



TO DEVELOP HIGH PERFORMANCE CONCRETE USING NATURAL CELLULOSE FIBER – A REVIEW PAPER

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Abstract: In building materials, natural cellulose fibers have been used to improve the strength of concrete materials. Normal concrete has relatively low tensile strength and it is normal practice to use steel bars to resist tensile forces for structural applications. The principle of using natural fibers to increase concrete's tensile, compressive and flexural strength. Flexural, compressive, and tensile strength tests have been conducted on the prepared samples by appropriate testing apparatus according to standard specifications. The current project deals with subject of addition of natural cellulose fibers to concrete in order to study the strength properties.

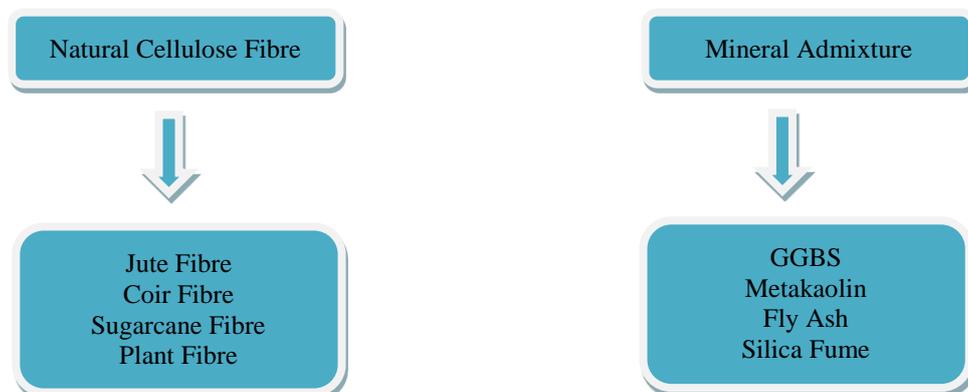
Index Terms - High Performance Concrete, Jute Fiber, Coir Fiber, GGBS, Metakaolin, Strength & Durability.

I. INTRODUCTION :

High Performance concrete is a mixture of concrete, that as compared to normal concrete, has high durability and high strength. This concrete includes one or more of cementitious materials such as ground granulated blast furnace slag, metakaolin and super plasticizer. High performance concrete works out to be economical, even though it's initial cost is greater than that of conventional concrete because the use of high performance concrete in construction increase the service life of the structure less damage which would reduce overall costs. Mostly Uses of high performance concrete has been in the construction of tunnels, long span bridge, area of pavements and high rise buildings.

Natural cellulose fiber :

The natural fibers occur in vegetable, animal, or mineral. Vegetable fibers, as the name implies, are obtained from plants. In plants, the main chemical component is cellulose, so they are often referred to as cellulosic fibers. The use of some of the best known natural fibers, such as sisal, coconut, sugarcane bagasse, plantain, jute, etc., has been primarily limited to the manufacture of textiles, ropes, mats, etc.



Mineral Admixture :

Mineral make mixtures reduce permeability, more economical, increase strength and other affected properties of concrete. Mineral admixtures are mostly remnants of some factories and are used to substitute cement to construct cheaper concrete. Waste products are used as mineral admixture in order to make maximum utilization possible. Many waste materials are available that can be used as mineral admixtures. Classified mineral admixture as: Fly ash, Silica Fume, GGBS, Metakaolin and Other Pozzolanic Materials.

II. LITERATURE REVIEW :

Improvement in impact strength of over 25% and increased ductility under static loading and considerably lower shrinkage characteristics of the order of 50% to 70% compared to those of plain concrete, are noted as positive features of vegetable fiber additions. Bonding of fiber with cementitious material is being observed. Addition of fiber reduces porosity in the cementitious matrix. Micro cracks were observed, fiber can resist the formation of crack. Strong interfacial bonding between fiber and cement matrix helps in increasing the mechanical properties of concrete.[1] When adding 0.6% coconut and 1.2% coconut with aqueous water cement ratio of 0.40. The compression strength test yields the good results. When the fiber content is increased, the tensile split strength increases at maximum of 5%. When fiber content increases after this value, a decrement in tensile stress is observed. The fiber content increases then, there is an increment in flexion strength with a maximum 5% of fiber.[2] The compressive quality, flexural quality and split rigidity of cement with coconut filaments as an admixture in bond at rates of 1.5%, 2.5%, 5.0% is seen to increment at 7 days, 28 days.[3] Reinforcement of concrete with Jute fiber percentages of 0.1%, 0.3%, and 0.5% by weight, led to an increase in the compressive strength, tensile and the flexural strength.[5]

III. EXPERIMENTAL WORK :

Compressive Strength Test :

Compressive strength is the capacity of the material or structural element to take loads without cracking or deflection on its surface.

Properly clean the mould with apply oil inside the mould and fill the concrete by 3 layer of 50mm thick with compact each layer minimum 35 strokes using temping rod which is 0.6m long and 16mm diameter of steel bar and the top surface is levelled by a smooth trowel. The concrete cubes are removed from the mould after 24 hour and are dipped in water for curing. After specified curing time(7 days, 14 days or 28 days) concrete cubes removed from water and ready for the test. The concrete cubes are placed in the compressive testing machine and the load is applied continuously without shock till the cube fails and during the test maximum load taken by cube is noted.

Split Tensile Strength Test :

The capacity of the concrete to resist pull force or tensile stress without cracking or splitting is called the concrete Tensile Strength.

300mm x 150mm size of standard cylinder was cast in a steel mould and the concrete is filled in 3 layer with compact each layer using temping rod which is 600mm long and 16mm diameter of steel bar and the top surface is levelled using smooth trowel. After 24 hour the specimen is removed from the cylindrical mould and is immersed in water for curing and is then tested after 28 day curing period. The specimen is placed horizontally between the loading surfaces of compressive testing machine using two plywood strips are being placed on the top and bottom of the specimen. The compressive load is applied continuously along the length of concrete cylinder till the concrete cylinder is split.

Flexural Strength Test :

Flexural strength of concrete is an indirectly measure of the tensile strength of concrete. It is a measure of the maximum stress of an unreinforced concrete beam or slab to resist failure at the failure point in bending.

150mm x 150mm x 700mm standard size of mould is filling by concrete in 3 layer with compact each layer using size of 400mm long & 2 kg weight of temping rod and the top surface of specimen is levelled by smooth trowel. Specimens stored in water must be tested instantly after remove from the water, when they are still wet. The bed of the testing machine will be given two steel rollers, 38 mm in breadth and these rollers will be mounted to the point that the separation from centre to centre is 60 cm. The concrete beam specimen is placed in the machine accurately cantered at the right angles of rollers with longitudinal axis of the concrete beam. The load is applied continuously till the specimen fail and maximum load taken by specimen is consider.

Acid Attack :

In nature, Ordinary Portland Cement (OPC) with pH values above 12 is strongly alkaline. This phenomenon is referred to as an acid attack when the cement paste comes into contact with the acids that break down its components.

For 28 days, concrete cube samples were immersed in water with a 5 percent HCL solution. After 28 days, cube samples were tested in a concrete testing machine and the results were evaluated as loss of strength relative to strength for 28 days of regular water treatment.

IV. RESULT AND DISCUSSION :

It can be concluded from the above study that the use of natural cellulose fibers in the concrete which is produced from the manufacture of textiles, ropes, mats, etc. The higher percentage of jute fibers in concrete forms contributes to better changes in the concrete's mechanical properties. Workability is negatively impacted by the inclusion of fiber. The addition of natural cellulose fiber greatly increases the resistance of the crack and the width of the crack is decreased. Strength and durability showed good results when fiber was applied mostly at 1 %, mechanical properties improved compared to the control mix, and durability test were also better performance in analysis.

V. REFERENCES :

- [1] Roja A. Nambiar, M.K. Haridharan, 2020. Mechanical and durability study of high performance concrete with addition of natural fiber (jute), Materials Today: Proceedings (ELSEVIER).
- [2] Habibunnisa Syed, Ruben Nerella, Sri Rama Chand Madduru, 2020. Role of coconut coir fiber in concrete, Materials Today: Proceedings (ELSEVIER), Volume 27, Part 2, Pages 1104-1110.
- [3] G. B. Ramesh Kumar, V. Kesavan, 2019. Study of structural properties evaluation on coconut fiber ash mixed concrete, Materials Today: Proceedings (ELSEVIER), Volume 22, Part 3, Pages 811-816, 321.
- [4] Mohammad S. Islam, Syed Ju Ahmed, 2018. Influence of jute fiber on concrete properties, Construction and Building Materials (ELSEVIER), Volume 189, Pages 768-776.
- [5] A. Razmi, M.M. Mirsayar, 2017. On the mixed mode I/II fracture properties of jute fiber-reinforced concrete, Construction and Building Materials (ELSEVIER), Volume 148, 1 September 2017, Pages 512-520.

