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Full Length Research Article

Fiber Reinforced Pervious Concrete by using Banana Fiber

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ABSTRACT

Pervious concrete is a composite material consisting of coarse aggregate, Portland cement and water. Now days the different sustainable and eco-friendly construction techniques are being used in pavement. The pervious concrete pavement is one of the types of pavement which capture surface infiltration in a void network allows it to pass into soil. The strength and permeability characteristics of pervious pavement using various percentage of banana fibre with have been investigated. Compressive strength has been increase with the addition of banana fibre up to optimum limit. Banana fibres are added to optimum mix by 0.1%, 0.2%, 0.3%, and 0.4% of weight. Hence pervious concrete of 1:3 cement: aggregate ratio with 0.2% banana fibre has been found to be performed well under static load condition with improved compressive strength without much sacrificing permeability. The solid waste management has also been achieved up to certain limit.

Introduction

Now a day's infrastructure development across the world created demand for construction material. Concrete is the premier civil engineering construction material, concrete contains ingredients like cement, aggregates, water and admixtures. At present, huge quantities of constructions materials are required in developing countries due to continued infrastructural growth and also huge quantities of agricultural waste of banana crop are generated every in our country almost all 13.5 million tons per annual. The banana waste decomposition is a very serious problem for the farmers because one side it goes as agriculture waste and other side it pollutes environment. Banana forming generates more quantity of biomass which goes as waste. This waste material can help to increase the strength of concrete.

Natural fibers present important advantages such as low density, appropriate stiffness and mechanical properties and high disposability and renewability. There has been lot of research on use of natural fibers in reinforcement. Banana fiber, a lingo- cellulosic fiber, obtain from the pseudo-stem of banana plant (Musa sepientum), is a best fiber with relatively good mechanical properties. The "pseudo-stem" is a clustered, cylindrical aggregation of leaf stalk bases. Banana fiber at present is a waste product of banana cultivation and either not properly utilized or partially done so. The extraction of fiber from the pseudo stem is not a common practice and much of the stem is not used for production of fibers. This is reflected from the relativity expansive price of banana fiber when compared to other natural fiber. The buyers for banana fiber are erratic and there is no systematic way to extract the fibers regularly. Useful applications of such fibers would regularize the demand which would be reflected in a fall of the prices.

This research paper was aimed to increase the strength of the pervious concrete and increase the permeability and using of locally available material as fiber.

Literature review

Nalini Thakre, Hirendra Rajput, Jaya Saxena, Harish Mitangale (2014):
Presented a paper on "comparative study on strength and permeability of pervious concrete by using nylon and polypropylene fibre. The fibres are used in various proportions i.e., 0.1%, 0.15%, 0.2% etc. of volume of concrete. Also the paper says about types of fibres help to increase the properties of pervious concrete. The fibres are glass fibres, natural fibres like flax, hemp, kenaf, jute, banana and coir, synthetic fibres like nylon, polypropylene, carbon, polyester etc. Natural reinforcing materials can be obtained at low cost and low levels of energy using local manpower and technology. The test result also indicated that the compressed strength of nylon and polypropylene fibre up-to 0.2% of used result get increased. And the permeability of fibre mixed pervious concrete is increased as comparison to the plain pervious concrete.

Hussam A.A Rahman (2012):
Conducted a test on "some properties of fibre reinforced no fine concrete". The paper focuses on studying the mechanical characteristics of polypropylene and carbon fiber reinforced no fine aggregate concrete containing a different

percentage of fibre. Tests to determine workability, density, compressive strength, split tensile strength and modulus of rupture were carried out. It was found that pervious concrete mixes with fibres have higher density than normal pervious concrete mixes containing polypropylene and carbon. The test results also indicated that the inclusion of fibre to the pervious concrete mixes increases compressive strength, split tensile strength and modulus of rupture.

Dhawal Desai (2010):
Studied the "effects of material properties on porosity of pervious concrete." This paper describes the effect of size of aggregates and proportion of cement, aggregate and water on porosity of pervious concrete. Different sample blocks were made in lab with variations in mixture to see the porosity for final conclusion. The samples in which aggregates above 20 mm were used were not porous from the base because of larger voids, the cement slurry settles down. Also in all those cubes in which compaction was done, the cement slurry settles down and thus made a flat bottom surface. So finally the conclusion was to use aggregate in the range of 9.5 mm - l9 mm and to reduce compaction while filling to =yield

Methodology
Step1:
Collection of coarse aggregate from beedupalli, puttaparthi, Andhra Pradesh.

Step2:
Concrete is mixed with the ratios of 1:4 (cement: coarse aggregate). Banana fiber is added 2% of total weight of concrete. Concrete is placed in the moulds using a trowel.
The moulds dimensions are 150mm*150mm*150mm. The trowel is moved around the top edge is discharged in order to ensure a symmetrical distribution of the concrete and to minimize segregation of coarse aggregate.

Table 1. Compressive strength for RFCby using banana fibre:

% of fiber added	Number of days	Compressive strength (N/mm2)
0%	28	64
0.5%	28	64.9
1%	28	66
1.5%	28	67.5
2%	28	69

Step3:
Compaction is the removal of air from the fresh concrete.
It increases the density of concrete and also the density of the concrete. Concrete is placed in the moulds approximately equal to three layers of volume. Each layer is compacted with 25 strokes with the rounded end of rod.

Step 4:
Final step is curing which covers the concrete with a layer of water, so it stays moist. By keeping the concrete moist the bond between the paste and aggregate gets stronger. The specimens are removed from the moulds after 24 hours casting, specimens are placed in the water immediately for curing. Finally specimens are tested for 3 days, 7 days, 21 days, and 28 days. Then results were prepared in the below.

Results
We have casted cubes of 150×150x150mm and the water cement ratio used is 0.45. The workability is determined by using slump test and compacting factor test. The given slump in all mix are true slump and the compacting factor value is within the range between 0.8 to 0.9. So the concrete are highly workable.

Conclusion
Results have been analyzed taking into consideration the strength characteristics of concrete Reinforced with the banana fibre of M30 grade.
1. The experimental tests revealed that the strength properties of concrete improved with the addition of banana fibres to the concrete.
2. The addition of banana fibres considerably increased the strength characteristics of concrete, mainly compressive strength and tensile strength.
3. The cracking resistance of the concrete has also improved to a greater extent.
4. When compared to normal concrete, the compressive strength of banana fibre reinforced concrete of M30 grade has improved.
5. The compressive strength of concrete has increased gradually up to 4% addition of banana fibre and has shown gradual decrement in the compressive strength beyond that percentage.

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