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Mechanical and Morphological Study of Coir Fiber Treated with Different Nitro Compounds

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Abstract*-Natural fiber extracted from plants has gained attentions owing to their advantages over synthetic polymers. Nowadays composites from natural fibers are among the most keenly required materials. In the present study raw coir fiber was treated with different nitro compounds in order to enhance the properties of coir fiber. Sample preparation of treated coir fiber was done using annealing method. The purpose of using annealing method is to increase the rate of reaction. Xrd studies revealed that some crystalline compound is present in the newly formed samples. Change in morphology of coir was found when treated with different nitro compounds that are confirmed through SEM technique. The goal of the present study is to show that chemical treatment is an effective method to enhance the properties of coir fiber that may be used as reinforcement in polymers to make ecofriendly, lightweight, biodegradable polymer composites.*

Key Words: *Fiber, annealing, polymer, SEM, renewable*

I. Introduction

Nowadays there is keen interest in making composites of mostly recycled wastes especially in making composites using most of the ecofriendly natural fibers as reinforcing fillers and thermosetting polymers as matrices [1]. Recent synthesis of polymer based composites has increased new ways for polymer formulations and gave the innovative product with optimal properties for different applications. [2, 3]. Polymers have emerged as one of the mostly used components of our daily life, epoxy or epoxide being one such example.

Till now synthetic filler have been the only choice for reinforcement of epoxy which is used to increase the toughness of epoxy. However, natural fibrous material are emerging as the alternate source which can be used as filler in place of synthetic material for reinforcement of epoxy due to their ecofriendly nature, high abundance in nature, biodegradable nature. Several research efforts have been done to study the effect of natural fiber based polymer composites on the mechanical behavior of epoxy composites which has been focused only on the fiber and their weight fractions within the composites Coir fiber is a ligno cellulic fiber obtained from the skull of coconut. It is a seed fiber. Coir fiber is found abundant in nature [4] and can be used in making variety of products. Coir fiber has also been used as reinforcement in different type's composite materials [5, 6, 7, and 8]. Coir fiber can be replaced in place of wood and other materials in synthesis of polymer composites [9, 10]. Coir fiber has been used as reinforcement for polymer composites, such as polyethylene, epoxy, polyester and phenolic resins [11, 12, 13, and 14]. The aim is to make a low-cost, high strength-to-weight ratio material to replace glass fiber composites.

The bonding between fiber and matrix can be improved by physical and chemical modifications of fiber surfaces. Chemical treatments have been done for treating the natural fiber. The influence of fiber treatments on the properties of coir fiber reinforced polyester composites has been studied.[13].

Alkali treatment has been subjected to coir fiber at higher temperatures ranging from 0-100 ^{o}C. Alkali treatment of coir fiber along grafting with ethylene coir fiber along grafting with ethylene dimethylacrylate (EMA) and curing under UV radiation has been studied [15]. In this paper we have

deliberate some characterization and performance of chemically treated coir fiber.

II. Experimental

II.1. Processing Of Coir Fiber

The fiber used for the experimental study was taken from the temples of Bhopal city. The raw fiber was taken out from the coconut skull and then quenched in tap water for about 48 hours. The fiber was then washed with tap water for 10-15 times so that dust and other impurities are removed. The washed fiber was dried in sun for 24 hours.

II.2. Chemical Treatment of Coir Fiber

1. The coir fiber was treated with nitro compounds, like: Ferric nitrate (Monohydrate, Extra pure, Fe $(NO_3)_3.\ 9H_2O$) and ammonium chloride (NH_4Cl) was taken in the ratio 10:4 in 500 ml of distilled water. The mix was stirred till a homogeneous solution was obtained. Water wetted and dried 100 g of processed coir fiber was added to the solution. Into it 100 drops of liquid ammonia was added to it and left the solution for one hour. Again the mixture thus obtained was dried and then annealed in a muffle furnace at 1000^0C and kept it at that temperature for 15 min. The fired sample was then powdered for its further study.

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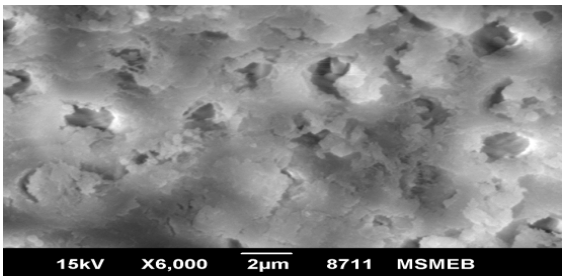
2**.** Aluminum nitrate (Monohydrate, Extra pure, Al $(NO_3)_3.\ 9H_2O$) and ammonium chloride (NH_4Cl) was taken in the ratio 10:4 in 500 ml of distilled water. The mix was stirred till a homogeneous solution was obtained. Water wetted and dried 100 g of processed coir fiber was added to the solution. Into it 100 drops of liquid ammonia was added to it and left the solution for one hour. Again the mixture thus obtained was dried and then annealed in a muffle furnace at 1000^0C and kept it at that temperature for 15 min. The fired sample was then powdered for its further study.

III. Results and Discussion

III.1. SEM Analysis



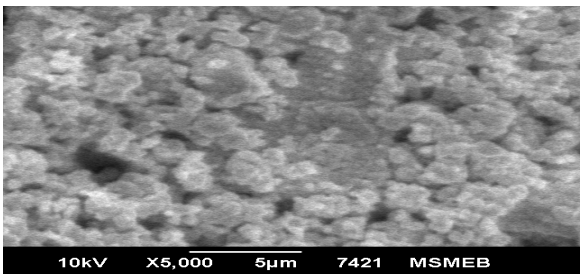


Fig (a) untreated coir fiber fired at 1000 degree (b) coir fiber treated by aluminum nitrate salt, coir fiber treated by ferric nitrate salt.

The figures show the pictorial view of untreated and treated images of coir fiber. From these figures we have found that the treatment has improved the surface roughness of the coir fiber when compared with untreated coir fiber. It has been seen that circular voids is clearly seen in untreated fiber which is found to be less when compared with treated coir fiber This may be due to the lessening of fiber diameter which increases the feature ratio; thereby developing a rough surface. Due to the elimination of the surface impurities and cementing materials like lignin and hemi-cellulose it can be found that separation of the definitive cells has increased which show the way to boost up the surface area of the coir fiber so it becomes more compatible with the matrix. Similar behavior has been found by other researchers on SEM [16, 17, and 18].

III.2. XRD Analysis

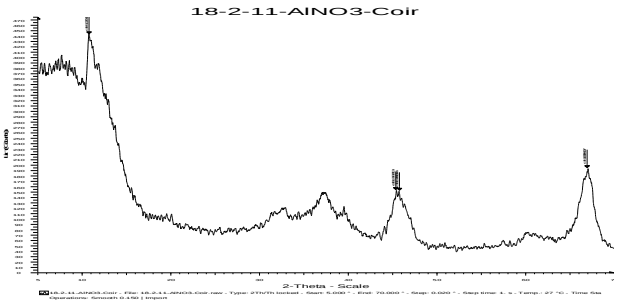


Fig.XRD analysis of coir fiber when treated by Aluminum nitrate salts.

It is observed from the xrd pattern of the nanoparticles of alumina obtained by annealing method contains gamma alumina (Al2O3) (ICCD PDF card no 29-0063).along with gamma alumina some peaks of boehmite phase (ICDD PDF No 21-1307) along with bayerite peaks (ICDD PDF No 20-0011).xrd analysis shows that the powders contain both boehmite and bayetite phases with beyerite as the major phase. The sharp peaks of bayerite indicate the presence of highly crystalline and coarse particles
A.k sivadasan et.al in his work found the gamma alumina when these particles were calcined in air to produce gamma alumina [19].similar peaks of alumina has been found by other workers also [20]

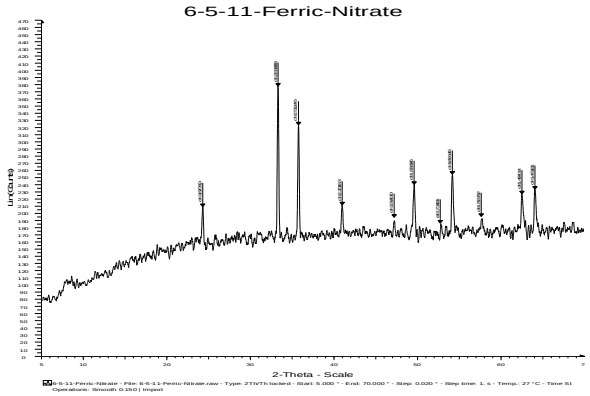


Fig. XRD analysis of treated coir fiber when treated by ferric nitrate salt.

Futher more we have studied the Xrd analysis of treated fibre and is depicted in Fig. The resuls have been compared with Xrd results for composites $Fe_2O_3.Fe_3O_4.FeO$ [21]. So, we can claim the all peaks prominent in our sample have corrosponding peaks (though of considerably low intensity) in $Fe_2O_3.Fe_3O_4.FeO$ composite.

II. Conclusion

Chemical treatment of coir fiber is an effective method to enhance the properties of fiber. We found a change in morphology in coir fiber through SEM analysis.Xrd studies revealed that some crystalline compound is present in the newly formed samples.

References

[1] Son J.I., Kim H.J., Lee P.W., Role of Paper Sludge Particle Size and Extrusion Temperature on Performance of Paper Sludge Thermoplastic Polymer Composites, Journal of Applied Polymer Science, Vol. 82(11), pp.2709-2718, 2001.

[2] George J., Sreekala, M.S., Thomas S., A Review on Interface Modification and Characterization of Natural Fiber Reinforced Plastic Composites ,Polymer Engineering& Science, Vol. 41, pp. 1471-1485, 2001

[3] Karnani R, Krishnan M, Narayan R, Bio-fiber-Reinforced Polypropylene Composites, Polymer Engineering & Science Vol. 37, pp. 476-483, 1997.

[4] Satyanarayana, K., Pillai, C.K.S., Sukumaran, K., Pillai, S.G.K., Rohatgi, P.K., Vijayan, K, Structure property studies of fiber from various parts of the coconut tree. Journal of Materials Science Vol. 17, pp.2453–2462, 1982.

[5] Owolabi, O., Czvikovszky, T., Kovacs, I., Coconut-fiber-reinforced thermosetting plastics. Journal of Applied Polymer Science Vol.30, 1827–1836, 1985.

[6] Choudhury, A., Kumar, S., Adhikari, B., Recycled milk pouch and virgin low density. Polyethylene/linear low-density polyethylene based coir fiber composites. Journal of Applied Polymer Science Vol. 106, pp.775–785, 2007.

[7] Geethamma, V.G., Composite of short coir fibers and natural rubber: effect of chemical modification, loading and orientation of fiber. Polymer Vol. 39 (6–7), pp. 1483–1497, 1998..

[8] Corradini, E., Morais, L.C., Rosa, M.F., Mazzetto, S.E., Mattoso, L.H., Agnelli, J.A.M., A preliminary study for the use of natural fibers as reinforcement in starch–gluten–glycerol matrix. Macromolecular Symposia Vol. 245–246, pp. 558–564, 2006.

[9] Sudhakaram P M, coir fiber composites. An alternate to wood panel products in fiber reinforced composites conf, ID- 1 (Nelson Mandela bar) 2007

[10] Cristy F, Coir for Eco- Development, Coir news, pp.32, 20 June 2003.

[11] Brahmakumar M., Pavithran C. and Pillai R. M., "Coconut Fibre Reinforced Polyethylene Composites: Effect of Natural Waxy Surface Layer of the Fibre on Fibre/Matrix Interfacial Bonding and Strength of Composites," Composites Science and Technology, Vol. 65, pp.563-569, 2005.

[12] Harish S., Michael D.P., Bensely A., Mohan Lal. D, Rajadurai. A, Mechanical property evaluation of natural fiber coir composite, Material Characterization, Vol. 60, pp.44, 2009 .

[13] Rout J, Misra M, Tripathy S. S, Nayak S. K and Mohanty A. K, The influence of fiber treatment on the performance of coir-polyester composites, Composite Science and Technology, Vol. 61, pp. 1303-1310, 2001.

[14] Monteiro S. N, Terrones L. A. H, and D'Almeida J. R. M., Mechanical performance of coir fiber, polyester composites, Polymer Testing, Vol. 27, pp. 591–595, 2008.

[15] Kumar N. M., Reddy G. V., Naidu S. V., Rani T. S., and Subha M. C. S., Mechanical properties of coir/glass fiber phenolic resin based composites, Journal of Reinforced Plastics and Composites, vol. 28, pp. 2605–2613, 2009.

[16] zanur Rehman M, Mubarak A khan, Surface Treatment of coir (cocos nucifera) fibers and its influence on fibers 'Composites Science and Technology, Vol. 67, pp. 2369–2376,2007.

[17] Mullick S., Master thesis entitled "Fabrication and characterization of natural fibre reinforced polymer composites" at NIT, Rourkela, (2012)

[18] Rout J., Misra M., Mohanty A. K., Nayak S. K., Tripathy S. S., SEM observations of the fractured surfaces of coir composites, J. Reinf. Plast. Compos. Vol.**22**, pp.1083, (2003).

[19] Sivadasan. A K, I Packia Selvam and Sankara Narayanan Potty, Microwave assisted hydrolysis of aluminium metal and preparation of high surface area γ Al_2O_3 powder , Bulletin of Material Science, Vol.33, pp.737-740(4), 2010.

[20] Sedaghat. A, Taheri-Nassaj E. , R. Naghizadeh, Journal of Non-Crystalline Solids Vol. 352, pp.2818–2828, 2006

[21] [Hanguuo and Yaoxian Li. Journal of colloid and interface Sci. Vol. 350, pp396-401, Issue 2, 15 oct 2010.

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