International Seminar On Non-Conventional Energy Sources for Sustainable Development of Rural Areas,
IJAERD- International Journal of Advance Engineering & Research Development
e-ISSN: 2348-4470, p-ISSN:2348-6406
Impact Factor: 4.72, DOI:10.21090/ijaerd

"USE OF COCONUT FIBRE IN FIBRE REINFORCED CONCRETE"

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ABSTRACT:- *The various researches have done to reduce brittleness and yield energy absorption properties of concrete and it is found that by using fibres in concrete mix, the brittleness properties of concrete can be reduce and it limits the yield absorptions of concrete. Brittleness property in concrete should be avoided when there is most chances of earthquake in certain areas and hence it is required to use fibre reinforced concrete in that areas. There are various types of fibres such as steel fibre, plastic fibre, nylon fibre, carbon fibres etc. And we used coconut fibre also known as coir fibre. Coconut fibre is a waste material which can be utilized as fibre in fibre reinforced concrete, if we used it the waste material also get reduce. Coconut fibre is easily available from rope industries and temples as waste materials.*

The concrete mix was prepared by using M20 grade of concrete as per IS 456:2000. In this project, several tests are done on coarse aggregates and fine aggregates such as flackiness index test, elongation test and sieve analysis. Tests for fresh concrete and hardened concrete such as slump test for workability calculation, compression test and tensile strength test.

Keywords- *Coconut fibre, Concrete.*

1. INTRODUCTION

1.1 GENERAL

The fibre reinforced concrete is defined as the concrete in which the fibres are used in adequate amount. The applications, development and limitations are derived as follows.

1.2 APPLICATIONS OF FIBRE

The objective of addition of fibres in concrete is to reduce the tensile cracking of composite material. Fibres binds the particles of concrete materials in such a way that the concrete specimens does not break suddenly. In heavy loads greater than ultimate bearing capacity, the concrete can suddenly breaks due to its brittleness property but if fibres are used then there is just crack will form and there would be time for action. This crack resisting property of fibres delays the initiation of flexural and shears cracking. It has extensive post cracking behaviour and enhances the ductility and the energy absorption property of the composite. Fibre-reinforced concrete can be used in many structures like pavements, houses, higher floors of buildings etc.

1.3 LIMITATIONS OF COCONUT FIBRE

Fibres are used in the concrete mix , will reduce cracking and control shrinkage effectively. These materials have great properties of strength and energy absorption capacity. Generally, the fibre reinforcement is not used as replacement over the steel reinforcement. The fibres have some good properties over the steel reinforcement but steel reinforcement have also great property like bearing tension and shear in structure. So both steel and fibres can be used in same concrete for utilising the properties of both. However, fibres are not effective in withstanding the tensile stresses with compared to steel reinforcements. But, fibres are used as more closely spaced than steel reinforcements and binds the particles more deeply, which are good for controlling crack and shrinkage. Hence fibres can be used for controlling cracks and steel can be used for load bearing. The steel fibres have disadvantage of corrosion if using in concrete. The other type of fibre like synthetic fibre is costly and would be uneconomical for ordinary people.

2. METHODOLOGY

2.1 GENERAL

A concrete mix was designed to achieve the minimum grade of M20 (by taking 1:1.5:3 as nominal mix) as required by IS 456 – 2000. The investigation was done by taking 3%, 5%, and 7 % (by the weight of cement) of coconut fibre in the concrete mix. Coconut fibres were obtained from local market. Minimum of two test specimen were taken for each analysis.

2.2 CONCRETE

Concrete is prepared by mixing cement, sand, aggregates and water with proper amount of coconut fibre (3 to 5 % by weight of cement).

Component of concrete:

1. *Cement (60%)*
2. *Coconut fibre (2 to 5 % by weight of concrete mix)*
3. *Sand*
4. *Coarse aggregate*
5. *Water (30%)*

2.3 MATERIAL TESTS:

Tests on coarse aggregates –

1. *Sieve analysis*
2. *Flakiness index test*
3. *Elongation test*

2.4 MIX DESIGN OF COCONUT FIBRE REINFORCED CONCRETE :-

Mix design is defined as the process of selecting suitable ingredients of concrete and determining their relative proportions with the object of producing concrete of certain minimum strength and durability as economically as possible. A Mix design was conducted to arrive at M 20 mix concrete.
The main purpose of proportioning of concrete ingredients is to get strong, dense and durable concrete with fibres.

2.5 MIXING OF CONCRETE

The coarse aggregate and fine aggregate were weighed and the concrete mixture was prepared by hand mixing on a water tight platform. On the water tight platform cement and fine aggregates are mixed thoroughly until a uniform colour is obtained, to this mixture coarse aggregate was added and mixed thoroughly.

Fig2.1:- mixing of cement and aggregates

Then water is added carefully making sure no water is lost during mixing. While adding water care should be taken to add it in stages so as to prevent bleeding which may affect the strength formation of concrete rising of water required for hydration to the surface. After thoroughly mixing the coconut fibres are added in appropriate proportions.

Fig2.2:- mixed with coconut fibre

Clean and oiled mould for each category was then placed on the vibrating table respectively and filled in three layers. Vibrations were stopped as soon as the cement slurry appeared on the top surface of the mould.

2.6 CASTING AND CURING

These concrete specimens were allowed to remain in steel mould for 24 hours to be hardened. After that these specimens were removed from moulds with carefully so that no edges were broken and then placed in the water tank for curing at the ambient temperature. This specimens were allowed to be in water for 7 days and 28 days so that hydration reactions may occur and strength can increase.

Fig2.3:- Curing in tank

2.7 TESTING OF SPECIMEN

Slump test

Slump test is the method of determining of workability of concrete. This method is generally used in field as well as in laboratory. The slump test is easy to use. The slump test gives the value of slump and there is no any direct relation between the workability and slump value. The apparatus required for conducting the slump test essentially consists of a metallic mould in the form of frustum of a cone having the internal dimensions of bottom diameter 200 mm, top diameter 100 mm and a height of 300 mm.

Apparatus and Test Procedure of Slump Test

The following apparatus and equipments were used.

1. *Mould*
2. *Rod*
3. *Base plate*
4. *Scoop*
5. *Ruler*

Grade of concrete	***Slump value***
M20(1:1.5:3)	*25mm*

2.8 TESTS ON HARDENED CONCRETE

Compressive strength test

Compressive strength is the property of a material or structure to withstand axial loads tending to reduce the size. The compressive strength is measured by using the Universal Testing machine. The concrete cube can be made to have high compressive strength, e.g. many concrete structures have compressive strengths in excess of 55 MPa. Here the compressive strength of concrete cubes for fibre reinforced concrete are found out using Compression testing machine. Three cubes were cast for each percentage of fibres and the average of the two compressive strength values was taken.

FIBRE USED IN %	*COMPRESSIVE STRENGTH (Mpa) IN 7 DAYS*	*COMPRESSIVE STRENGTH (Mpa) IN 28 DAYS*
3%	*5.2*	*5.8*
5%	*3.8*	*4.5*
7%	*1.9*	*3.6*

3. CONCLUSION

Coconut fibre is available in adequate amount, which makes it quite viable as a reinforcement material in concrete. The coconut fibres are also used by rope industry , hence for coconut fibre producer there will be more benefit for him if the fibres are used in concrete making .

The objectives of this work were:

1. *To find out variation in compressive, tensile and flexural strengths of CFRC but only compressive strength test was carried out.*
2. *To determine the influence of shape and size of fibres on strength of concrete This project was limited to rural residential constructions.*

The major conclusions from this study are

1. *At 3% addition of coconut fibre with a water cement ratio of 0.48, compressive strength tests yielded best results. However, the compressive strength decreased with increase in further amount of fibres in concrete.*

2. *Coconut fibres being low in density reduces the overall weight of the fibre reinforced concrete thus it can be used as a structural light weight concrete.*
3. *By reinforcing the concrete with coconut fibres which are freely available, we can reduce the environmental waste.*
4. *Since, 5% & 7 % fibres do not show favourable results, it can be concluded that fibre content should not be used beyond 3%*
5. *The workability of concrete with coconut fibres was found to be very less. Thus, certain admixtures such as air entraining agents and super plasticizers can be used so as to improve the workability.*
6. *Hand mixing becomes very tedious and leads to formation of a non homogeneous mix.*

3.1 LIMITATIONS OF THE PROJECT

The limitations of this project are:
1) This study on coconut fibre reinforced concrete is limited to rural residential Constructions.
2) The mix design is for M20 concrete and further investigation on coconut fibre reinforced concrete is necessary.

3.2 FUTURE SCOPE

The effects of coconut fibres on high strength concrete should be studied and thus the use of CFRC can be extended to industrial and commercial buildings. Since the coconut fibre degradation inside the concrete study is not done, the applicability of CFRC in reinforced constructions should be studied.
Coconut fibre is a good thermal insulator in itself and as such it can improve the thermal properties of concrete. This is useful in a tropical countries like India where the temperature are high in most duration of years in different places.. The coconut fibre reinforced concrete can be used in buildings of such areas where the earthquake are occurs in greater extents.
The coconut fibres are mostly available in all parts of country hence its by products can be utilize as coconut fibre. Using of coconut fiber is said to be making of waste materials as a useful ingredient in concrete..

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