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IMPACT BEHAVIOR OF TERMITE MOUND PARTICULATED NATURAL FIBER-POLYMER COMPOSITES

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***ABSTRACT*: *During the last few years, natural fibers have received much more attention than ever before from the research community all over the world. These natural fibers offer a number of advantages over traditional synthetic fibers. In this present investigation, to study the impact behavior on new series of filler added composites involving, natural coir as a reinforcing material in vinyl ester resin based polymer matrix has been reported. Termite mound was successfully used to fabricate natural composites with the composition of 10-30%. These termite mound are bio-degradable and they also have higher impact strength than compare to other natural fibers. Termite mound Particulates Coir fiber reinforced composites exhibited the maximum value of impact strength of 45.35 kJ/m^2 was obtained in 30 mm fiber length, 20% Particulate content. It is clearly observed that the inclusion of Termite mound particulate in natural fibers improves strengths and withstand the impact load.*

Key words- *Coir fiber composite, filler content termite, vinyl ester resin*

1. INTRODUCTION

Natural fiber reinforced polymer composites have raised great attentions and interests among materials scientists and engineers in recent years due to the considerations of developing an environmental friendly material and partly replacing currently used glass or carbon fibers in fiber reinforced composites. They are high specific strength and modulus materials, low prices, recyclable, easy available in some countries.Satyanarayana et al 1986 Suggested the physical and mechanical properties exhibited by the different fibers from coconut tree they can be used for various applications, especially as composites .The major chemical constituents of these fibres are found to be cellulose (39 to 46%) and lignin (13 to 25%). Dixit S and V erma P 2012 Studied on untreated (coir/ sisal/ jute) fibre-reinforced polyester composites. the tensile properties of natural fibre composites can be significantly improved by natural fibers in a sandwich construction. Significant reduction in water absorption of natural fibre composites is also obtained with the sandwich construction.Sandhyarani Biswas et al 2011 investigated the successful fabrication of a coir fiber reinforced epoxy composites with different fiber lengths is possible by simple hand stirring technique. the hardness is decreasing with the increase in fiber length up to 20 mm. However, on further increase in fiber length increases the micro hardness value up to 16.9 Hv. study has confirmed that coconut coir fiber reinforced epoxy composites have better tensile strength(13.05 MPa),tensile modulus(2.064 GPa),and higher impact strength (17.5 kJ/m2) of the composites are also greatly influenced by the fibre lengths.Monteiro et al 2008 evaluated the Random oriented coir fiber–polyester composites are low-strength materials, but can be designed to have a set of flexural strengths that enable their use as non- structural building elements. The lack of an efficient reinforcement by coir fibers is attributed to their low modulus of elasticity, in comparison with that of the bare polyester resin.S.Harish et al 1997 studied the Coir fiber epoxy composites exhibit average values for the tensile strength, flexural strength and impact strength of 17.86 MPa,31.08 MPa and 11.49 kJ/m2, respectively. These values are significantly lower than those measured for glass fiber- reinforced plastics laminate specimens.S.V.Joshi et al 2004 evaluated The natural fiber production results in lower environmental impacts compared to glass fiber production. Also lower weight of natural fiber reinforced composites improves fuel efficiency and reduces emissions during the use phase of the component, especially in auto applications.D.Lingaraju et al 2011 investigated the Hybrid Nano composite laminates are prepared by hand lay-up method. The laminates are prepared using 5-layers of glass woven roving mates of 610gsm and Nano filler content varied from 0, 1, 2, 3 and 4wt%. Burnishing process is increased the hardness of composite material with the increase of depth cut and also smoothen the surface.

2. MATERIALS AND PROCESSING

2.1 Coir fiber

Coir Nature's wonder fiber is extracted from the protective husk of the coconut. The husks separated from the nuts are retted in lagoons up to ten months. The retted husks are then beaten with wooden mallets manually to produce the golden fiber. India and Sri Lanka are the main areas where the fibers from the husk are extracted by traditional methods for the commercial production of a variety of products. (Brushes, brooms, ropes, yarns for nets, bags, mats and padding for mattresses) However, worldwide, only a small part of the fibers available are currently used for these purposes. The processes of fiber extraction are varied and depend on the effectiveness of the wet processing such as bleaching and dyeing of coir and also varied end uses.

2.2 Vinyl ester resin

Polymers generally act as a good binder for fibers as observed from several references. Their carry availability coupled with their lower cost has provoked the selection of polymers as binder for the fibers. Unsaturated Vinyl ester offer the advantage of easy mold ability, better handling and better flow properties. Easy fabrication and better mixing of Vinyl ester promote their usage. Vinyl ester resin tends to have a purplish to bluish to greenish tint. This resin has lower viscosity than polyester resin, and is more transparent. This resin is often billed as being fuel resistant, but will melt in contact with gasoline. This resin tends to be more resistant over time to degradation than Vinyl ester resin, and is more flexible. It uses the same hardener as polyester resin (at the same mix ratio) and the cost is approximately the same. (Vasanta V Cholachagudda et al 2013) Coir reinforced Vinyl ester composite the tensile strength increases by 27.80% at 15% fiber loading and decrease at 20% wt of coir loading by 20.85% so further addition of coir will no longer increases the strength rather it decreases.

2.3 Materials of Composites

The specimen used in this study was made of coir fiber reinforced composite material. The composite was made up of general vinyl ester resin and coir fibers. Accelerator was cobalt octoate and catalyst was methyl ethyl ketone peroxide as shown in table 1.

Table 1 Materials of fabrication composites

Material	Type
Matrix	Vinylester resin
Fiber Reinforcement	Coir fiber
Catalyst	Methyl Ethyl Ketone Peroxide(MEKP)
Accelerator	Cobalt Octoate
Promotor	Di Methyl Aniline (DMA)
Filler	Termite mound soil
Releasing agent	Poly Vinyl Acetate (PVA)

2.4 Fabrication of Composites

The natural coir fiber was selected as reinforcement material in this investigation. The matrix material of unsaturated vinyl ester resin and the filler material of Termite mound soil was used .The compression moulding process technique was used for fabricating filler impregnated Coir Vinyl ester composites. Poly Vinyl Acetate (PVA) release agent was applied to the surface before the fabrication. The coir fibers were pre-impregnated with the matrix material consisting of unsaturated Vinyl ester resin, Termite mound soil filler, Cobalt Octoate accelerator and MEKP catalyst in the ratio of 1:0.015:0.015.The impregnated layers were placed in the resin matrix (300 mm × 300 mm) and pressed heavily before removal. After one hour, the composites were removed from the mould and cured at room temperature (28^0C) for 24 hrs.

Figure 1 Photographic images of fabricated composite sheets

3. EXPERIMENTAL RESULTS AND DISCUSSION

3.1 Impact testing

Sample as incised into the shape (64×12.7×3) mm, the impact strength test was conducted using an Tinius Olsen impact test machine as per ASTM D256-05 standards. Five readings for each identical specimen were taken and their average result was determined.

3.2 Effect of fiber parameters

The impact tests results are shown in Table 2. The relationship between fabrication parameters, (Fiber length, Particulate content and fiber content) and Impact strength (KJ/m^2) shown in Figure 2 .The maximum Impact strength are obtained in all the levels of fiber length. The very low Impact strength was obtained in 10 mm fiber length, 10% Particulate content, and maximum Impact strength was obtained of fiber length 30 mm, particulate content 20 % and 20% fiber content of impact value 45.35 kJ/m^2

Table 2 Experimental results

Runs	Fiber length (mm)	Particulate content (%)	Fiber content(%)	Impact strength (kj/m^2)
1.	10	10	30	25.65
2.	10	20	30	38.75
3.	10	30	30	29.35
4.	30	10	20	34.65
5.	30	20	20	45.35
6.	30	30	20	38.75
7.	50	10	10	32.45
8.	50	20	10	40.25
9.	50	30	10	28.60

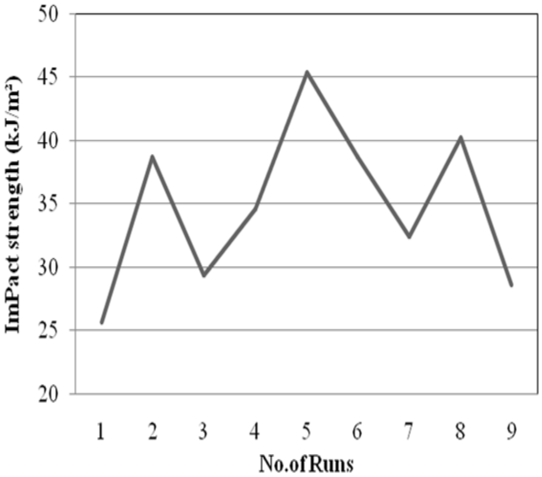

Figure 2 Effect of fiber parameter in Impact strength

4. CONCLUSION

The termite mound was successfully used to fabricate natural composites with the composition of 10-30%. These termite mound are bio-degradable and they also have higher impact strength than compare to other natural fibers.Termite Mound Particulated Coir fiber reinforced composites exhibited the maximum value of impact strength of 45.35 kJ/m^2 was obtained in 30 mm fiber length, 20% Particulate content. It is clearly observed that the inclusion of Termite Mound Particulate in natural fibers improves strengths and withstand in sudden load.

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