ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

APPLICATION OF ALOE FEROX WITH BANANA FIBER AS COMPOSITE PLATE FOR DOMESTIC PURPOSE

M. Shantharaj*, P. Chithambaranathan, M. Palpandi
[*] Assistant Professor, Department of Mechanical Engineering, PSNACET, Dindigul, INDIA
Associate Professor, Department of Mechanical Engineering, PSNACET, Dindigul, INDIA
Assistant Professor, Department of Mechanical Engineering, PSNACET, Dindigul, INDIA

DOI: 10.5281/zenodo.221113

ABSTRACT

A composite consisting of Aloe Ferox Fiber and Banana Fiber is carried out by using Compression Molding Process with the help of Epoxy Resin. Composite plates are produced which is a double layer of one fiber over the other fiber and mixture of chopped fibers to increase its strength and ability. Both the fibers are treated with sodium hydroxide. Separate specimen plates are made for testing according to the ASTM standard. A Comparison is made between alignment of fiber in molding process as continuous and in chopped state condition to avoid gap, void in between the fibers in order to increase their strength, withstanding capacity to overcome commercial products such as plastics and plywood.

INTRODUCTION

Many natural and synthetic fibers are used in many ways and in this Aloe ferox fiber which is not used in this field is being used along with Banana fiber as composite to examine their mechanical behavior by various tests like vibration, tensile, impact test.Usually aloe ferox plant is used only for medical purposes by means of ointment, cosmetics, and powder and gel forms for wounds in human body.

Generally aloe ferox used in the fields of Ayurveda, Ethno medicine, Ethno botany, Phytomedicine, Pharmacology & Pharmacognosis.Now its fiber is extracted from its leaves by dumping them in water followed with beating them in stone to get its fiber in a pale yellow color, aloe gel are demonstrating its analgesic, anti-inflammatory, wound healing, immune modulating and anti-tumor activities as well as antiviral, antibacterial, antifungal and antiviral properties. The aloe juice has been shown to lower cholesterol and triglycerides while demonstrating anti-diabetic activity. Aloe ferox is used to create a non-bitter gel that can be used in cosmetics, and is reported to have wound healing properties banana fiber, normally used for its main property of strength and durability, . The source of banana fiber is the waste banana trunk or stems which are abundant in many places in the world. Moreover, these banana fibers are recycling and biodegradable.

Epoxy resin is used as bonding element for both the fiber; this resin is choosed for better curing even in low temperature than polyester and vinyl ester. Epoxies generally out-perform most other resin types in terms of mechanical properties and resistance to environmental degradation, which leads to their almost exclusive use in many components. As a laminating resin their increased adhesive properties and resistance to water degradation make these resins ideal for use in various applications. Epoxy resins are easily and quickly cured at any temperature from 5°C to 150°C, depending on the choice of curing agent. One of the most advantageous properties of epoxies is their low shrinkage during cure which minimizes fabric 'print-through' and internal stresses.

High adhesive strength and high mechanical properties are also enhanced by high electrical insulation and good chemical resistance. Epoxies find uses as adhesives, caulking compounds, casting compounds, sealants, varnishes and paints, as well as laminating resins for a variety of industrial applications. The advantages of epoxy resin are High mechanical and thermal properties, High water resistance, Long working times available, Temperature resistance can be up to 140°C wet / 220°C dry, Low cure shrinkage.

LITRATURE REVIEW

Kulkarni et. Al (1982) had discussed about the mechanical properties of banana fiber, The UTS and breaking strain are found to decrease with an increase in the test length on the basis of the internal structure of the fiber, namely, the number of cells, spiral angle and the number of defects

Iyer and coworkers (1995) had carried out a study on properties of some varieties of banana fibers. This article presents an evaluation of yield, structure and properties of banana fibers gathered from a few commercial cultivated varieties. Results indicate that variations exist in both structure and properties of fibers from different regions along the length and across the thickness of the trunk.

Vinita and Alka (1999) carried out a study on the softening of banana fiber, treatment with acetic acid solution enhances the properties of banana fibers to a great extent, which will further improve the bending capacity of banana fibers for apparel use Desai (2008) reported about the conventional textiles in India-Banana fibers. The banana fibers were reported to be elegant and highly versatile. The hand extracted fibers were used in manufacturing of handicraft articles, bags, table mats wall hangings, etc.

Vanessa R.L. Celestino, Hélida M.L. Maranhão, Carlos F.B. Vasconcelos, Cristiano R. Lima, Giovanna C.R. Medeiros, Alice V. Araújo, Almir G. Wanderley Aloe ferox leaves are drained to extract resin to be used in folk medicine as anti-inflammatory, immunostimulant, anti-bacterial, anti-fungal, antitumor, laxative and to heal wounds and burns.

Magdalini Krokida, Athina Pappa, Maria Agalioti-usage of aloe ferox gel in dietary foods and pharmaceutical products. Freeze drying, along with spray drying, constitute the basic drying technologies used for the increase of shelf-life of Aloe components. Aloe gel, the inner part of the plant's leaf, is the main source of these components, containing about 98% water. The purpose of this study is the investigation of the effect of drying in the preservation of Aloe's functional substances.

EXPERIMENT METHOD

A) Compression Molding

The process used will be determined by which process can produce the part to appropriate specifications at the most economical rate.The choice of methods and equipment for use in the production of thermosetting molding compounds is usually determined by the type of reinforcement being used Reinforcements are added to thermosets to improve properties Impact, flexural strengths, shrinkage, etc. There will be a movable die in top and a fixed die in bottom after doing the routine process on the mold by arranging fiber with resin along with hardener component as per the resin selected and then normal procedure starts until the fiber are being treated well on resin and also compressed under desired pressure. This will takes place between three to four hours of process to get a complete specimen plate.

Compression presses are rated by their closing force capacities can be manual, semiautomatic or fully automatic Preform temperature, molding temperature, molding pressure, molding time and cooling time are the most important design parameters Cavity depth is very important to achieve the proper molded density Compression moulding uses a hydraulically operated press, The Press consists of two heated mold platens, one stationary and one movable Platens have either “T” slots or tapped holes to fix the mold halves to the platens Tie Rods, usually 4, provide for precise alignment as the press is opened and closed The press open and shut height and the platen temperature are controlled.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Fig 1.At compression stage

B) Alignment of fiber

After the treatment of fiber under sodium hydroxide they are weighted according to the amount of epoxy resin being added in desired ratio and then by applying wax over the die for easy removal of the plate from the mold, then fiber are arranged according to the dimension of the mold in compression molding machine one over the other like sandwich above that epoxy resin along with the hardener component is poured on all the nook and corner of the mold for perfect finish and the machine is set at a pressure of 200Mpa .After 3-4 hours the mold is being released from the machine and upper die and lower die are unpaired to take the plate out. Aloe ferox fiber and Banana fiber are placed in the mold in two ways they are as continuous fiber and chopped fibers in order to avoid gap, void in-between the fiber.

Fig 2.continuous fibers (Banana & Aloe ferox)

Fig 3.Chopped fibers (Banana & Aloe ferox)

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

Fig 4.continous fiber

Fig 5.Chopped fiber

C) Specimen

Testing methods to be followed for each and every test, for tensile test the specimen platen is cut at a dimension of 167mm *20mm and for impact test the dimension is 65mm *20mm.In tensile test the specimen is get fixed at the both ends in the universal testing machine and load is provided on the specimen until it gets broken so its elongation%,tensile stress at periodic time, yield stress can be noted in mm.In impact test there are charpy impact test and Izod impact test, we prefer Izod impact test in which a specimen is placed and a load is allowed to swing across the specimen to find out the amount of energy required to break the specimen in joules

Fig 6.Specimen for tensile and impact test

RESULTS AND DISCUSSION

Based on the original length and change in length the strain can be calculated and from the force applied and area of cross section of the specimen the stress can be evaluated an d relation between them is displayed as a graph.

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

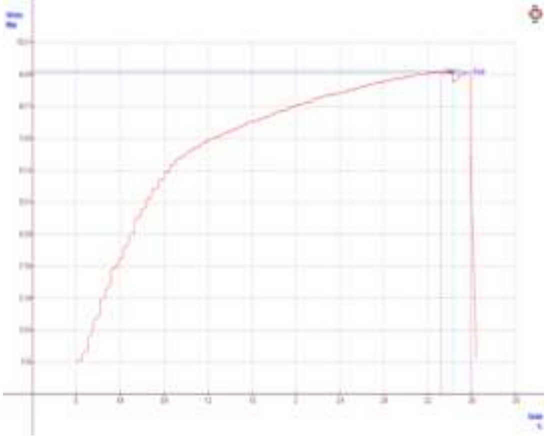

Fig 7.stress vs strain

Formula:

1.Stress=FORCE/AREA

2.Strain =L-Lo/L

By considering the area of the specimen and its dimension the load is supplied so that the specimen elongates to its maximum and there by tensile stress at yield, at break and also at Max are found out. Elongation % is based on the area and force applied to the specimen

Fig 8.Composite plate as switch board

Table 1.Tensile test result(Continous plate)

S.NO	RESULTS	VALUES	UNITS
1	Area	0.30	Cm^2
2	Tensile stress at yield	95.58	MPa
3	%Strain at yield	3.28	%
4	Tensile stress at break	95.6	MPa
5	% Strain at break	3.54	%
6	Yield force	2867.46	N

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

7	Break force	318.61	N
8	% Elongation	3.54	%
9	Tensile stress at Max	95.78	MPa
10	% strain at Max	3.54	%

Table 2. Impact test result

S.no	Load	Energy required to break the specimen	Units
1.	3.567 KG	4.597(Continous plate)	Joules

CONCLUSION

The main objective of the project is to replace the comercial products such as plastics and plywoods by this combination of aloe ferox and banana fibers as composite as well as a hybrid fiber and the chopped fibers show better results when compared with continous fibers by considering their properties according to their arrangement for production of composite plates.

REFERENCE

[1] O'Brien, C., Van Wyk, B. E., & Van Heerden, F. R. (2011). Physical and chemical characteristics of Aloe ferox leaf gel. South African Journal of Botany, 77(4), 988-995.
[2] Hamman, J. H. (2008). Composition and applications of Aloe vera leaf gel. Molecules, 13(8), 1599-1616.
[3] Wintola, O. A., & Afolayan, A. J. (2011). Phytochemical constituents and antioxidant activities of the whole leaf extract of Aloe ferox Mill. Pharmacognosy magazine, 7(28), 325.
[4] Mabusela, W. T., Stephen, A. M., & Botha, M. C. (1990). Carbohydrate polymers from Aloe ferox leaves. Phytochemistry, 29(11), 3555-3558.
[5] Sinha, M. K. (1974). 5—The use of banana-plant fibre as a substitute for jute. Journal of the Textile Institute, 65(1), 27-33.
[6] Idicula, M., Neelakantan, N. R., Oommen, Z., Joseph, K., & Thomas, S. (2005). A study of the mechanical properties of randomly oriented short banana and sisal hybrid fiber reinforced polyester composites. Journal of applied polymer science, 96(5), 1699-1709.
[7] Joseph, S., Sreekala, M. S., Oommen, Z., Koshy, P., & Thomas, S. (2002). A comparison of the mechanical properties of phenol formaldehyde composites reinforced with banana fibres and glass fibres. Composites Science and Technology, 62(14), 1857-1868.
[8] Pothan, L. A., Neelakantan, N. R., Rao, B., & Thomas, S. (2004). Stress relaxation behavior of banana fiber-reinforced polyester composites. Journal of reinforced plastics and composites, 23(2), 153-165.
[9] Nema, J., Shrivastava, S. K., & Mitra, N. G. (2013). Chemical composition of Aloe ferox under stresses of soil pH and desiccation. Int J Chem, 3, 44-48.
[10] Magwa, M. L., Gundidza, M., Coopoosamy, R. M., & Mayekiso, B. (2006). Chemical composition of volatile constituents from the leaves of Aloe ferox. African Journal of Biotechnology, 5(18).
[11] Celestino, V. R., Maranhão, H. M., Vasconcelos, C. F., Lima, C. R., Medeiros, G. C., Araújo, A. V., & Wanderley, A. G. (2013). Acute toxicity and laxative activity of Aloe ferox resin. Revista Brasileira de Farmacognosia, 23(2), 279-283.
[12] Chen, W., Van Wyk, B. E., Vermaak, I., & Viljoen, A. M. (2012). Cape aloes—a review of the phytochemistry, pharmacology and commercialisation of Aloe ferox. Phytochemistry Letters, 5(1), 1-12.
[13] Grace, O. M., Simmonds, M. S. J., Smith, G. F., & Van Wyk, A. E. (2008). Therapeutic uses of Aloe L.(Asphodelaceae) in southern Africa. Journal of Ethnopharmacology, 119(3), 604-614.
[14] Adhami, H. R., & Viljoen, A. M. (2015). Preparative isolation of bio-markers from the leaf exudate of Aloe ferox ("aloe bitters") by high performance counter-current chromatography. Phytochemistry Letters, 11, 321-325.

[15] Speranza, G., Gramatica, P., Dadá, G., & Manitto, P. (1985). Aloeresin C, a bitter C, O-diglucoside from Cape Aloe. Phytochemistry, 24(7), 1571-1573.

[16] Rauwald, H. W., & Beil, A. (1993). High-performance liquid chromatographic separation and determination of diastereomeric anthrone-C-glucosyls in Cape aloes. Journal of Chromatography A, 639(2), 359-362.

[17] Sapuan, S. M., Leenie, A., Harimi, M., & Beng, Y. K. (2006). Mechanical properties of woven banana fibre reinforced epoxy composites. Materials & design, 27(8), 689-693.

[18] Loots, D. T., van der Westhuizen, F. H., & Botes, L. (2007). Aloe ferox leaf gel phytochemical content, antioxidant capacity, and possible health benefits. Journal of agricultural and food chemistry, 55(17), 6891-6896.

[19] Van Wyk, B. E., Van Oudtshoorn, M. V. R., & Smith, G. F. (1995). Geographical variation in the major compounds of Aloe ferox leaf exudate. Planta medica, 61(03), 250-253.

[20] Kambiz, L., & Afolayan, A. J. (2008). Extracts from Aloe ferox and Withania somnifera inhibit Candida albicans and Neisseria gonorrhoea. African Journal of Biotechnology, 7(1).