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EXPERIMENTAL INVESTIGATION OF PAPERCRETE WITH GLASS FIBRE AS A PARTIAL REPLACEMENT FOR FINE AGGREGATE

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ABSTRACT

Concrete has been used in various structures all over the world since last two decades. Recently a few infrastructure projects have also seen specific application of concrete. The development of concrete has brought about the essential need for additives both chemical and mineral to improve the performance of concrete. The different varieties of fibres have below tried as additions. Hence, an attempt has been made in the present investigation to study the behavior of papercrete and Glass fibres in Concrete. To attain the setout objectives of the present investigation, 20% of paprecrete and sand has been replaced with Glass fibres by 6, 8,10, 12 and 14 % to produce Concrete. However, difficulties in carrying out valid direct tensile tests have limited the research in this field. To obtain some mechanical and physical parameters of papercrete and glass fibre, several laboratory tests were performed. The experimental results of papercrete and glass fibre will provide some recommendations for using papercrete and glass fibre. The experimental investigation were carried out using detailed strength and durability related tests such as compressive strength test of cubes, split tensile strength test of cylinders and flexural strength of beam. The experimental response of the tested specimens is illustrated as the result.

Keywords: Experimental, Investigation, Papercrete, Partial Replacement, Sand With Glass Fibre.

1. INTRODUCTION

Since the large demand has been placed on building material industry especially in the last decade owing to the increasing population which causes a chronic shortage of materials, the civil engineers have been challenged to convert the wastes to useful building and construction materials. This experimental study which investigates the potential use of waste paper and glass fibre for producing a low-cost and light weight composite as a building material. Any construction activity requires several materials such as concrete, steel, brick, stone, glass, clay, mud, wood, and so on. However, the cement concrete remains the main construction material used in construction industries. For its suitability and adaptability with respect to the changing environment, the concrete must be such that it can conserve resources, protect the environment, economize and lead to proper utilization of energy. To achieve this, major emphasis must be laid on the use of wastes and byproducts in cement and concrete used for new constructions. Research on the usage of waste construction materials is very important since the materials waste is gradually increasing with the increase of population and increasing of urban development. The research was developed in association with concrete Precast companies for which the referred improved characteristics are especially appealing as the reduced weight of the precast elements is important for transportation and installation. Experimental tests were then performed on papercrete and GRC specimens to determine its mechanical strength, Young's modulus, creep and shrinkage behavior, and stress–strain diagrams. As the material characteristics were very much dependent on the production procedures, the experimental tests had to consider cementitious matrix with different plain mortar productions. These tests led to a characterization of the production conditions to obtain optimized material properties.

2. MATERIAL COLLECTION

2.1 Cement

Ordinary Portland cement, 53Grade conforming to IS: 269 – 1976.Ordinary Portland cement, 53Gradewas used for casting all the Specimens. Different types of cement have different water requirements to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength development. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strengths at early ages can be considerably influenced by the particular cement used. It is also important to ensure compatibility of the chemical and mineral admixtures with cement.

2.2 Fine Aggregate

Locally available river sand conforming to Grading zone II of IS: 383 –1970. Clean and dry river sand available locally will be used. Sand passing through IS 4.75mm Sieve will be used for casting all the specimens.

2.3 Coarse Aggregate

Locally available crushed blue granite stones conforming to graded aggregate of nominal size 12.5 mm as per IS: 383 – 1970. Crushed granite aggregate with specific gravity of 2.77 and passing through 4.75 mm sieve and will be used for casting all specimens. Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste – aggregate ratio, aggregate type has a great influence on concrete dimensional stability.

2.4 Papercrete

Papercrete is a tricky term. The name seems to imply a mix of paper and concrete, hence papercrete. But more accurately, only the Portland cement part of concrete is used in the mix-if used at all. Arguably, it could have been called "paperment" papercrete may be mixed in many ways. Different types of paperecrete contain 50-80% of waste paper. Up to now, there is no hard and fast rule, but recommended standard will undoubtedly be established in feature. The basic constituents are waste nearly any kind of paper, board, glossy magazine stock, advertising brochure, junk mail or just about any other types of "mixed grade" paper is acceptable. Some types of paper work better than other, but all types of works, newsprint are the best. Water proofed paper and card board, such as butcher paper, beer cartons etc., are hard to break down in water. Catalogs, magazines and other publication are fine in and of themselves, but some have a stringy, rubbery, sticky spine, which is also water resistance. Breaking down this kind of material in the mixing process can't be done very well. Small fragments and strings of these materials are almost always in the final mix. When using papercrete containing the unwanted material in a finish, such as stucco or plastering, the unwanted fragment some time shown up on the surface, but this is not the serious problem. Figure.2.1 shows Immersed Paper and Figure .2.2 shows Paper Pulp. Papercrete's additives can be,

- Cement

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- Quarry Dust
- Paper

Fig.2.1 Immersed Papers

FIG 2.2 Paper Pulp

2.5 Glass Fibre

Glass fibre also called fibreglass. It is material made from extremely fine fibres of glass Fibreglass is a lightweight, extremely strong, and robust material. Although strength properties are somewhat lower than carbon fibre and it is less stiff, the material is typically far less brittle, and the raw materials are much less expensive. Its bulk strength and weight properties are also very favorable when compared to metals, and it can be easily formed using molding processes. Glass is the oldest, and most familiar, performance fibre. Fibres have been manufactured from glass since the 1930s.

FIG 2.3 Glass Fibre

Types of Glass Fibre

1. **A-glass**: With regard to its composition, it is close to window glass. In the Federal Republic of Germany it is mainly used in the manufacture of process equipment.

2. **C-glass**: This kind of glass shows better resistance to chemical impact.

3. **E-glass**: This kind of glass combines the characteristics of C-glass with very good insulation to electricity.

4. **AE-glass**: Alkali resistant glass.

Generally, glass consists of quartz sand, soda, sodium sulphate, potash, feldspar and a number of refining and dying additives. The characteristics, with them the classification of the glass fibres to be made, are defined by the combination of raw materials and their proportions. Textile glass fibres mostly show a circular.

Uses of Glass Fibre or Glass Yarn

Glass fibre is manufactured in a wide range of fine diameters. Some of them are so fine that they can be seen only through a microscope. This quality of fineness contributes greatly to the flexibility of glass fibres. Various manufacturers produce different types of glass fibres for different end uses. Glass fibres them are used for various purpose.

- For making home furnishings fabrics;
- For making apparels and garments; and
- For the purpose tries and reinforced plastics.

There are certain glass fibres that can resist heat up to 7200ºC and can withstand forces having speed of 15,000 miles per hour. These types of glass fibres are used as

- Filament winding around rocket cases;
- Nose cones;

- Exhaust nozzles;
- Heat shields for aeronautical equipment;
- Fishing rods; and
- Wall paneling

2.6 Water

Casting and curing of specimens were done with the potable water that is available in the college premises.

3. MATERIAL PROPERTIY

3.1. Physical Properties of Cement

Ordinary Portland cement, 53Grade conforming to IS: 269 – 1976.Ordinary Portland cement, 53Grade was used for casting all the Specimens. Different types of cement have different water requirements to produce pastes of standard consistence. Different types of cement also will produce concrete have a different rates of strength development. The choice of brand and type of cement is the most important to produce a good quality of concrete. The type of cement affects the rate of hydration, so that the strengths at early ages can be considerably influenced by the particular cement used. It is also important to ensure compatibility of the chemical and mineral admixtures with cement.

3.1.1 Specific Gravity

The density bottle was used to determine the specific gravity of cement. The bottle was cleaned and dried. The weight of empty bottle with brass cap and washerW_1 was taken. Then bottle was filled by 200 to 400g of dry cement and weighed as W_2.The bottle was filled with kerosene and stirred thoroughly for removing the entrapped air which was weighed as W_3.It was emptied, cleaned well, filled with kerosene and weighed as W_4.

3.1.2 Fineness (By Sieve Analysis)

The fineness of cement has an important bearing on the rate of hydration and hence on the rate of gain of strength and also on the rate of evolution of heat. Finer cement offers a greater surface area for hydration and hence faster development of strength.

100 grams of cement was taken on a standard IS Sieve No.9 (90 microns). The air-set lumps in the sample were broken with fingers. The sample was continuously sieved giving circular and vertical motion for 15 minutes. The residue left on the sieve was weighed.

3.1.3 Consistency

The objective of conducting this test is to find out the amount of water to be added to the cement to get a paste of normal consistency. 500 grams of cement was taken and made into a paste with a weighed quantity of water (% by weight of cement) for the first trial. The paste was prepared in a standard manner and filled into the vicat mould plunger, 10mm diameter, 50mm long and was attached and brought down to touch the surface of the paste in the test block and quickly released allowing it to sink into the paste by its own weight. The depth of penetration of the plunger was noted. Similarly trials were conducted with higher water cement ratios till such time the plunger penetrates for a depth of 33-35mm from the top. That particular percentage of water which allows the plunger to penetrate only to a depth of 33-35mm from the top is known as the percentage of water required to produce a cement paste of standard consistency.

3.1.4 Initial Setting Time

The needle of the Vicat apparatus was lowed gently and brought in contact with the surface of the test block and quickly released. It was allowed to penetrate into the test block. In the beginning, the needle completely pierced through the test block. But after sometime when the paste starts losing its plasticity, the needle penetrated only to a depth of 33-35mm from the top. The period elapsing between the time when water is added to the cement and the time at which the needle penetrates the test block to a depth equal to 33-35mm from the top was taken as the initial setting time.

3.2 Property of Fine Aggregate

Clean and dry river sand available locally will be used. Sand passing through IS 4.75mm Sieve will be used for casting all the specimens.

3.2.1 Absorption, Porosity, and Permeability

The internal pore characteristics are very important properties of aggregates. The size, the number, and the continuity of the pores through an aggregate particle may affect the strength of the aggregate, abrasion resistance, surface texture, specific gravity, bonding capabilities, and resistance to freezing and thawing action. Absorption relates to the particle's ability to take in a liquid. Porosity is a ratio of the volume of the pores to the total volume of the particle. Permeability refers to the particle's ability to allow liquids to pass through. If the rock pores are not connected, a rock may have high porosity and low permeability.

3.2.2 Surface Texture

Surface texture is the pattern and the relative roughness or smoothness of the aggregate particle. Surface texture plays a big role in developing the bond between an aggregate particle and a cementing material. A rough surface texture gives the cementing material something to grip, producing a stronger bond, and thus creating a stronger hot mix asphalt or portland cement concrete. Surface texture also affects the workability of hot mix asphalt, the asphalt requirements of hot mix asphalt, and the water requirements of portland cement concrete. Some aggregates may initially have good surface texture, but may polish smooth later under traffic. These aggregates are unacceptable for final wearing surfaces. Limestone usually falls into this category.

3.2.3 Strength and Elasticity

Strength is a measure of the ability of an aggregate particle to stand up to pulling or crushing forces. Elasticity measures the "stretch" in a particle. High strength and elasticity are desirable in aggregate base and surface courses. These qualities minimize the rate of disintegration and maximize the stability of the compacted material. The best results for Portland cement concrete may be obtained by compromising between high and low strength, and elasticity. This permits volumetric changes to take place more uniformly throughout the concrete.

3.2.4 Hardness

The hardness of the minerals that make up the aggregate particles and the firmness with which the individual grains are cemented or interlocked control the resistance of the aggregate to abrasion and degradation. Soft aggregate particles are composed of minerals with a low degree of hardness. Weak particles have poor cementation. Neither type is acceptable. The Mohs Hardness Scale is frequently used for determination of mineral hardness.

3.3 Property of Coarse Aggregate

Crushed granite aggregate with specific gravity of 2.77 and passing through 4.75 mm sieve and will be used for casting all specimens. Several investigations concluded that maximum size of coarse aggregate should be restricted in strength of the composite. In addition to cement paste – aggregate ratio, aggregate type has a great influence on concrete dimensional stability. 20mm down size aggregate was used.

3.3.1 Specific Gravity

A pycnometer was used to find out the specific gravity of coarse aggregate. The empty dry pycnometer was weighed and taken as W_1. Then the pycnometer is filled with 2/3 of coarse aggregate and it was weighed as W_2. Then the pycnometer was filled with part of coarse aggregate and water and it weighed as W_3. The pycnometer was filled up to the top of the bottle with water and weighed it as W_4.

3.3.2 Bulk Density

Bulk density is the weight of a material in a given volume. It is expressed in Kg/m^3.A cylindrical measure of nominal diameter 250mm and height 300mm was used. The cylinder has the capacity of 1.5 liters with the thickness of 4mm. The cylindrical measure was filled about 1/3 each time with thoroughly mixed aggregate and tampered with 25 strokes. The measure was carefully struck off level using tamping rod as straight edge. The net weight of aggregate in the measure was determined. Bulk density was calculated as follows.

Bulk density = (Net weight of coarse aggregate in Kg)/ (Volume)

3.3.3 Surface Moisture

100g of coarse aggregate was taken and their weight was determined, say W_1. The sample was then kept in the oven for 24 hours. It was then taken out and the dry weight is determined, says W_2. The difference between W_1 and W_2 gives the surface moisture of the sample.

3.3.4 Water Absorption

100g of nominal coarse aggregate was taken and their weight was determined, say W_1. The sample was then immersed in water for 24 hours. It was then taken out, drained and its weight was determined, says W_2. The difference between W_1 and W_2 gives the water absorption of the sample.

3.3.5 Fineness Modulus

The sample was brought to an air-dry condition by drying at room temperature. The required quantity of the sample was taken (3Kg). Sieving was done for 10 minutes. The material retained on each sieve after shaking, represents the fraction of the aggregate coarser then the sieve considered and finer than the sieve above. The weight of aggregate retained in each sieve was measured and converted to a total sample. Fineness modulus was determined as the ratio of summation of cumulative percentage weight retained (F) to 100.

3.4 Properties of Water

Water used for mixing and curing shall be clean and free from injurious amounts of Oils, Acids, Alkalis, Salts, Sugar, Organic materials Potable water is generally considered satisfactory for mixing concrete Mixing and curing with sea water shall not be permitted. The pH value shall not be less than 6.

3.5 Properties of Paper

Paper is the main ingredient of papercrete and so its properties depend on paper's microstructure. Wood fragments are thermo metrically or mechanically treated to dissolve the lignin binder and to free the cellulose fibers. Paper is then made by pressing the pulp to remove excess water. Paper is an anisotropic material and the quality and strength of its fibers differs depending on several factors. They are, the type of wood, the percentage of recycled paper, The amount of water in the pulp, the way of pulping (chemical or mechanical) and the speed of drying. Today half of the paper fiber utilized in current production comes from recovered fibers. Yet recovered fibers are inherently less strong and moving the pulp means orienting the fibres. Table 3.1 shows the properties of dry paper.

Properties	Values
Weight	47 GSM
Thickness	0.06 mm
Moisture	7.5%
Bursting Strength	168 kPa
Tearing resistance	12.6 kg
Tensile Strength	1.13 kg
Porosity	475 mls/minute

Table 3.1 Properties of dry paper

3.6 Glass Fibre

Thermal Properties

Glass fibres are useful thermal insulators because of their high ratio of surface area to weight. However, the increased surface area makes them much more susceptible to chemical attack. By trapping air within them, blocks of glass fibre make good thermal insulation, with a thermal conductivity of the order of 0.05 W/(m·K).

Tensile properties

Fibre type	Tensile strength (MPa)	Compressive strength (MPa)	Density (g/cm^3)	Thermal Expansion (µm/m·°C)	Softening T (°C)	Price ($/kg)
E-glass	3445	1080	2.58	5.4	846	~2
S-2 glass	4890	1600	2.46	2.9	1056	~20

Table 3.2: Tensile Properties Of Fibre

The strength of glass is usually tested and reported for "virgin" or pristine fibres those that have just been manufactured. The freshest, thinnest fibres are the strongest because the thinner fibres are more ductile. The more the surface is scratched, the less the resulting tenacity. Because glass has an amorphous structure, its properties are the same along the fibre and across the fibre. Humidity is an important factor in the tensile strength. Moisture is easily adsorbed and can worsen microscopic cracks and surface defects, and lessen tenacity. In contrast to carbon fibre, glass can undergo more elongation before it breaks. There is a correlation between bending diameter of the filament and the filament diameter. The viscosity of the molten glass is very important for manufacturing success. During drawing (pulling of the glass to reduce fibre circumference), the viscosity must be relatively low. If it is too high, the fibre will break during drawing. However, if it is too low, the glass will form droplets rather than drawing out into fibre.

3.7 Fresh Concrete Properties

3.7.1 Workability

With the addition of furnace slag, the slump loss with time is directly proportional to increase in the slag content due to the introduction of large surface area in the concrete mix by its addition. Although the slump decreases, the mix remains highly cohesive.

3.7.2 Segregation and Bleeding

Furnace slag reduces bleeding significantly because the free water is consumed in wetting of the large surface area of the furnace slag and hence the free water left in the mix for bleeding also decreases. Furnace slag also blocks the pores in the fresh concrete so water within the concrete is not allowed to come to the surface.

3.8 Hardened Concrete Properties

3.8.1 Compression Test on Concrete Cubes

The determination of the compressive strength of concrete is very important because the compressive strength is the criterion of its quality. Other strength is generally prescribed in terms of compressive strength. The strength is expressed in N/mm^2. This method is applicable to the making of preliminary compression tests to ascertain the suitability of the available materials or to determine suitable mix proportions. The concrete to be tested should not have the nominal maximum size of aggregate more than 20mm test specimens are either 15cm cubes or 15cm diameter used. At least three specimens should be made available for testing. Where every cylinder is used for compressive strength results the cube strength can be calculated as under. Minimum cylinder compressive strength = 0.8 x compressive strength cube (10 cm x 10 cm) The concrete specimens are generally tested at ages 7 days and 28 days.

3.8.2 Split Tensile Test on Cylinder

Concrete is strong in compression but weak in tension. Tension stresses are likely to develop in concrete due to drying shrinkage, rusting of reinforcement, temperature gradient etc. In concrete road slab this tensile stresses are developed due to wheel loaded and volume changes in concrete are available to determine this. Split test is one of the indirect methods available to find out the tensile strength.

3.8.3 Flexural Test on Beams

It is the ability of a beam or slab to resist failure in bending. It is measured by loading un-reinforced 6x6 inch concrete beams with a span three times the depth (usually 18 in.). The flexural strength is expressed as "Modulus of Rupture" (MR) in psi. Flexural MR is about 12 to 20 percent of compressive strength

4. MIX DESIGN

4.1 Definition

Mix design is the process of selecting suitable ingredient if concrete and determines their relative proportions with the object of certain minimum strength and durability as economically as possible.

4.2 Objective Of Mix Design

- The objective of concrete mix design as follows.
- The first objective is to achieve the stipulated minimum strength.
- The second objective is to make the concrete in the most economical Manner. Cost wise all concrete's depends primarily on two factors, namely cost of material and cost of labour. Labor cost, by way of formwork, batching, mixing, transporting and curing is namely same for good concrete.

4.3 Factors To Be Considered In Mix Design

1.Grade of concrete

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2.Type of cement

3.Type & size of aggregate

4.Type of mixing & curing

5.Water /cement ratio

6.Degree of workability

7.Density of concrete

8.Air content

5. TESTING PROCEDURE

5.1 Compressive Strength Test

At the time of testing, each specimen must keep in compressive testing machine. The maximum load at the breakage of concrete block will be noted. From the noted values, the compressive strength may calculated by using below formula When a specimen of material is loaded in such a way that it extends it is said to be in tension (Figure.5.1) On the other hand if the material compresses and shortens it is said to be in compression.

Compressive Strength = Load / Area

Size of the test specimen=150mm x 150mm x 150mm

Figure 5.1 Compression Test

5.2 Split Tensile Test

The size of cylinders 300 mm length and 150 mm diameter are placed in the machine such that load is applied on the opposite side of the cubes are casted. Align carefully and load is applied, till the specimen breaks. The formula used for calculation.

Split tensile strength = 2P/ µdl

Figure.5.2 Split Tensile Test

The tensile strength is one of the basic and important properties of the concrete. The concrete is not usually expected to resist the direct tension because of its low tensile strength and brittle nature. However, the determination of tensile strength of concrete is necessary to determine the load at which the concrete members may crack. The cracking is a form of tension failure.

5.3 Flexural Strength Test

Figure 5.3 Flexural Strength Test

During the testing, the beam specimens of size 1500mmx150mmx150mm were used. Specimens were dried in open air after 7 days of curing and subjected to flexural strength test under flexural testing

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assembly. Apply the load at a rate that constantly increases the maximum stress until rupture occurs. The fracture indicates in the tension surface within the middle third of span length. The flexural strength was obtained using the formula (R) Flexural strength, also known as modulus of rupture, bend strength, or fracture strength,[a mechanical parameter for brittle material, is defined as a material's ability to resist deformation under load. The transverse bending test is most frequently employed, in which a specimen having either a circular or rectangular cross-section is bent until fracture or yielding using a three point flexural test technique. The flexural strength represents the highest stress experienced within the material at its moment of rupture. The flexural strength would be the same as the tensile strength if the material were homogeneous. In fact, most materials have small or large defects in them which act to concentrate the stresses locally, effectively causing a localized weakness. When a material is bent only the extreme fibres are at the largest stress so, if those fibres are free from defects, the flexural strength will be controlled by the strength of those intact 'fibres'. However, if the same material was subjected to only tensile forces then all the fibres in the material are at the same stress and failure will initiate when the weakest fibre reaches its limiting tensile stress. Therefore it is common for flexural strengths to be higher than tensile strengths for the same material. Conversely, a homogeneous material with defects only on its surfaces (e.g., due to scratches) might have a higher tensile strength than flexural strength. If we don't take into account defects of any kind, it is clear that the material will fail under a bending force which is smaller than the corresponding tensile force. Figure 5.3 shows Flexural Strength Test

6. TEST RESULT

6.1 For M25 Grade Concrete (20% replacement with papercrete)

RATIO –I

Glass Fibre – 6% by replacement of Sand

RATIO - II

Glass Fibre – 8% by replacement of Sand

RATIO – III:

Glass Fibre – 10% by replacement of Sand
RATIO - IV

Glass Fibre – 12% by replacement of Sand

RATIO – V

Glass Fibre – 14% by replacement of Sand

Above all ingredients are added by weight of San Table 6.1 shown Compressive Test on Cube, Table 6.2 shown Split Tensile Strength of Cylinder and Table 6.3 shown Flexural Strength of Beam.

Figure.6.1 shows Compression Test Graph Result,Figure.6.2 shows Split Tensile Test Graph Result and Figure.6.3 shows Flexural Strength Graph Result.

S.NO	DAYS	COMPRESSIVE STRENGTH (N/mm^2)	
		Conventional Concrete	Papercrete with Glass Fibre
1	7	8.36	12.42
2	14	19.24	22.98
3	28	23.75	25.02

Table 6.1 Compressive Strength of Cube

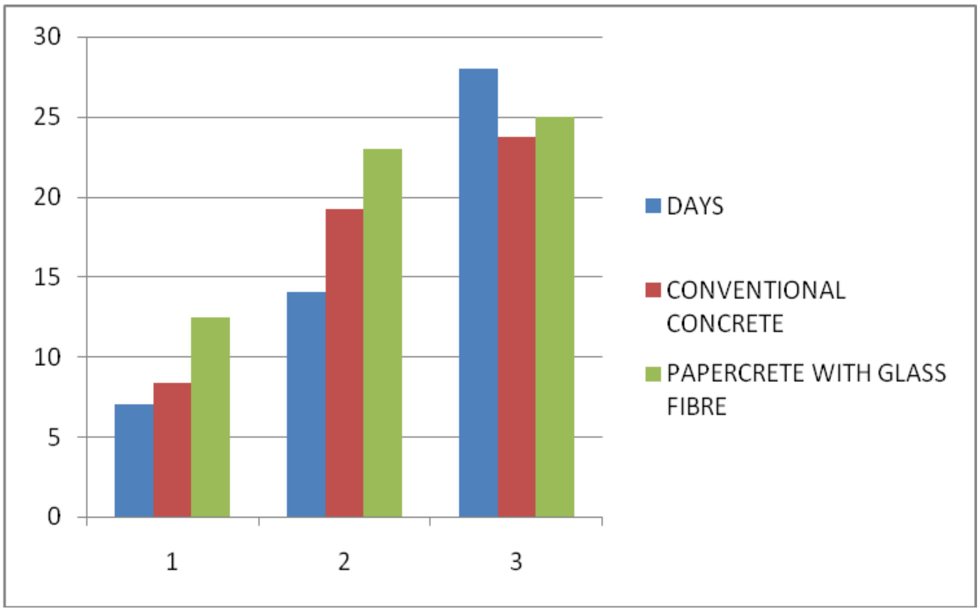

Figure 6.1 Compression Test Graph Result

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S.NO	DAYS	SPLIT TENSILE STRENGTH (N/mm^2)	
		Conventional Concrete	Papercrete with Glass Fibre
1	7	2.00	2.98
2	14	2.56	3.44
3	28	3.25	4.55

Table 6.2 Split Tensile Strength of Cylinder

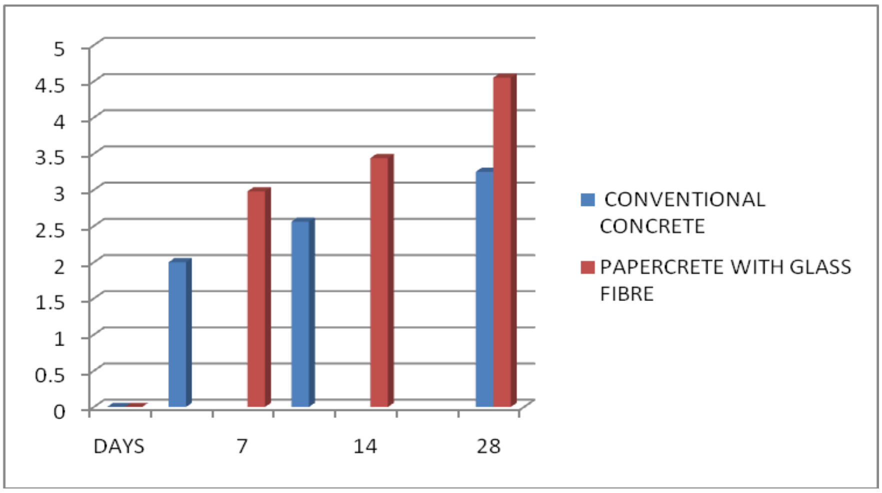

Figure 6.2 Split Tensile Test Graph Result

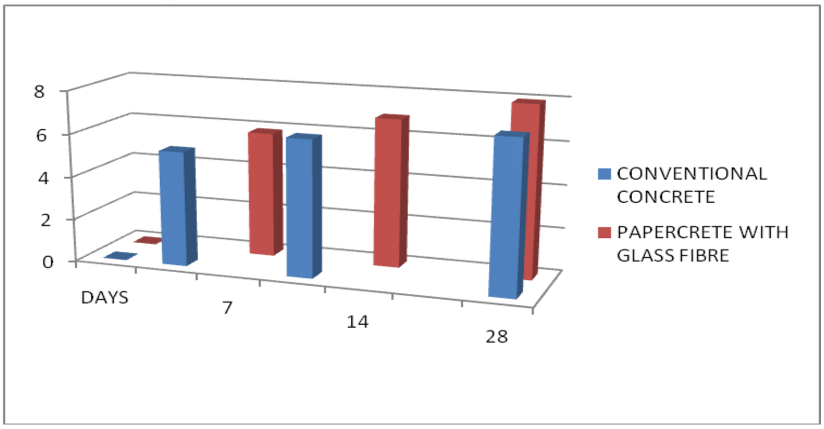

Figure.7.3 Flexural Test Graph Result

S.NO	DAYS	FLEXURAL STRENGTH (N/mm^2)	
		Conventional Concrete	Papercrete with Glass Fibre
1	7	5.35	5.85
2	14	6.35	6.90
3	28	7.04	7.94

Table 6.3 Flexural Strength of Beam

CONCLUSION

The conclusions drawn from these experimental investigations are as follows. The Strength of concrete containing papercrete of 20% and Glass fibre of 12% was high, when compared with that of the conventional mix. Fine aggregate replacement level of 12 percent Glass fibre with coarse aggregate replacement level of 20 percent papercrete in concrete mixes was found to be the optimum level to obtain higher value of the strength and durability at the age of 7 days.

A considerable improvement in the flexural strength was seen at 20% replacement of papercrete and 12% of glass fibre used in concrete. Due to less weight of these concrete, the total dead load of the building will be reduced. The present work is concerned with the tensile behavior of Papercrete with GFRC specimens with 28 days of age. The following conclusions can be summarized: - Fracture energy of cement based materials is significantly increased by adding glass fibre to the mix composition. The tensile strength is largely determined by the fibre orientation which depends on the mixing method. A tensile strength of about 4.55 MPa is found when a spray up technique is used for the PGFRC.

REFERENCES

[1]. T.Subramani, G.Shanmugam (2015), “Experimental Investigaton of Papercrete and Recycled Aggregate as a Coarse Aggregate”, Volume 4, Issue 5, May 2015, pp 323-332.
[2]. T.Subramani, A.Mumtaj (2015), “Experimental Investigation of Partial Replacement of Sand with Glass Fibre”, Volume 4, Issue 5, May 2015, pp 254-263.
[3]. Malhotra V.M., Mehta, P.K. (1996), “Pozzolanic and Cementitious Materials, Advances In Concrete Technology”, Gordon And Breach, London.
[4]. P. Kumar Mehta Editor, Concrete Technology For Sustainable Development In The Twenty First Century, Proceedings Of The International Symposium, Hyderabad, Feb. 9-11, 1999.
[5]. Subramani.T, Udhaya Kumar.K, “Damping Of Composite Material Structures with Riveted Joints”, International Journal of Modern Engineering Research, Volume. 4, Issue. 6 (Version 2), pp 1 – 5, 2014,
[6]. Subramani.T, Reni Kuruvilla, Jayalakshmi.J, “Nonlinear Analysis Of Reinforced Concrete Column With Fiber Reinforced Polymer Bars" International Journal of Engineering Research and Applications Volume. 4, Issue. 6 (Version 5), pp 306- 316, 2014.

[7]. Subramani.T, Sakthi Kumar.D, Badrinarayanan.S "Fem Modelling And Analysis Of Reinforced Concrete Section With Light Weight Blocks Infill " International Journal of Engineering Research and Applications, Volume. 4, Issue. 6 (Version 6), pp 142 - 149, 2014.