Improvement for Compressive Strength of Composite of concrete with different material by analytical and FEA method

Sonul D. Bodhane[1]and Swapnil M. Choudhry [2]

[1]M-TECH Mechanical Engineering (CAD/CAM), Wainganga College of Engineering& Management,Nagpur[2]Asst.ProfessorMechanical Engineering (CAD/CAM) Depat. Wainganga College of Engineering& Management, Nagpur

Abstract -**There are some resources like natural fiber like human hair, coconut fiber are destroyed as a waste material. But after knowing better sides of these fibers, they are getting a proper attention over the years. With the aim of utilizing abundant waste material, a human hair, coconut fiber and polypropylene composite has been developed using it as reinforcing constituent and cement as matrix constituents. This paper presents testing of this material combination with concrete and uses these properties of human hair, coconut fiber and polypropylene fiber reinforced combine with cement, it forms composite. Composites with various compositions of human hair, coconut fiber and polypropylene were fabricated. The fabricated specimen composed of various % of human hair, coconut fiber and polypropylene fibers in cement concrete is tested for properties improvement and came out as an eye opener. The best result we achieved with Composite 2 which is having 0.25% human hair which testes experimentally and virtually as well. So in this paper, analytical approach is made for getting exact solution for the composite and compare with the results obtained from FEA method. And holds the value 31.5 MPa as compressive strength by experiment and analysis by ANSYS software is 29.96 MPa.**

Keywords—**Concrete, Human Hair, coconut fiber, polypropylene, Creo-parametric2.0, ANSYS.**

INTRODUCTION

Due to increase in population, natural resources are being exploited substantially as an alternative to synthetic materials. Due to this, the utilization of natural fibres for the reinforcement of the composites has received increasing attention. Natural fibres have many remarkable advantages over synthetic fibres. Nowadays, various types of natural fibres have been investigated for use in composites including flax, hemp, jute straw, wood, rice husk, wheat, barley, oats, rye, cane (sugar and bamboo), sisal, coir, water hyacinth, pennywort, kapok, paper mulberry, banana fibre, pineapple leaf fibre and papyrus. Natural fibres are largely divided into three categories depending on their origin: Mineral based, Plant based, and Animal based. In general, a mineral based composite is asbestos and is only a naturally occurring mineral fibre. The main properties of asbestos fibres are their thermal, electrical, and sound insulation; inflammability; matrix reinforcement (cement, plastic, and resins), adsorption capacity, wearand friction properties (friction materials), brake linings and chemical inertness (except in acids).

1.1 THE SCOPE FOR REINFORCEMENT OF CONVENTIONAL MATERIALS

The composite matrix is required to fulfil several functions, most of which are vital to the performance of the material. Bundles of fibres are, in themselves, of little value to an engineer, and it is only the presence of a matrix or binder that enables us to make use of them. The rôles of the matrix in fibre-reinforced and particulate composites are quite different. The binder for a particulate aggregate simply serves to retain the composite mass in a solid form, but the matrix in a fibre composite performs a variety of other functions which must be appreciated if we are to understand the true composite action which determines the mechanical behaviour of a reinforced material. We shall therefore consider these functions in some detail. Functions of the matrix • the matrix binds the fibres together, holding them aligned in the important stressed directions. Loads applied to the composite are then transferred into the fibres, the principal load-bearing component, through the matrix, enabling the composite to withstand compression, flexural and shear forces as well as tensile loads.

STRUCTURAL ANALYSIS USING ANSYS 14.0

Finite element modeling (FEM) and finite element analysis (FEA) are used today in several fields of engineering and technology. Finite element analysis is one of the powerful techniques for not only design but also for manufacturing applications. Therefore, FEA has an important role in CIM. This chapter gives a brief account of the technique and surveys some applications of this technique. A few examples from design and a brief review of applications to manufacturing simulation are given in this chapter. Traditional approach to design analysis involves the application of classical or analytical techniques. This approach has the following limitations:

i. Stresses and strains are obtained only at macro level. This may result in inappropriate deployment of materials. Micro level information is necessary to optimally allocate material to heavily stressed parts.
ii. Adequate information will not be available on critically stressed parts of the components.
iii. It may be necessary to make several simplifications and assumptions to design complex components and systems, if design analysis is carried out in the conventional manner.
iv. Manual design is time consuming and prone to errors.
v. Design optimization is tedious and time consuming.

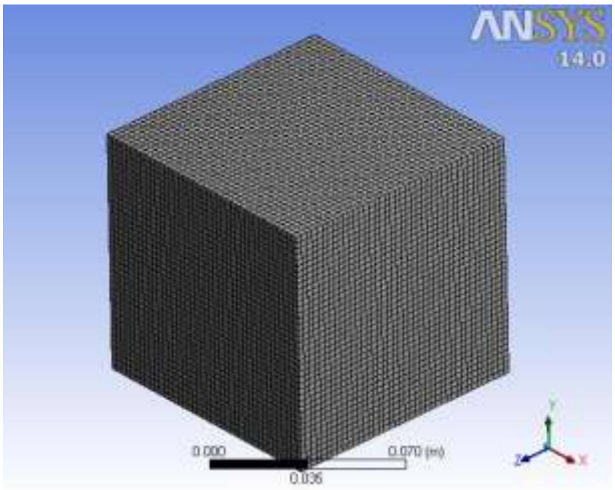

Fig: 3.1 Meshing

Table 3.1 Loading Condition

Object Name	*Fixed Support*	*Force*
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	1 Face	
Definition		
Type	Fixed Support	Force
Suppressed	No	
Define By		Vector
Magnitude		30000 N (ramped)
Direction		Defined

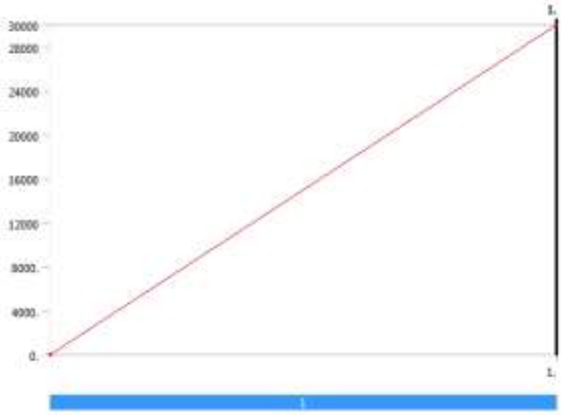

Fig: 3.2 Graph for loading

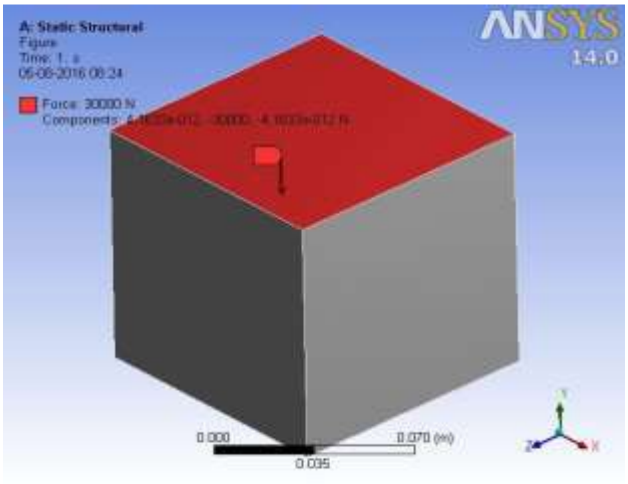

Fig: 3.3 Boundary Condition

3. ANALYTICAL APPOACH

1. FOR CONCRETE ONLY

= P/A
=285000/10000
=28.5Mpa

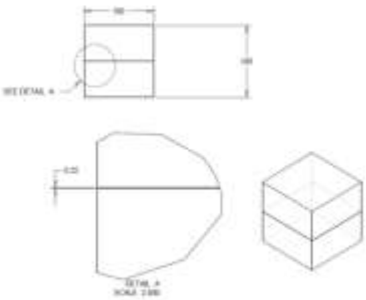

Fig: 2.1 detailing of cube having 0.25% of other material

2. FOR CONCRETE AND PROTEIN

= P/A
=74812.5/4987.5
=15Mpa
= P/A
=37.5/25
=1.5 Mpa
= P/A
=74812.5/4987.5
=15Mpa

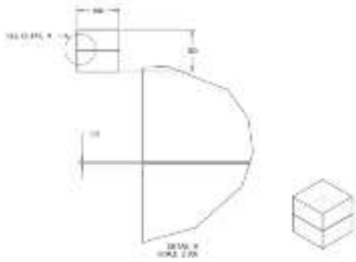

Fig: 2.2 detailing of cube having 0.5% of other material

For concrete and protein
= P/A

=54725/4975
=11Mpa
= P/A
=576/240
=2.4 Mpa
= P/A
=54725/4975
=11Mpa

3. FOR CONCRETE AND POLYPROPYLENE

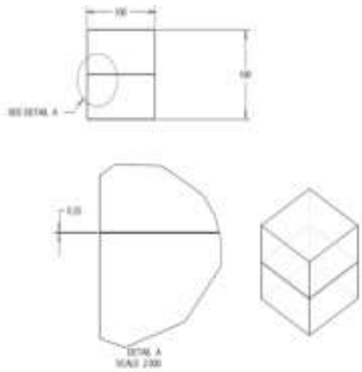

Fig:2.1 Detailing of cube having 0.25% of other material

For concrete and protein
= P/A
=22443.75/4987.5
=4.5Mpa
= P/A
=37.5/25
=1.5 Mpa
= P/A
=22443.75/4987.5
=15Mpa

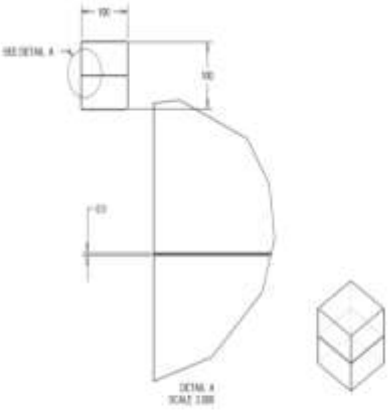

Fig:2.2 Detailing of cube having 0.5% of other material

For concrete and protein
= P/A
=59700/4975
=12Mpa
= P/A
=150/50
=3 Mpa
= P/A
=59700/4975
=12Mpa

4. FOR CONCRETE AND COCONUT FIBRE

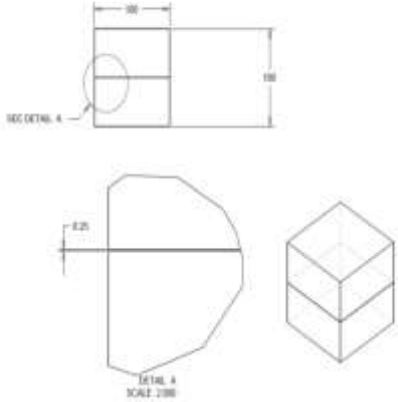

Fig:2.1 Detailing of cube having 0.25% of other material

For concrete and protein
= P/A
=57356.25/4987.5
=11.5Mpa
= P/A
=62.5/25
=2.5 Mpa
= P/A
=57356.25/4987.5
=11.5Mpa

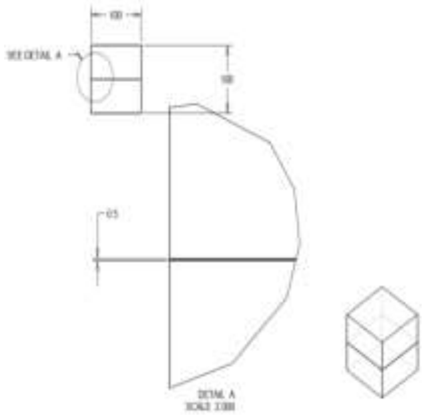

Fig:2.2 Detailing of cube having 0.5% of other material

For concrete and protein
= P/A
=54725/4975 =11Mpa
= P/A
=100/50
=2 Mpa
= P/A
=54725/4975
=11Mp

4. RESULTS AND DISCUSSION

EXPERIMENTAL INVESTIGATION

Table 4.1 Experimental reading

MATERIAL	%	ITERATION	VLAUE OBTAINED FROM ANALYTICAL CALCULATION (Mpa)	RESULTS OBTAINED FROM ANSYS 14.0 (N/)
CONCRETE			28.5	27.9
HUMAN HAIR	0.25	1	31.5	30.9
	0.5	2	24.0	23.5
POLYPROPELENE	0.25	1	10.5	10.3
	0.5	2	27	26.48
COCONUT FIBRE	0.25	1	25.5	25.01
	0.5	2	24	23.5

5. CONCLUSIONS

This paper is validation of results which are obtained from analytical calculation as well as virtual solution which is obtained in ANSYS software. The present work goes with the two essential works as fabrication of composites with different combination of the material such as polypropylene, coconut fibre and human hair with concrete. The combination is varies from 0.25, 0.5 and 1.5 in terms of percentage. The best result we achieved with Composite 2 which is having 0.25% human hair which testes experimentally and virtually as well. And holds the value 31.5 MPa as compressive strength by experiment and analysis by ANSYS software is 29.96 MPa. After comparing both result it concluded that 0.25% of human air will increases strength of the composites. Hence we can say that human hair fibre reinforces the cement matrix and enhances the properties for which it is incorporated.

REFERENCES

[1] C. D. Scott and R. E. Smalley, “Nanosci. Nanotechnol, vol. 3, no. 75, **(2003).**

[2] C. Popescu and H. Höcker, “Hair—the most sophisticated biological composite material”, Chemical Society Reviews, vol. 36, no. 8, (**2007**), pp. 1282-1291.

[3] T. U. Ganiron Jr, “Sustainable Management of Waste Coconut Shells as Aggregates in Concrete Mixture”, Journal of Engineering Science and Technology Review, vol 6, no. 5, **(2013)** December, pp. 7-14.

[4] T. U. Ganiron Jr, “Investigation on the Use of Sosrobahu Technology as Road Construction Technique”, International Journal of Advanced Science and Technology, vol. 65, **(2014)** April, pp. 27-38.

[5] T. U. Ganiron Jr, “Use of Recycled Glass Bottles as Fine Aggregates in Concrete Mixture”, International Journal of Advanced Science and Technology, vol. 61, **(2013)** December, pp. 17-28.

[6] G. Li, “Experimental Study of Cement-Asphalt Emulsion Composite”, Cement and Concrete Research, vol. 28, no. 5, (**1998**), pp. 635-64.