Using Marakh as Natural Fiber in Fiber Reinforced Concrete

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Abstract— This paper presents the experimental investigation carried on using Marakh (scientifically known as leptedenia pyrotechnica and found in region of Rajasthan) in Natural Fiber Reinforced Concrete subjected to flexural strength and compressive strength with different proportion of fiber content(with reference to cement content) and aspect ratio of fiber.

Key words: Marakh, flexural strength, Fiber Reinforced Concrete

I. INTRODUCTION

Regular concrete is a brittle material which possesses a high compressive strength but on the other side has a low tensile strength. The combined use of regular concrete and steel reinforcing bars was able to overcome that disadvantage leading to a material with good compressive and tensile strengths but also with a long post-crack deformation (strain softening). Unfortunately reinforced concrete has a high permeability that allows water and other aggressive elements to enter, leading to carbonation and chloride ion attack resulting in corrosion problems. Steel rebar corrosion is in fact the main reason for infrastructure deterioration. On the other hand, reinforced steel is a high cost material, has high energy consumption and comes from non-renewable resource. Natural fibers are a renewable resource and are available almost all over the world. Therefore to promote the use of concrete reinforced with vegetable fibers could be a way to improve concrete durability and also sustainable construction. This chapter deals with the subject of natural fiber reinforced concrete. It includes fiber characteristics, properties and the description of the treatments that improve their performance; it covers the compatibility between the fibers and the cement matrix and also how their presence influences cement properties. It also includes the properties and durability performance of concrete reinforced with natural fibers.

II. LITERATURE REVIEW

Gjorv mentioned a study of Norway OPC bridges indicating that 25 % of those built after 1970 presented corrosion problems. Another author mentioned that 40% of the 600.000 bridges in the U.S. were affected by corrosion problems being estimated in 50 billion dollars the cost of the repairing operations Since world population is expected to grow more 2000 million until the year 2030, much more reinforced concrete structures will be built and much more deterioration problems are expected to take place. Concrete durability is environmental related. Because if we were able to increase the life time of a concrete from 50 to 500 years, its environmental impact decreases 10 times.On the other hand, reinforced steel is a high cost material, has high energy consumption and comes from non-renewable resource. Natural fibers are a renewable resource and are available almost all over the world.

III. METHODOLOGY

Firstly mix design of concrete was done of M25 grade as per BIS . Then as per cement content 3 different proportion of fibre content and 3 aspect ratio, 9 different type of concrete is made and also plain concrete. For compressive strength 30 cubes of 150mm * 150mm *150mm and for flexural strength , specimen of 100mm * 100mm * 500mm and 30 number of beam is being casted. For each test of concrete type and strength and 3 specimens were casted. Tensile strength of Marakh Fiber is 80 MPa and is alkali treated in 2% NaOH for 4 hrs.

1) Compressive strength of cubes were tested. Compressive strength of plain concrete was 27 MPa concrete with different proportion of fiber content (with reference to cement) and aspect ratio of fiber are as follow

Fiber% content	Aspect Ratio	Compressive Strength (MPa)
0.50	75	27.2
0.50	100	29.3
0.50	125	30.0
0.75	75	30.4
0.75	100	30.7
0.75	125	31.0
1.00	75	32.4
1.00	100	33.6
1.00	125	33.0

Table 1: Compressive strength of different mix proportion of natural fiber reinforced concrete

2) Ultrasonic pulse velocity test was conducted and found that quality of concrete was good.

Fiber% content	Aspect Ratio	Pulse velocity (m/s)	Quality of concrete
0.50	75	4047	Good
0.50	100	4153	Good
0.50	125	4215	Good
0.75	75	4016	Good
0.75	100	4225	Good
0.75	125	4115	Good
1.00	75	4123	Good
1.00	100	4211	Good
1.00	125	4302	Good

Table 2: Checking of quality of concrete using ultrasonic pulse velocity

3) Flexural Strength of beam of size 100mm * 100mm * 500mm is tested. Plain concrete has flexural strength 3.9 MPa. Flexural Strength of different of concrete of other proportion are as follow

Fiber% content	Aspect Ratio	Flexural Strength(MPa)
0.50	75	4.9

0.50	100	5.4
0.50	125	5.6
0.75	75	6.0
0.75	100	6.2
0.75	125	5.9
1.00	75	5.6
1.00	100	5.7
1.00	125	5.8

IV. CONCLUSION

It has been observed that adding natural fibre named Marakh in concrete enhances the compressive and flexural strength . With aspect ratio 100 and fibre content 1%, compressive strength of concrete is increased by 24.4 % and with aspect ratio 100 and fiber content 0.75% , flexural strength of concrete is increased by 58%.

V. FUTURE SCOPE

Further investigations about natural reinforced concrete are needed in order to clarify several aspects that current knowledge does not. The available literature data is mostly related to the mechanical behaviour of natural fibre reinforced concrete. For instance only recently has the delaying effect of fibre inclusion received the proper attention. Since the main reason for fibre degradation relates to alkaline degradation, much more research is needed about the chemical interactions between the cement matrix and the natural fibers. The right treatments to improve fiber and cement matrix compatibility are still to be found. The same could be said about the variation on fiber properties thus control quality methods are needed in order to ensure minimal variations on the properties of natural fibers. Durability related issues also deserve more research efforts.

VI. REFERENCES

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