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EXPERIMENTAL STUDY ON 16M ACTIVATOR WITH COIR FIBRE REINFORCED GEOPOLYMER CONCRETE

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ABSTRACT

Considering the present atmospheric conditions, among the green house gases CO_2 is the major emitted gas which causes the Global warming, The CO_2 contributing 65% global warming. In that 65% about 7% of green house gas is emitted by the global cement industry. To with stand this global warming effect of some extent alternate binders are using to make concrete incase of Portland cement.

In this project work for the production of geopolymer concrete low calcium flyash (Class F) was used. Coir fibre is added which was treated with latex solution in this experiment. The used coir fibre are chopped of 25mm with 0, 0.8, 1.6, 2.4, 3.2 percentages. Na_2SiO_3 and NaOH are used as binding agents for the flyash activation. The blend of sodium hydroxide and sodium silicate was at a proportion of 1:2.5 was considered. The adopted binding agent to flyash ratio was 0.45. The molarity used for the experiment was 16M. the strength parameters are tested at 7, 14, 28 days under ambient curing.

Keywords: flyash (class- F), sodium silicate, sodium hydroxide, coir fibre and latex liquid.

I. INTRODUCTION

The phrase geopolymer cement was initially presented by Davidovits in the year 1978, to speak to the mineral polymers approaching about because of geochemistry. Geopolymers be shaped by the basic initiation of alumina silicates and the materials like fly powder. The utilization of fly fiery debris has consolidated potential biological advantages and much worse cost than other source. Experimental Study On Coir Fibre Reinforced Fly Ash Based Geopolymer Concrete For 16M materials Low-calcium fly slag based geopolymer real has been accounted for just before comprise the magnificent compressive quality, great corrosive conflict, and imperviousness to sulphate assault1. Geopolymer solid does not oblige any water pro framework holding, rather the soluble arrangement responds with Silicon and Aluminium here in the fly fiery remains. Davidovits work extensively demonstrates that the assortment of the geopolymer novelty could lessen the production of CO2 from the concrete commercial ventures. Geopolymers are persons from the collection of dead polymers. The unreal organization of the geopolymer substance is similar to attribute zeolitic resources until now the microstructure is indistinct. Every substance with the aim of containing the most part silicon (Si) aluminum (Al) in the indistinct structure is an imaginable basic substance for the production of geopolymer. Metkaolin or calcinedKaolin, low calcium ASTM Class F fly fiery remains, normal Al-Si minerals, combine of calcined stone

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deposits and non-calcined raw materials, a mix of fly fine particles and metakolin, combine of granulated impact fly cinder plus metakaolin encompasses be contemplated as starting place resources. Extensively recognized antacid fluid utilized as a part of geopolymerisation is a unity of sodium hydroxide or potassium hydroxide with sodium silicate otherwise potassium silicate. Low-calcium (ASTM Class F) fly grind is ideal as a foundation substance than high-calcium (ASTM Class C) fly fiery debris. The nearness of calcium in elevated arithmetic may intervene through the polymerization system and modify the micro arrangement. The nearness of fibre enhances elastic and flexural qualities of the blend, break harshness and split hindering properties of the grid. In this examination distinctive size of coir fibre is treated with common elastic latex.

II. OBJECTIVE

1. To assess the diverse strength properties of geopolymer concrete blend with fly ash and various % of coir fibre i.e, 0%, 0.8%, 1.6%, 2.4%, 3.2%.
2. To compare coir fibre geopolymer concrete with coir fibre cement concrete.

III. EXPLORATORY EXAMINATION

3.1. Materials utilized Following materials are generally used to produce Geo Polymer Concrete:

1. Low calcium elegance F fly ash
2. Coir fibre
3. Latex
4. Aggregates (a) Fine aggregates and (b) Coarse aggregates
5. Alkaline liquids (a)Sodium hydroxide solution (b)Sodium silicate solution
6. Distilled water

3.1.1. Fly Ash:

Fly slag otherwise called pulverized fuel powder. The smoldering of tougher, extra seasoned anthracite and bituminous firewood normally creates Class F fly fiery debris. This fly fiery debris is pozzolanic in the environment, in addition to surround not as much of 20% lime (CaO). Having pozzolanic properties, the smooth silica with alumina of Class F fly debris remains requires a launch specialist, for the model, Portland concrete, quick lime, or hydrated lime blended among run to take action and create cementations mixes. Then again, including a compound activator, for example, sodium silicate (water glass) to a Class F fiery remains can frame a geopolymer. For this anticipate low-calcium waterless fly slag from VTPS Thermal force plant Vijayawada was utilized as a part of understanding among ASTM C618 Class F, and the ACI team 226 statement, shown in Figure 1.

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Figure1. Flyash

3.1.2. Coir fibre

Coir is a trademark fibre separated from the bark of coconut and worn as a piece of things, for illustration, floor mats, doormats, brushes, dozing pads, et cetera. Coir is the hard-hitting stuff initiate among the durable in the interior shell and the outer cover of a coconut. Individual jobs of cocoa coir are in upholstery wadding, dismissal, and improvement. Coir is a modest fibre among the common filaments accessible in the most part of the world. Moreover, it has the benefits of a lignocelluloses fibre, shown in Figure 2.

Figure2. Coir fibre

Colour : Brown
Fibre length cm : 2.5
Fibre diameter mm : 0.2-0.35
Bulk Density, kg/m3 : 140-150

3.1.3. Latex Rubber:

Latex is the constant disseminate of polymer scaled downscale particles in a runny standard. Latex might be common or manufactured. It preserves live prepared by polymerizing a monomer, for instance, styrene to facilitate has been emulsified with surfactants. Latex, when initiated in the environment, is a soft fluid initiate in 10% of all sprouting plants. It is a perplexing suspension involving proteins, starches alkaloids, oils, sugars, tannins, caps, and gums that thicken on presentation to air. It is in the main emanate following tissue harm. In copious plants, latex is washed out, though some have pale, carroty, or ruby latex, shown in Figure 3.

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Figure3. Latex Rubber

3.1.4. Aggregates

(a) Fine aggregate:

Fine total involves ordinary sand or pulverized stone polish. For the most part, the totals having the size under 4.75mm are termed as fine aggregate. It should to be hard, tough and clean and be free from natural matter and so on. Fine aggregate should not contain any obvious measure of clay balls and harmful contaminations, for example, soluble bases, salts, coal, rotting vegetation etc. The residue substance should not exceed 4%. Normal sand is worn as a fine total. The properties of sandpaper were controlled through driving tests as per IS: 2386 (Part-1), shown in Figure 4.

Figure4. Fine aggregate

Particular Gravity: 2.6

Fineness Modulus: 2.83

Water Absorption: 0.75%

Mass Density (kg/m3): 1588

(b) Coarse aggregate:

Coarse aggregate is a general classification particulate idle materials utilized as a part of development. Hard stones are pulverized to the required size and are utilized as coarse aggregate, shown in Figure 5.

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Figure5. Coarse aggregate

The substance that is hung on as IS strainer of size 4.75 is called coarse total.

Particular Gravity : 2.78

Fineness Modulus : 7.21

Water Retention : 0.50%

Mass Density (kg/m3) : 1602

3.1.5. Alkaline liquids

The most understood alkaline liquid used because an amount of geopolymerisation is a merge of sodium hydroxide otherwise potassium hydroxide with sodium silicate otherwise potassium silicate. the unique gravity of Sodium Hydroxide (NaOH) is 1.16 and Sodium Silicate (Na2SiO3) is 1.57, shown in Figure 6.

Figure6. NaOH

Figure7.Na2SiO3

VI. METHODOLOGY

Preparation of Alkaline Activator Solution On this paper, the compressive strength, flexural plus split tensile checks of geopolymer concrete is inspected for the blends of molarity of 16M. A blend of sodium hydroxide arrangement with sodium silicate association became worn as antacid activators in favor of geopolymerisation. To arrange sodium hydroxide arrangement of 16 molarity (16 M), 640 g (16 x 40), (molarity x nuclear mass) of sodium hydroxide drops had been separated in delicate water and made up to at least one liter. The accumulation

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of NaOH strong collection in a result will vary established upon the merging of the arrangement conveyed in addition as molarity, M.

Materials utilized as a part of the present examination elegance-F fly fiery remains, coarse total, fine aggregate, sodium hydroxide association, sodium silicate association, latex elastic and coir fibre with the converting quotes of zero, 0.8, 1.6, 2.4, 3.2 are utilized as fibre fortification in support of the readiness of Geo Polymer concrete blends. A mixture of deliberate evaluation Sodium hydroxide (97%) and Sodium silicate course of motion (Na2O– 13.72%, SiO2-34.16%, and H2O-47.2%) is used as part of the present exam as the basic liquid.

Treatment of coir fibre, Coir pith and different undesirable materials are isolated from the coir fibre. it is then slashed to about diverse duration of 2.5cm and subjected to synthetic chemical treatments. Coir fibres are absorbed sodium hydroxide solution for 48 hours. Fibre was taken out, over and once more washed with water and dried major all round. Latex compound is an installation by using blending 70% of common place elastic latex and 10% of sodium hydroxide solution and 20% of water. The latex compound and the left answer were disenchanted to accomplish homogenization. At that point, the coir fibre is plunged in the mixture around 15minutes and dried. inside the laboratory, the fly powder, and the aggregates be blended dried up in a slate blender for round three motion. Later alkaline solutions and coir fibre are brought to the combination.

Instruction of Geopolymer Concrete Specimens The ready arrangement of sodium hydroxide was varied with sodium silicate arrangement one day earlier than addition the solid to obtain the looked for alkalinity within the basic activator arrangement. At first, fine totals, fly fiery debris in addition to coarse totals be waterless mixed in a level dish blender for 3 minutes. Following waterless mixing, basic activator arrangement was additional to the waterless blend, later coir fibre was added to the mix and wet mixing was an expert for 4 minutes. Completely 45 specimens (150 mm x 150 mm x 150 mm) for compressive quality, 45 specimens (150 mm separation crosswise over and 300 mm stature) for split rigidity and 45 specimens (500 mm x 100 mm x 100 mm) for flexural quality with the fluctuating coir fibre rates of 0, 0.8, 1.6, 2.4 and 3.2 were tested. criterion cast iron moulds are worn for tossing the examination examples. Previous to tossing, engine lubricate was spread happening the interior surfaces of moulds. Geopolymer cement was mixed using a level skillet blender machine and was filled the moulds in layers. Each layer of cement was compressed with a table vibrator.

Curing of Geopolymer Concrete Specimens In the wake of throwing the examples, they were reserved in moulds in favor of a rest time of one day with a short time later they were demoulded, In view of the fact that the geopolymer solid do not set rapidly at space warmth as in customary cement. The expression relax period demonstrates the instance taken from the completing of throwing of test examples to the begin of curative at a lifted warmth. Geopolymer solid examples take no less than three days for a total location with no leaving a nail sway on the cemented exterior. Each one of the examples is given a consistent relax time of one day and toward the finish of the relax time span, thirty solid shapes, thirty barrels and thirty pillars were kept under including situation for curative at room hotness.

4.1. Preparation of coir fibre cement concrete:

Concrete is made with 43 grade cement with rivers and 10 mm coarse aggregate. The quantity of materials used as per mix design as follows.

Cement=331.04kg/m^3

Fine aggregate=540kg/m^3

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Coarse aggregate=1260kg/m^3

Water=148.97kg/m^3

Water/Cement ratio=0.45

Cement and aggregates are mixed for 1 min, and water is added in small amount and mixing is done for 2 min. Now, the treated fibres are added to the mixture with the slow increment and mixing is done thoroughly. Completely 45 specimens (150 mm x 150 mm x 150 mm) for compressive quality, 45 specimens (150 mm separation crosswise over and 300 mm stature) for split rigidity and 45 specimens (500 mm x 100 mm x 100 mm) for flexural quality with the fluctuating coir fibre rates of 0, 0.8, 1.6, 2.4 and 3.2 were tested for 7days,14days,28 days curing.

V. TESTS ON GEOPOLYM+ER CONCRETE

5.1. Compressive strength

The compressive energy is the threshold of a cloth or arrangement to endure hundreds having the propensity to decrease size. it may be unique by means of scheming connected strength adjoining to twisting in a difficult device. a few substances spoil at their compressive power restrict; others entwine for all time, so a given compute of disfigurement might be specific as the utmost for the compressive burden. Compressive electricity is an input quality for delineating of shape. Compressive energy is regularly measured on an all inclusive trying out engine that volume from little desk-pinnacle frameworks to ones with greater than 53 MN limit.

5.2. Split tensile strength

Tensile trying, also recognized as stress testing is a crucial resource discipline examination in which a model be subjected near a inhibited pressure awaiting disappointment. The grades starting the examination are usually worn to choose a substance in favor of a request, on behalf of excellence control, and to foresee how a substance will respond under diverse types of services. property to facilitate are specifically precise through a tensile test are a tremendous tensile strength, furthermost persistence, and diminution in the province. Beginning these dimensions the accompanying properties be able to also be set on: Young's modulus, Poisson's ratio, yield strength, and tension harden. Uniaxial tensile trying is the mainly repeatedly used for getting the unthinking type of isotropic materials. For an isotropic material, such as combined resources with textiles, biaxial tensile test be essential.

5.3. Flexural strength

Flexural strength additionally referred to as modulus of the break, coil strength, or split energy, is a substance asset, taken into consideration as the anxiety in a cloth simply earlier than it yields in a flexure take a look at. The oblique bowing test is maximum a whole lot of the time utilized, in which a sampling having either an inside the vicinity of or rectangular pass section is perverted until crack or acquiescent with a 3 point flexural check scheme. The flexural pressure represents the principle anxiety professional in the cloth at its snippet of crack. it's far deliberate in provisos of strain, right here branded the illustration.

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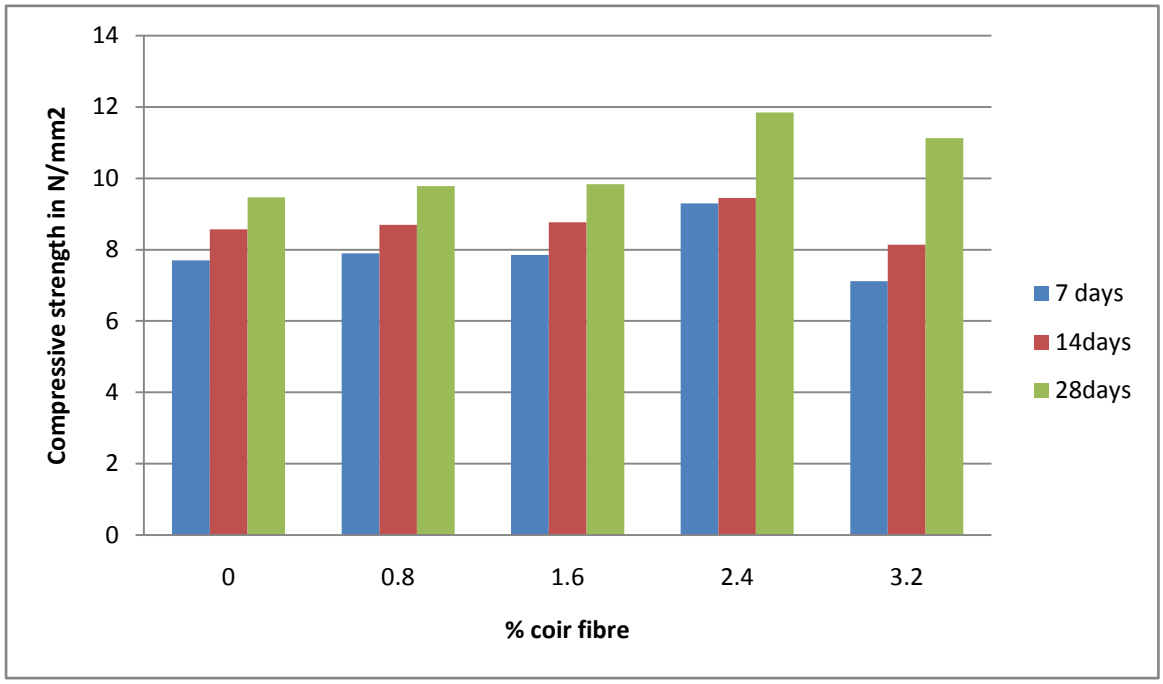
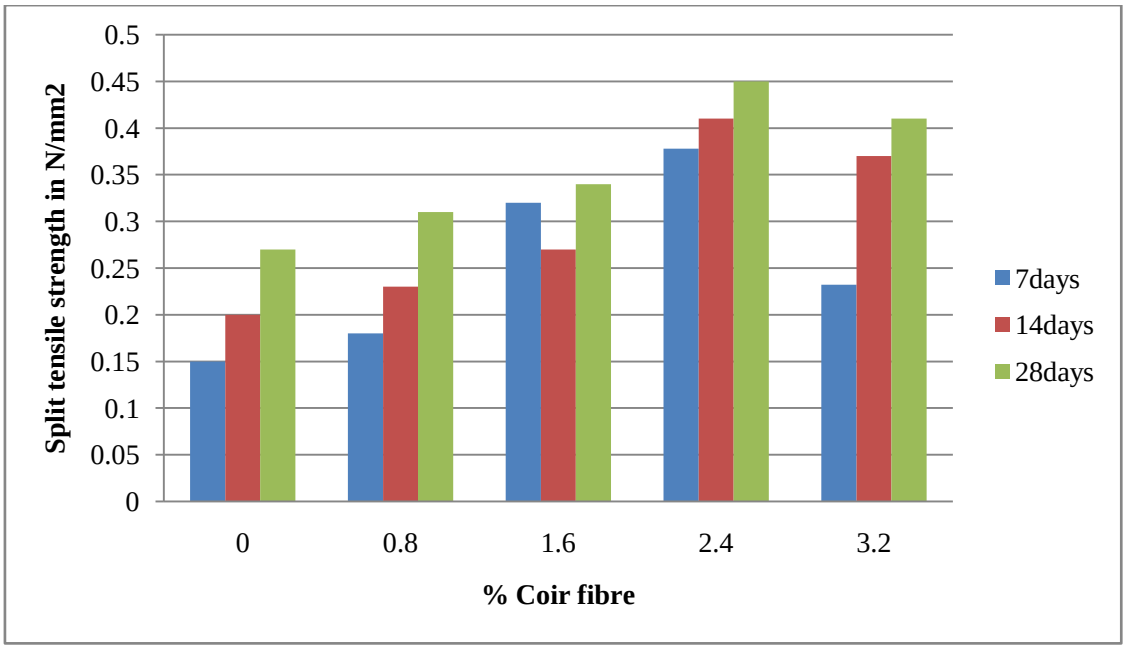
VI.RESULTS

6.1 COIR FIBRE GEOPOLYMER CONCRETE

6.1.1 COMPRESSIVE TEST:



6.1.2 SPLIT TENSILE TEST



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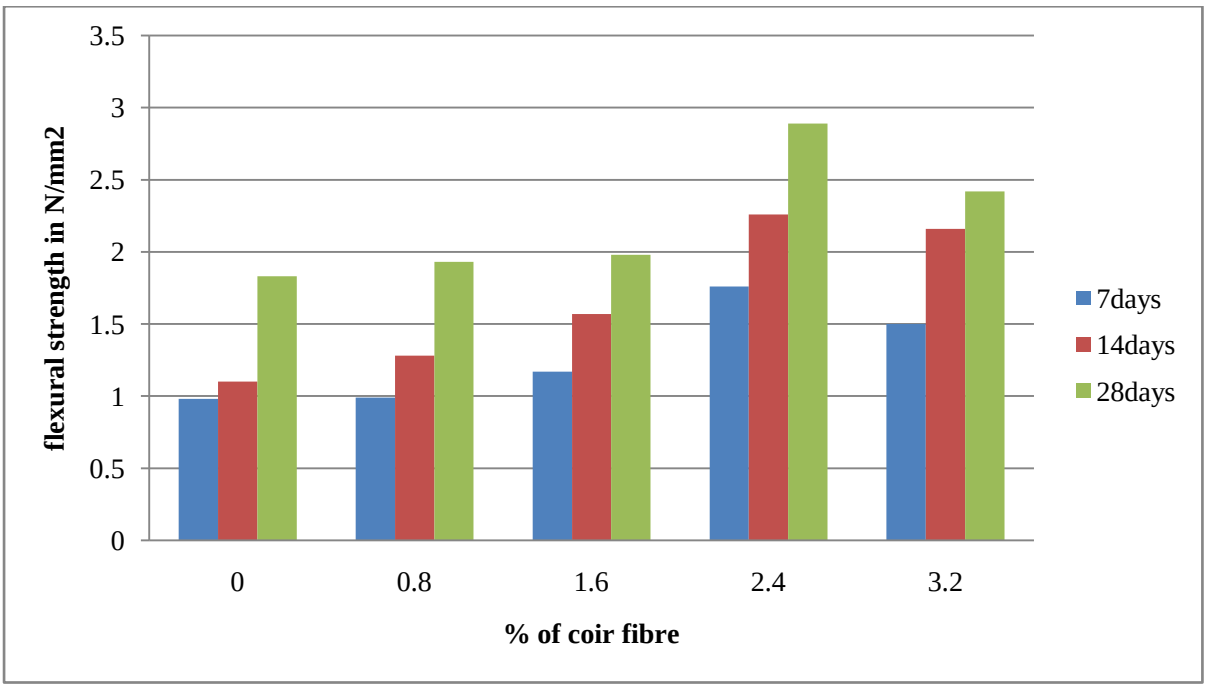
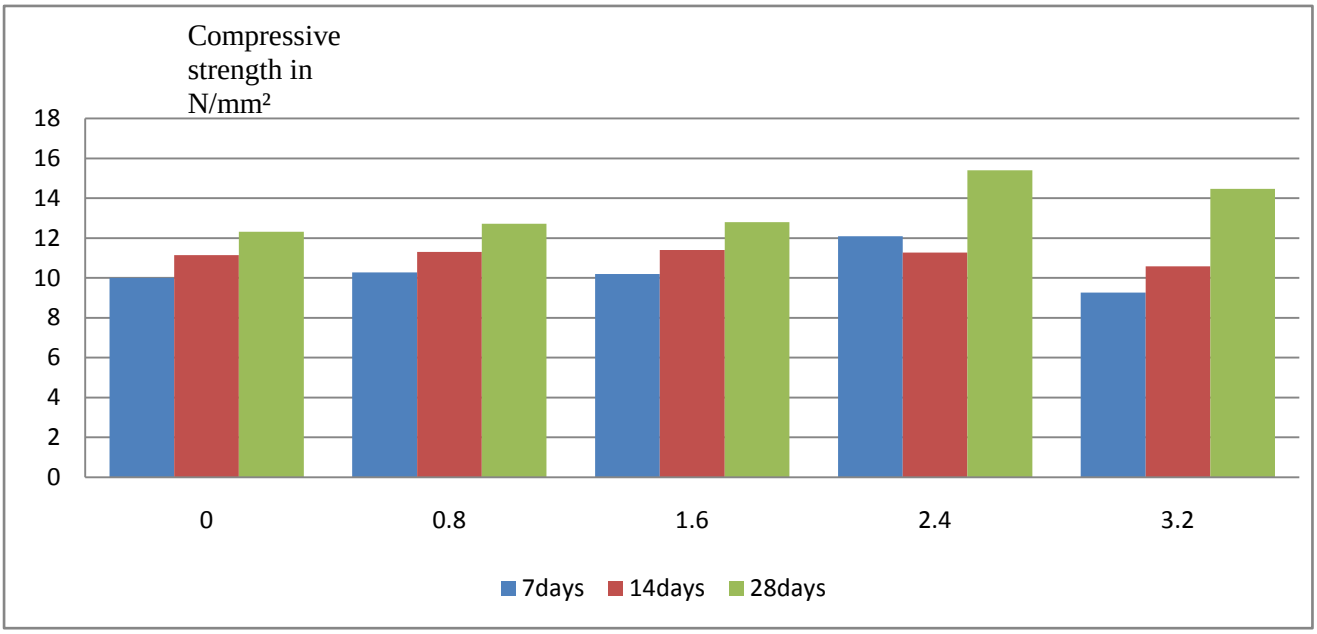
6.1.3 FLEXURAL STRENGTH TEST:



6.2 COIR FIBRE CEMENT CONCRETE

6.2.1 COMPRESSIVE TEST:



% of coir fibre

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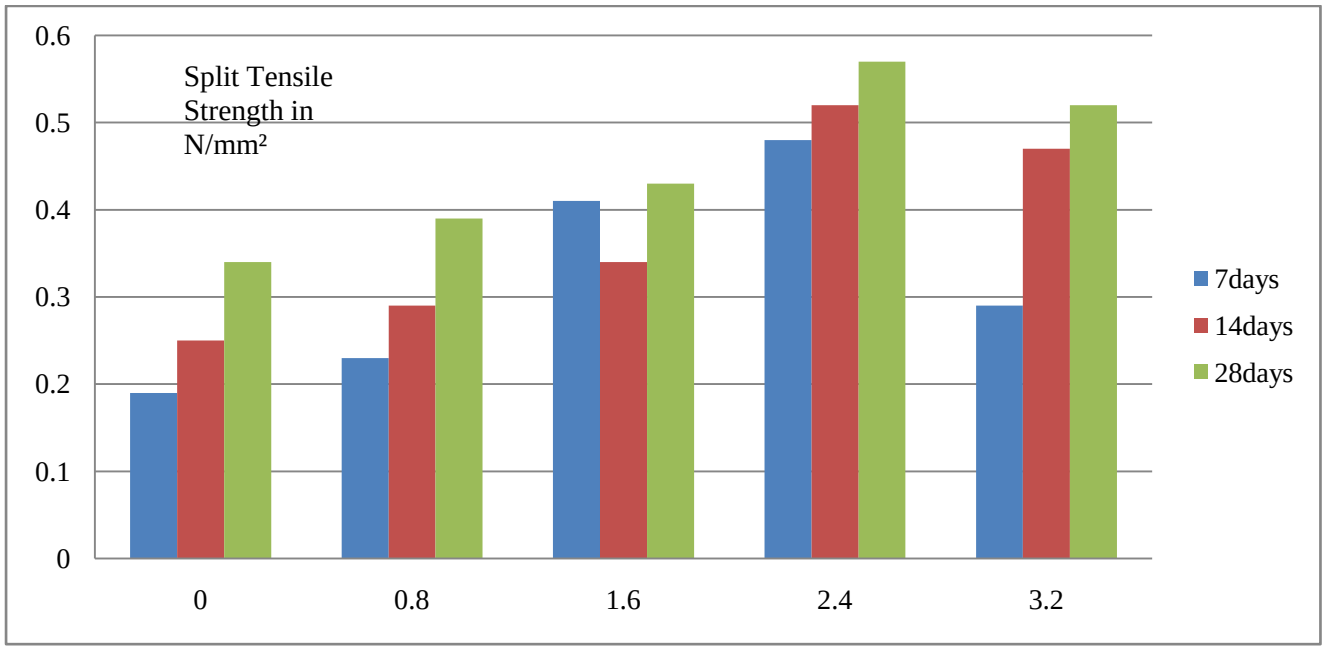
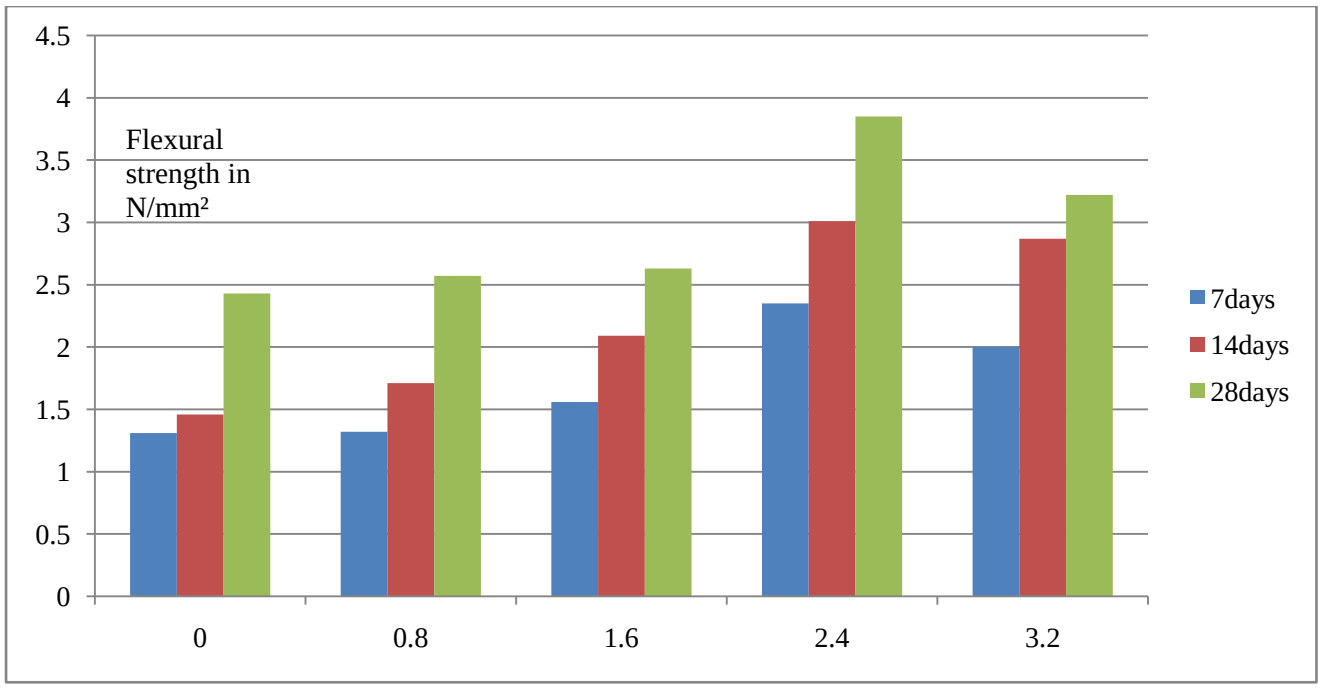
6.2.2 SPLIT TENSILE TEST:



% of coir fibre

6.2.3 FLEXURAL STRENGTH:



% of coir fibre

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CONCLUSIONS

1. The propagation micro cracks are resisted.
2. Optimum percentage of coir fibre is 2.4 in this research.
3. Increase in coir fibre percentage the strength parameters are also increase upto optimum and then strength decreases.
4. For 28 days 2.4% of coir fibre the compressive strength is 27.42% more comparing to 0% of coir fibre.
5. For 28 days 2.4% of coir fibre the split tensile strength is 66.66% more comparing to 0% of coir fibre.
6. For 28 days 2.4% of coir fibre the flexural strength is 57.92% more comparing to 0% of coir fibre.
7. For 28 days 2.4% of coir fibre, the compressive strength of coir fibre cement concrete is 29.95% more comparing to coir fibre geopolymer concrete.
8. For 28 days 2.4% of coir fibre, the split tensile strength of coir fibre cement concrete is 26.66% more comparing to coir fibre geopolymer concrete.
9. For 28 days 2.4% of coir fibre, the flexural strength of coir fibre cement concrete is 33.21% more comparing to coir fibre geopolymer concrete.

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