"To Improve the Compressive Strength of Composite by Experimentation and Analysis"

Sonul.D.Bodhane[1] Swapnil M. Choudhr[2]
[1]M.Tech Student [2]Assistant Professor
[1,2]Department of Mechanical Engineering
[1,2]Wainganga College of Engineering& Management, Nagpur

Abstract— With the rise of population the uses of conventional and non-conventional resources are highly increased. As we know the resources available are limited to their origin but the uses also may not be affected as well according to their importance. There are some resources like natural fibres have not come under proper attention in passing years, even some of which like human hair, coconut fibre are destroyed as a waste material. But after knowing better sides of these fibres, they are getting a proper attention over the years. With the aim of utilizing abundant waste material, a human hair, coconut fibre and polypropylene composite has been developed using it as reinforcing constituent and cement as matrix constituents. This paper presents fabrication and properties evaluation of human hair, coconut fibre and polypropylene fibre reinforced cement composite. Composites with various compositions of human hair, coconut fibre and polypropylene were fabricated. The fabricated specimen composed of various % of human hair, coconut fibre and polypropylene fibres 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. And holds the value 31.5 MPa as compressive strength by experiment and analysis by ANSYS software is 29.96 MPa.

Key words: Compressive Strength, Composite, fibres

I. 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, wear and friction properties (friction materials), brake linings and chemical inertness (except in acids).

A. 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

II. EXPERIMENTATION

The section of experimentation comes after the, fabrication of composites with the help of conventional moulding process. The method is provided with its simple specifications and various useful components. The fabrication is preceded in a specific pre-decided manner that means the composition aspect of human hair, coconut fibre and polypropylene with concrete. There are various % of human hair, coconut fibre and polypropylene which is supposed to incorporate with the appropriate % of concrete. We obtain ten composites with the addition of suitable % range of both the materials.

These composites are as: polypropylene, human hair and coconut fibre., These three material are used for experimentation purpose and their properties are well compared and suitably observed for properties evaluation as compressive strength. Avoiding more tables and calculations as space point of view only one consideration of Composite 1 is shown in present paper and results obtained for both of remaining by performing similar test is properly mentioned.

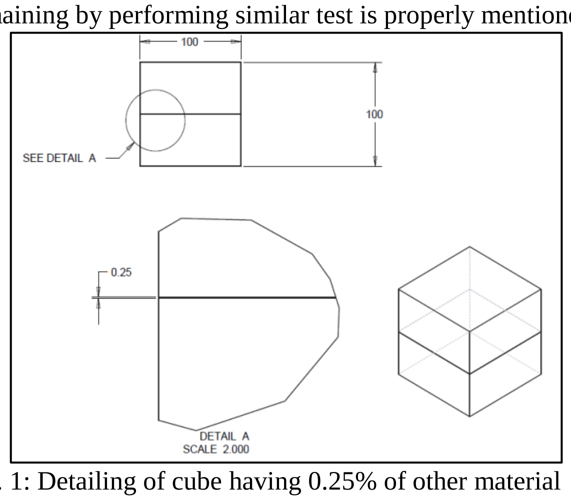

Fig. 1: Detailing of cube having 0.25% of other material

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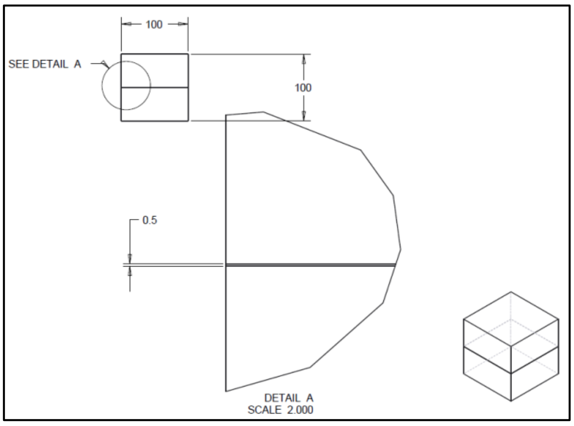

Fig. 2: Detailing of cube having 0.5% of other material

III. 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:

1) 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.
2) Adequate information will not be available on critically stressed parts of the components.
3) 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.
4) iv. Manual design is time consuming and prone to errors.
5) Design optimization is tedious and time consuming.

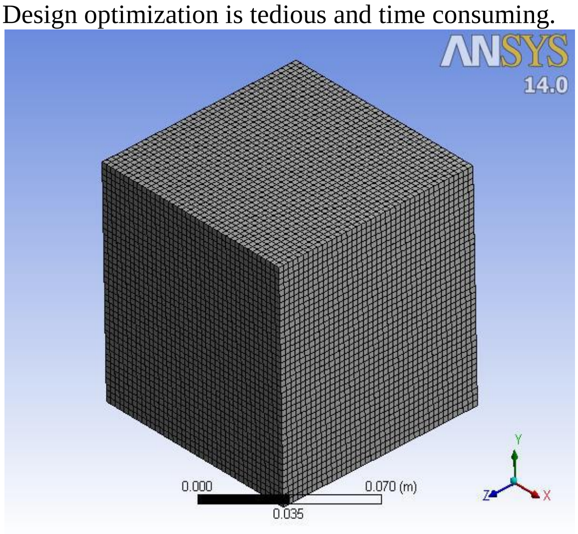

Fig. 3: Meshing

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

Table 1: Loading Condition

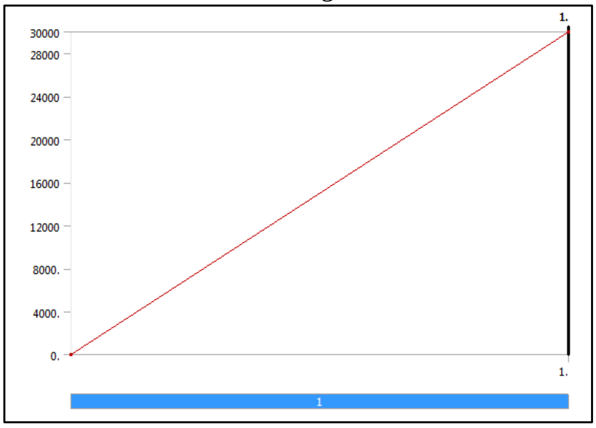

Fig. 4: Graph for loading

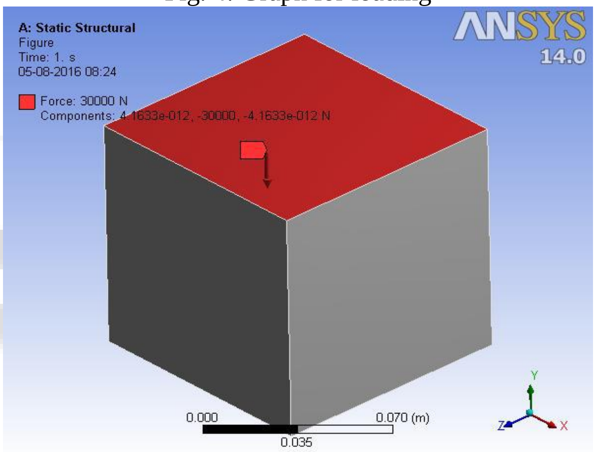

Fig. 5: Boundary Condition

IV. RESULTS AND DISCUSSION

A. *Experimental Investigation*

MATERIAL	%	ITERATION	VLAUE OBTAINED (Kg)	STRENGTH (N/mm^2)
CONCRETE			28.5	27.9
HUMAN HAIR	0.25	1	31.5	30.9
	0.5	2	24.0	23.5
	1.5	3	27	26.48
POLYPROPELENE	0.25	1	10.5	10.3
	0.5	2	27	26.48
	1.5	3	18	17.65
COCONUT FIBRE	0.25	1	25.5	25.01
	0.5	2	24	23.5
	1.5	3	21	20.6

Table 2: Experimental reading

Material	% of	Deformati	Compress	Experime

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	added materi al	on (10^{-5}) m	ive strength (10^{6}) Pa	ntal readings
Concrete		1.004	27.5	28.5
Concrete and polypropyl ene	0.25	1.0018	10.0	10.5
Concrete and protein	0.25	1.0044	29.96	31.5
Concrete and coconut fibre	0.25	1.002	16.63	25.5

Table 3:

Material	% of added materi al	Deformati on	Compress ive strength	Experime ntal readings
Concrete		1.004	27.5	28.5
Concrete and polypropyl ene	0.5	1.0607	25.15	27
Concrete and protein	0.5	1.0082	22.45	24.4
Concrete and coconut fibre	0.5	1.0027	20.85	24

Table 4:

Material	% of added materi al	Deformati on	Compress ive strength	Experime ntal readings
Concrete		1.004	27.5	28.5
Concrete and polypropyl ene	1.5	1.0863	16.81	18
Concrete and protein	1.5	1.0017	25.03	27
Concrete and coconut fibre	1.5	1.0003	23.25	21

Table 5:

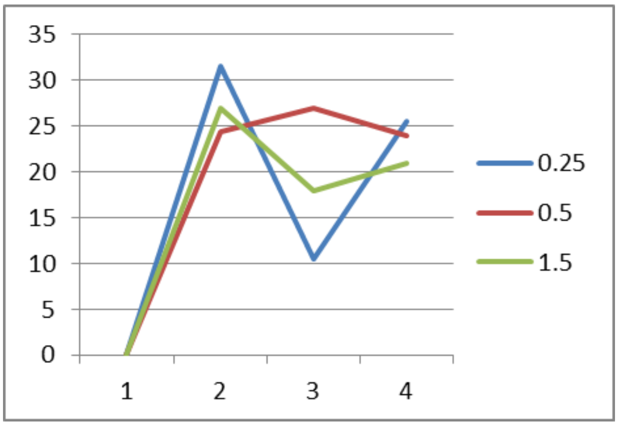

Fig. 6: Graph For Experimental Reading

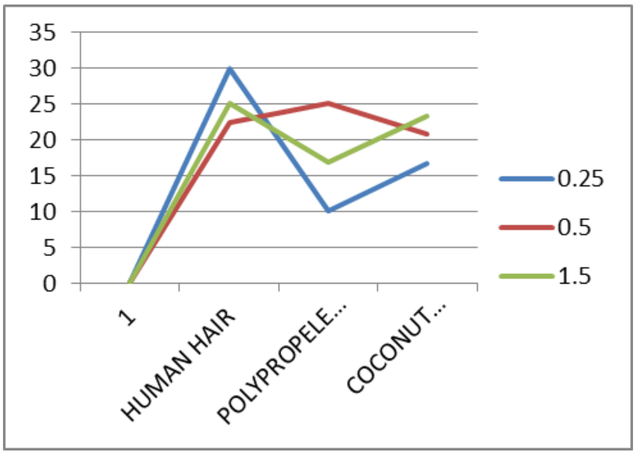

Fig. 6: Graph For Virtual Reading (Ansys14.0)

V. CONCLUSION

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. And after that comparison and properties evaluation of obtained composites respectively and observed favourable results. The result completely justifies the specified work as strength rises with raised % of human hair in concrete. The best result we achieved with Composite 3 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 29.96Mpa. After comparing both result it concluded that 0.25% of human air will increases strength of the composites. Comparative graph also shown for the better visualization of the result.

Fig. 7:

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