IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)
e- ISSN: 2278-1684, p-ISSN : 2320–334X
PP 70-74
www.iosrjournals.org

TENSILE AND IMPACT BEHAVIOUR OF RICE HUSK AND TERMITE MOUND PARTICULATED COIR-FIBER-POLYSTER COMPOSITE

S.Anilkumar[1], S.Sathiyamurthy[2], S.Jeyabal[3], K.Chidambaram[4]
[1]*(PG scholar, Department of Mechanical Engineering,Sri Ramanujar Engineering College,Chennai 600127, Tamilnadu, India)*
[2]*(Department of Mechanical Engineering,Sri Ramanujar Engineering College, Chennai 600127,Tamilnadu, India)*
[3]*(Department of Mechanical Engineering,A.C. College of Engineering and Technology, karaikudi, 630 004, Tamilnadu, India)*

ABSTRACT: *Increased environmental awareness and consciousness throughout the world has developed an increasing interest in natural fiber and its application in various fields. Again the availability of natural fiber like coir, jute, banana etc is abundant in India. The use of natural fibers as reinforcing material in both thermoplastic and thermosetting matrix composites provides positive environmental benefits with respect of ultimate disposability and best utilization of new material. In the present investigation, a study on the mechanical properties of new series of filler added composites involving natural coir as a reinforcing material in polyester resin based polymer matrix has been reported.This research is focused on studying the tensile and impact behavior of termite mound and rice husk particulated coir fiber reinforced polyester composite. The termite mound and rice husk was successfully fabricated with natural fiber with a composition of 10 to 30% by weight. The composite was tested and the result clearly indicated that the inclusion of rice husk and termite mound particulate improved the tensile and impact strength.*

Keywords: *natural fiber, polyester resin,polymer matrix rice husk, termite mound.*

I. INTRODUCTION

Composites are materials that comprise strong load carrying material (known as reinforcement) imbedded in weaker material (known as matrix).Reinforcement provides strength and rigidity, helping to support structural load. The matrix or binder (organic or inorganic) maintains the position and orientation of the reinforcement. Composites are formed by combining fibers and polymer resin which is also known as Fiber Reinforced Composites (FRC). Fiber-reinforced composite comprises fibers of high strength, lightweight and high stiffness, embedded in a matrix with distinct interfaces between them. The role of matrix is to transfer the load to the fibers and to provide a barrier against an adverse environment and to protect the surface of the fibers against mechanical abrasion.

In recent years, there has been growing environmental consciousness and understanding of the need for sustainable development, which has raised interest in using natural fibers as reinforcements in polymer composites to replace synthetic fibers such as glass. The advantages of natural fibers include low price, low density, unlimited, sustainable availability and low abrasive wear of processing machinery. Further, natural fibers are recyclable, biodegradable and carbon dioxide neutral and their energy can be recovered in an environmentally acceptable way.

A number of investigations have been carried out to assess the potential of natural fibers as reinforcement in polymers. Joshi et al [1] compared life cycle environmental performance of natural fiber composite with glass fiber composites and found that natural fiber composites are environmentally superior in the specific applications study. They have suggested that the light weight natural fiber composites improve fuel efficiency and reduce emissions when used as components in automobile applications. Wei.C et al [2] have successfully tested coir fiber polyester composites as helmet, house roofing and post boxes. The results indicated that the coir loading ranging from 9 to 15% by weight had flexure strength of about 38 MPa. Takatani et al [3] have developed composite material for building using natural fibers. Mukherjee et al [4] evaluated the mechanical properties of sisal fiber. The mechanical property does not show appreciable change with increase in diameter of the fiber but with increase in length. Harish et al [5] investigated the mechanical properties on samples using natural coir fiber with epoxy resin and compared the results with glass fiber reinforced plastics. Although the result indicated lower values when compared with glass fiber, the authors have suggested for the applications of various filler material or hybrid fillers which can improve the mechanical properties. In the present investigation the tensile and impact behavior of natural coir fiber polyester composite were carried out with termite mound and rice husk as new filler materials. Specimens were fabricated and tested by varying the length of coir from 10 mm to 50 mm in multiples of 20 and varying the particulate content from 10 to 30% by weight in multiples of 10.

II. EXPERIMENT

2.1 Fabrication of composite

The following table shows the various materials used to fabricate the composite specimen.

Table 1- Materials used for fabrication of composite

Material	Type
Matrix	Polyester resin
Catalyst	Methyl Ethyl Ketone Peroxide (MEKP)
Accelerator	Cobalt Octoate
Promotor	Di Methyl Aniline (DMA)
Fillers	Termite mound soil and Rice Husk
Reinforcement	Coir fiber
Releasing agent	Poly vinyl acetate

The natural coir fiber was selected as reinforcement material in this investigation. The matrix material of unsaturated polyester resin and the filler material of Rice husk and Termite mound soil were used. The Compression moulding process technique was used for fabricating particulate filled Coir Polyester composites. Poly Vinyl Acetate (releasing agent) was applied to the surface before the fabrication. The coir fibers were pre-impregnated with the matrix material consisting of unsaturated Polyester resin, Termite mound soil and Rice Husk filler. Cobalt Octoate was used as accelerator and Methyl Ethyl Ketone Peroxide was used as catalyst .The impregnated layers were placed in the resin matrix (300 mm × 300 mm) and pressed heavily . After 1hour, the composites were removed from the mould and cured at room temperature for 24 hours.

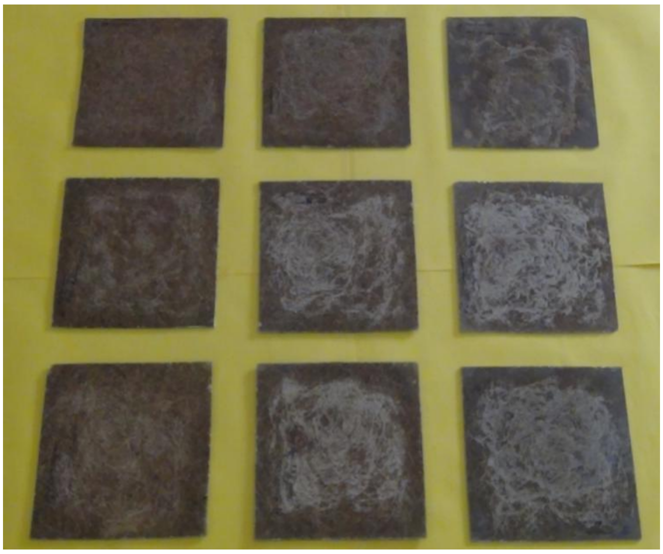

Fig 1- Photographic image of fabricated Composite sheets

2.2 Mechanical Test

2.2.1 Tensile Testing

Specimens for tension test were cut from the prepared composite and finished to the accurate size using emery paper. Tests were conducted using Tensile testing machine at a cross head speed of 5 mm/min as per ASTM D638-08 Standard. Five specimens with identical dimensions for each composite material sample were tested and average result were determined.Testing conditions of 23±2 ^{0}C temperature and relative humidity of 50 ±5 % were followed.

2.2.2 Impact Testing

Sample was incised into the shape (64×12.7×3.2) mm.The Impact strength test was conducted in an impact test machine as per ASTM D256-05 standards. Five readings for each identical specimen were taken and their average result was determined.

III. RESULTS AND DISCUSSIONS

The results of tensile and impact tests are shown in Table 2.

Table 2. Experimental results

RUNS	FIBER LENGTH (mm)	PARTICULATE CONTENT (%)	AVERAGE TENSILE STRENGTH (MPa)	AVERAGE IMPACT STRENGTH (KJ/m^2)
1.	10	10	17.60	24.65
2.	10	20	20.65	37.75
3.	10	30	16.65	25.35
4.	30	10	21.30	33.65
5.	30	20	26.75	42.35
6.	30	30	18.75	36.75
7.	50	10	20.50	30.45
8.	50	20	22.15	37.25
9.	50	30	18.95	25.60

3.1 Effect of Fiber Parameters and Particulate

The maximum tensile properties are obtained in all the levels of fiber length. The very low tensile strength value was obtained in 10 mm fiber length with 30% of Particulate content, and maximum tensile strength was obtained in 30 mm fiber length with 20 % Particulate content. The maximum Impact properties are obtained in all the levels of fiber length. The very low Impact strength was obtained in 10 mm fiber length with 10 % Particulate content, and maximum Impact strength was obtained in 30 mm fiber length with 20 % Particulate content.

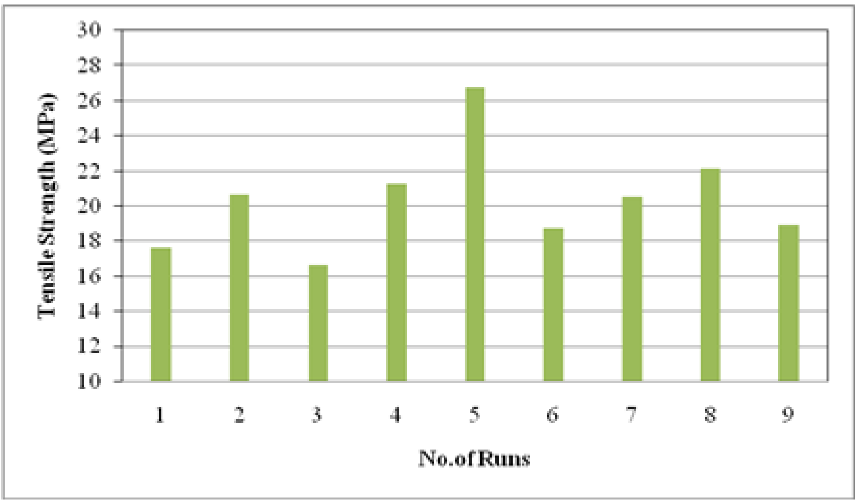

Fig 2 - Effect of fiber parameters in Tensile strength.

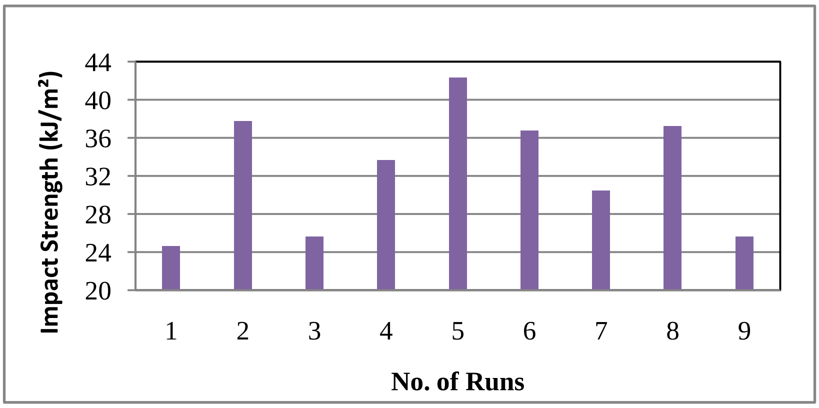

Figure 3 - Effect of fiber parameters in Impact strength.

IV. CONCLUSION

The mechanical behaviors of Rice Husk and Termite Mound Particulated Coir fiber reinforced composites were evaluated in this investigation. The termite mound and rice husk 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. Rice Husk and Termite Mound Particulated Coir fiber reinforced composites exhibited the maximum value of Tensile strength of 26.75 MPa. Rice Husk and Termite Mound Particulated Coir fiber reinforced composites exhibited the maximum value of impact strength of 42.35 kJ/m^2 .It is clearly observed that the inclusion of Rice husk and Termite Mound Particulate in natural fibers improves the strength and withstand impact load (sudden load).

REFERENCES

[1] S.V Joshi. L.T. Drzal, A.K. Mohanty, S. Arora 'Are natural fiber composites environmentally superior to glass fiber reinforced composites?'Composites Part A: Applied Science and Manufacturing 35 (2004) 371–376

[2] Wei, C., Mu, Q.H. and Luo, W.H. (2003) 'Influences of treatment methods for sisal stems on properties of sisal fiber/formaldehyde resin composites', China Plastics, Vol.17, pp.44–47.

[3] Takatani, M., Ikeda , K., Sakamoto, K. and Okamoto, T. (2008) 'Cellulose esters as compatibilizers in wood/poly(lactic acid) composite', Journal of Wood Science, Vol. 54, No. 1, pp. 54–61.

[4] Mukherjee. P.S., Satyanarayanan K.G. Structure and properties of some vegetable fiber coir, Material Characterization,Composites Part A: Applied Science and Manufacturing 1984,vol.60:pp.3925-3934.

[5] Harish.S., Peter Michael, D., Bensely, A., Mohan Lal, D. and Rajadurai, A. “Mechanical property evaluation of natural fiber coir composites”, Materials Characterization,Vol.60, 2009, pp.44–49.

[6] Torres FG, Cubillas ML, Study of the interfacial properties of natural fiber reinforced polyethylene. PolymerTest2005;24:694-8.

[7] Geethamma VG, Kalaprasad G, Gabriel G, Sabu T. Dynamic mechanical behavior of short coir reinforced natural rubber composites”Composites Part A: Applied Science and Manufacturing 2005;36:1499-506.