber cement ratio.

Tushar R More¹, Pradip D Jadhao¹ and S M Dumne (2015) conducted an experimental study on M53 concrete. The rubber aggregates used are prepared mechanically by cutting the tyres to maximum nominal size equal to 4.75. Four different concrete mixes of same concrete grade are prepared with constant 10% silica fume replaced to cement and by partial replacement of fine aggregates of 3, 6, 9 and 12% with rubber aggregates by an equal volume of rubber aggregates to form rubberized concrete. And concrete of same grade is prepared with no replacement of fine aggregate and silica fume. Then checked the compaction factor, flexural strength, split tensile strength at 7th and 28th days for various concrete mixes. The results for workability, flexural strength, splitting tensile strength tests are conducted using M25 with 0, 3, 6, 9 and 12% replacement of rubber aggregates to natural aggregates for further discussion and interpretation. Author observed the decrease in compaction factor due to increase in percentage of rubber aggregates in all samples of concrete mix. Also found the effect of size and shape of rubber aggregate on compaction factor. During test of flexural.

Pooja Warke and Scohrinkhala Dewangan,(May 2016)

Conducted an experimental study on M20 concrete. Various tests for properties of aggregate and properties of cement carried out. Add jute fibers to the concrete mix as 0.2%,0.3%,0.4% volume of concrete. Final strength was analysed after 7 days and 28days of curing. An admixture such as Sikkament is used to improve the behavior of concrete under a variety of conditions. The addition of jute fibers increased compressive strength higher with the 0.2% fiber-cement ratio and little decreases compressive strength with 0.3% fiber-cement ratio and 0.4% fiber cement ratio of compressive strength little decreases as compared to 0.3% of fiber-cement ratio.

Rahul R. Kshatriya, Vikas L. Kumavat (2016) Conducted an experimental study on M53 concrete and compared with M40 concrete..First determine the mix proportion of M40 concrete. Jute fiber is treated with alkali, polymer mix. All the specimens were demolded after 24 h of casting and water cured for 7 days respectively. At the specified date they were removed from water, surface dried and tested. Each test result represented the mean of at least three specimens. All the specimens were demolded after 24 h of casting and water cured for 7 days respectively. At the specified date they were removed from water, surface dried and tested. Each test result represented the mean of at least three specimens. observed that when the raw jute is added in concrete by 1% weight of cement then the compressive strength of concrete cube increased by 17.5% and by adding modified jute compressive strength increase by 26.5%.observed that when the raw jute is added in concrete by 1% weight of cement then the split tensile strength of concrete cylinder increased by 7% and by adding modified jute split tensile strength increase by 6%.observed that when the raw jute is added in concrete by 1% weight of cement then the flexural strength of concrete cube increased by 1% and by adding modified jute flexural strength increase by 4%.

Amit Kumar Ahirwar (2016) experimental investigation to study the effects of replacement of cement (by volume) with different percentage of fly ash and the effects of adding of processed natural coconut fibre on flexural strength, compressive force, split tensile force and modulus of elasticity was taken up.. In this, Cement was replaced with percentages 10, 20, 30 and 40% of Class C fly ash and of coconut fibres (0.50 and 1.0 %) having 40 mm length were used. experiment outcome show that the substitute of 43 grades ordinary Portland cement with fly ash showed an increase in compressive strength and flexural strength for the preferred mix proportion. The workability of concrete

decreases with the increase in fly ash, the particle of Fly ash reduces the amount of water required to produce a given slump.

4. CONCLUSION

The literature review presents the current state of knowledge jute fibre reinforced concrete (JFRC) on the basis of previous research done in JFRC (jute fibre reinforced concrete). It can be concluded that jute fibre in concrete if used in correct proportion and manner it is likely a viable option for structural use as it has advantages that construction is greener and environment friendly. Jute fibre is an economical and eco-friendly easily available a natural fibre to enhance the concrete property.

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