# EXPERIMENTAL STUDY ON FIBER IN REINFORCED CEMENT CONCRETE BY USING PARTIALLY RECYCLED COURSE AGGREGATE

[1]Mrs. M SRI KAVYA, [2]BANDI MADHURI, [3]DARSHANAM RISHIKA, [4]CH ASHOK, [5]MUKKERA DIVAKAR

[1]Assistant Professor, DEPARTMENT OF CIVIL ENGINEERING CMR COLLEGE OF ENGINEERING & TECHNOLOGY

[2,3,4,5] B-Tech, DEPARTMENT OF CIVIL ENGINEERING CMR COLLEGE OF ENGINEERING & TECHNOLOGY

**Abstract:**

All of us know that the normal concrete possess very low tensile strength, limited ductility and little resistance to cracking. So this paper focuses towards the experimental investigation of the mechanical properties of plastic fiber reinforced concrete with conventional concrete. Fibers while delivered in certain percentage in the concrete improves the property as crack resistance, ductility, flexural strength and durability. So for enhancing the durability of the structure we are using plastic fiber. Plastic fibers are resistant to most chemical & it would be cementitious matrix which would deteriorate first under aggressive chemical attack. Plastic fibers being hydrophobic can be easily mixed as they do not need lengthy contact during mixing and only need to be evenly distressed in the mix. For this experimental work we are using four percentages of fiber and four aspect ratios were adopted to conduct the tests in wet stage and in hardened stage. The aspect ratios used were 30, 50, 70 and 90 and the various volume fractions of fibers adopted were 1, 2, 3 and 4. M25 grade of concrete was designed as per IS10262-2019 code of practice which was adopted for all experimentation. The use of Recycled Concrete Aggregate (RCA) is gaining importance throughout the globe due to the depleting sources of natural aggregate and disposal problem of demolished waste. Also, it is well established that the fibers make concrete ductile. Workability was tested by slump, compaction factor and Vee-Bee tests. With several tests conducted to check workability, strength and durability, it is concluded that the waste plastic Fibers can be used as an ingredient of concrete. The compressive, split tensile and flexural strengths are affected positively up to 0.5% of fibers. If the structure has to resist impact and shear loads, higher percentage of fibers can be adopted. Permeability characteristics are also found to have improved with 0.5% of fibers. KEYWORDS : Plastic Fibers, Conventional Concrete, Recycled Coarse Aggregate , Workability.

**INTRODUCTION:** GENERAL

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 building materials, the civil engineers have been challenged to convert the industrial wastes to useful building and construction materials. This experimental study which investigates the potential use of waste plastic fibre for producing a low-cost and light weight composite as a building material. These alternatives were made with plastic fiber. 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.

FIG:-1

The utilization of recycled aggregate is particularly very promising as 75 per cent of concrete is made of aggregates. The use of recycled aggregates from construction and demolition wastes is showing prospective application in construction as alternative to primary (natural) aggregates. 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 reasons that many investigations and analysis had been made on recycled aggregate are because recycled aggregate is easy to obtain and the cost is cheaper than virgin aggregate.

**OBJECTIVES OF THE PROJECT:**

The specific objectives of the current investigations are as follows.

- To conduct a comprehensive feasibility study on producing waste plastic fiber reinforced concrete (WPFRC) using fibers .

- To conduct slump, compaction factor and Vee-Bee tests to study the workability characteristics of waste plastic fiber reinforced concrete (WPFRC) for all percentage of fibers and aspect ratios

- To conduct compression, split tensile, flexural, shear and impact strength tests on waste plastic fiber reinforced concrete for all percentage of fibers and aspect ratios to study the mechanical properties of concrete when waste plastic fibers are included in concrete.

**RESEARCH MATERIALS:**

The materials used in this experiment were locally available . In this research work we are going to conduct different test on the materials to be used. After casting of the concrete we will also perform different test on the specimen. As we are going to make M25 grade concrete so for this we have to make mix design. So before making mix design we need to perform different testson the materials we will be using.

**Cement:**

Cement is one of the most popular building material. It is used as a binder in the construction industry. It has both

adhesion and cohesion properties. It can bind particles into a compact durable solid mass. The most common type of cement are used as a component in the production of mortar in masonry and concrete, which is a combination of cement and an aggregate to form a strong building material.

FIG:-2

In this test cement Grade M53 OPC is used. When water is added to it paste is formed which hardens with time. This cement grade is used for focused works such as pre stressed concrete 17 In this test cement Grade M53 OPC is used. When water is added to it paste is formed which hardens with time. This cement grade is used for focused works such as pre stressed concrete components, precast items such as paving block, building blocks, etc., runways, concrete roads, bridges, and other RCC works where the grade of concrete is M25 and above.

The cement chemical composition is listed in the table below

| | |
|---|---|
| Silica-($SiO_2$) | 17% to 25% |
| Alumina-($Al_2O_3$) | 3% to 8% |
| Iron Oxide-($Fe_2O_3$) | 0.5% to 6% |
| Lime-(CaO) | 60% to 67% |
| Magnesia-(MgO) | 1% to 3% |
| Sulphur Trioxide-($SO_3$) | 1% to 3% |
| Miscellaneous | 1% |

**Compressive Strength Test**

Compressive strength is the ability of material or structure to carry the loads on its surface without any crack or deflection. A material under compression tends to reduce the size, while in tension, size elongates.

AIM : To determine the Compressive Strength Test of Specimen

REFERENCE STANDARDS:

IS 516-1959 – Methods of tests for strength of concrete

EQUIPMENT & APPARATUS:

- Standard Compression testing machine
- Cube mould of standard size 15 cm x 15 cm x 15 cm
- Balance(0-10kg)

**PROCEDURE:**

1.Place the prepared concrete mix in the steel cube mould for casting.

2.Once it sets, After 24 hours remove the concrete cube from the mould.

3.Keep the test specimens submerged underwater for stipulated time.

4.As mentioned the specimen must be kept in water for 7 or 14 or 28 days and for every 7 days the water is changed. Ensure that concrete specimen must be well dried before placing it on the Digital Compressive Test Machine.

5.Weight of samples is noted in order to proceed with testing and it must not be less than 8.1Kg.

6.Testing specimens are placed in the space between bearing surfaces.

7.Care must be taken to prevent the existence of any loose material or grit on the metal plates of machine or specimen block.

8.The concrete cubes are placed on bearing plate and aligned properly with the center of thrust in the testing machine plates. ¬ The loading must be applied axially on specimen without any shock and increased at the rate of 140kg/sq cm/min. till the specimen collapse.

9.Due to the constant application of load, the specimen starts cracking at a point & final breakdown of the specimen must be noted.

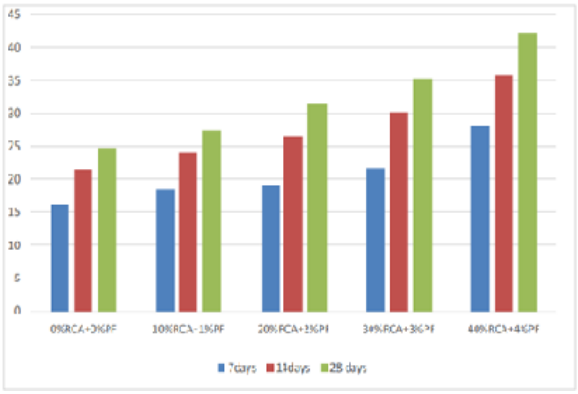
Compressive Strength = Load / Area Size of the test specimen

FIG:-3

**RESULTS:**

The main objective of this research is to compare the mechanical properties of conventional concrete with fiber reinforced concrete. So for that we need to perform the compressive, tensile and flexural strength test on the cube, cylinder and beam respectively. So before that we need to perform the test on the materials that will be used in the casting of the cubes, beams and cylinders.

| MIX | SPECIFICATION | COMPRESSIVE STRENGTH ($N/mm^2$) | | |
|---|---|---|---|---|
| | | 7days | 14days | 28days |
| M1 | 0%RCA+0%PLASTIC FIBER | 16.2 | 21.5 | 24.8 |
| M2 | 10%RCA+1%PLASTIC FIBER | 18.3 | 24 | 27.4 |
| M3 | 20%RCA+2%PLASTIC FIBER | 19.2 | 26.6 | 31.2 |
| M4 | 30%RCA+3%PLASTIC FIBER | 21.8 | 30.2 | 35.23 |
| M5 | 40%RCA+4%PLASTIC FIBER | 28.01 | 35.8 | 40.1 |




GEAPH:-1

**CONCLUSION:**

(i) With the increase in recycled coarse aggregate content, the compressive strength is decreasing.

(ii) The behavior of experimental concrete under slump and compaction factor tests shows that workability is reduced in PFRC. It was due to resistance offered by the fibers to the movement of aggregates

(iii) As the percentage of fiber increasing the strength of concrete is increasing.

(iv) Replacement Level Of 40% Recycled Aggregate in concrete mixes was found to be the optimum level to obtain higher value of the strength at the age of 28 days.

(v) The workability of concrete is increased upon increase in addition of plastic fibres.

(vi) We got higher values of strength at 40% replacement for both compressive strength and spilt tensile strength.

**REFERENCES** :

[1] T.Subramani, S.Krishnan, S.K.Ganesan, G.Nagarajan. ”Investigation of Mechanical Properties in Polyester and Phenyl-ester Composites Reinforced With Chicken Feather Fiber” International Journal of Engineering Research and Applications Vol. 4, Issue 12(Version 4), pp.93-104, 2014.

[2] J.Jayalakshmi , " Analytical Investigation Of Bonded Glass Fibre Reinforced Polymer Sheets With Reinforced Concrete Beam Using Ansys" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 105-112 , 2015 [3] D.Latha , " Experimental Study On Recycled Industrial Waste Used In Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 113-122 , 2015

[4] V.Angappan , " Experimental Investigation Of Papercrete Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 134-143 , 2015

[5] T.Subramani, V.K.Pugal , " Experimental Study On Plastic Waste As A Coarse Aggregate For Structural Concrete" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp.144-152 2015

[6]B.Suresh , " Experimental Investigation Of Using Ceramic Waste As A Coarse Aggregate Making A Light Weight Concrete " , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 153-162 , 2015

[7] T.Subramani, M.Prabhakaran , " Experimental Study On Bagasse Ash In Concrete" , International Journal of 68 Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 163-172 , 2015

[8] A.Mumtaj , " Experimental Investigation Of Partial Replacement Of Sand With Glass Fibre" , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 254-263 , 2015

[9] T.Subramani, S.B.Sankar Ram Experimental Study on Concrete Using Cement With Glass Powder, IOSR Journal of Engineering,Volume 5 , Issue 5, Version 3, pp43-53, 2015 [10]T.Subramani, S.Kumaran , " Experimental Investigation Of Using Concrete Waste And Brick Waste As A Coarse Aggregate " , International Journal of Application or Innovation in Engineering & Management (IJAIEM) , Volume 4, Issue 5, pp. 294-303 , 2015

[10] Merugu, S., Tiwari, A., Sharma, S.K., "Spatial Spectral Image Classification with Edge Preserving Method", Journal of the Indian Society of Remote Sensing, 2021, Vol. 49-Issue 3, PP-703-711.

[11] Nair, D.V., Murty, M.S.R., "Fault tolerant-based virtual actuator design for wide-area damping control in power system", Electrical Engineering, 2021, Vol. 103-Issue 1, PP-463-477.

[12] Debnath, S., Talukdar, F.A., Islam, M., "Combination of contrast enhanced fuzzy c-means (CEFCM) clustering and pixel based voxel mapping technique (PBVMT) for three dimensional brain tumour detection", Journal of Ambient Intelligence and Humanized Computing, 2021, Vol. 12-Issue 2, PP-2421-2433.

[13] Karuppusamy, L., Ravi, J., Dabbu, M., Lakshmanan, S., "Chronological salp swarm algorithm based deep belief network for intrusion detection in cloud using fuzzy entropy", International Journal of Numerical Modelling: Electronic Networks, Devices and Fields, 2021, Vol. Issue, PP.

[14] Nayak, S.C., Nayak, S.K., Panda, S.K., "Assessing compressive strength of concrete with extreme learning machine", Journal of Soft Computing in Civil Engineering, 2021, Vol. 5-Issue 2, PP-68-85.