International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-9 Issue-1S4, December 2019

Examination on Tribological Properties of Luffa Fiber Reinforced Polyester Composites

G. Kalusuraman, I. Siva

Abstract: ***In this work Tribological property of luffa fiber reinforced unsaturated polyester composites are carried out. The composites were fabricated using the compression moulding technique with optimum pressure of 150Mpa. The fabricated specimens were cut as per the ASTM standard of the wear test and ASTM G99 as followed for the entire testing of the wear. In this work, the applying load and velocity of the rotating disc was considered as a process parameter. The fiber loading was taken for the specimen to be fabricated as 30%. The test on the specimen was conducted for 10N, 20N, 30 N and velocity of 1m/s, 2m/s, 3m/s respectively. The result shows that coefficient of friction increase when increases in sliding distance..***

Keywords ***: About four key words or phrases in alphabetical order, separated by commas.***

I. INTRODUCTION

A composite material is a combination of two or more materials of the different or same property. The composite material is not only used for structural properties, it also considered and detailed in electrical, thermal and mechanical properties. Normally, the natural fibers are used making composites. The advantages of natural fiber composite are easily available, low cost, reasonable strength, stiffness, renewable and biodegradable. luffa fibers are basically available in Thailand. Natural fiber shows little resistance to the environmental influences and intrinsic variability on properties. Kaewta kaewtatip et al reported that they are analyzing the tensile strength of luffa fibers and the details of their chemical structure are studied by the scanning Electron Microscope (SEM) [1]. Valcinide O.A. Tanobe et al. reported that luffa fiber induced in many types of chemical treatments and found their impact properties depend upon chemical products. They are shown that NaOH treatment is easily improving the surface energy of the fiber [2]. Marissa A. Paglicawan et al. reported that the properties of the luffa fibers only achieve the result of mechanical properties of the composites [3]. Jainhu Shen et al. reported that compared to other fibers the luffa having high strength and stiffness [4]. H. Demir et al. reported that when the luffa is immersed in water it has a water absorption properties in less than 5% [5]. Irullappasamy Siva et al. reported that Tribological properties of Silane treatment of the coconut and glass fibers are having a less specific wear rate [6]. O. Oboh et al. reported that the luffa is applied on agriculture, biological systems and Research technology [7]. It was observed that many of them conducted reported wear test on sisal, jute, fibers for this article and there is a research gap on wear properties of the luffa composites. In this work, the composites are fabricated with luffa fiber by using the compression molding process. and it is subject to under various loading and different sliding distance.

Manuscript published on 30 December 2019.

***** Correspondence Author (s)
G. Kalusuraman*, Faculty of Mechanical Engineering, Kalasalingam Academy of Research and Education, Krishnankoil-626 126, India, Email: kalusunrk@gmail.com
I. Siva , Faculty of Mechanical Engineering, Kalasalingam Academy of Research and Education, Krishnankoil-626 126, India, Email: isiva@klu.com

II. MATERIALS AND METHODS

A. Materials used

The luffa fiber is collected from the location in Natural Herbal shop at virudhunagar. In order to increase the chemical reaction in the resin for the preparation of the composites, catalyst as a methyl ethyl ketone peroxide and accelerator as a cobalt napthenate were used.

B. Fabrication of Composites

The template Compression moulding machine was used for making a plate of composite materials. The luffa fibers have been prepared and cut into the open book shape then remove the seeds in the fiber. Then selected fiber was used for the treatment process. 30% of weights of fiber are taking and apply over the top of the plate. Then it is pre-compressed with the help of the compression moulding machine. After the pre-compression, the wax is applied top and bottom side of the plate. Then the pre-compressed fiber was placed on the plate and 70% of resin was added to the pre-compressed fiber and the plate mould is placed on the compression machine and optimum pressure applied in 50kg/cm2 . The curing time for a plate was 12hrs. After 12hrs the moulds are removed from the machine. Now, the composite was prepared in the size of 180×150×3mm2. For the wear testing process, the plate is cut as per standard of ASTM G99 to do wear test.

C. Testing of Composites

For the wear testing process, pin on disc wear testing machine was used. According to the condition, the load was taken ad different condition as a 10N, 20N, 30N. The sliding velocity was as a 1m/s, 2m/s, 3m/s. The sliding distance was [0-3000m]. The wear piece was attached to the rod with the help of glue or pasting compounds. Before wear test, the initial weight of the piece was taken and the work piece was attached to the holder. Then the work piece was placed in a rotating disc and set the time and distance in the machine according to the calculation.

The time was set into the machine to depend upon the calculation. The speed and time calculation was done by using the following equation.

$$V = 3.14 * D * N/60 \quad (1)$$

Where, v-velocity (m/s), N-speed (rpm), D-Diameter of the disc (m).

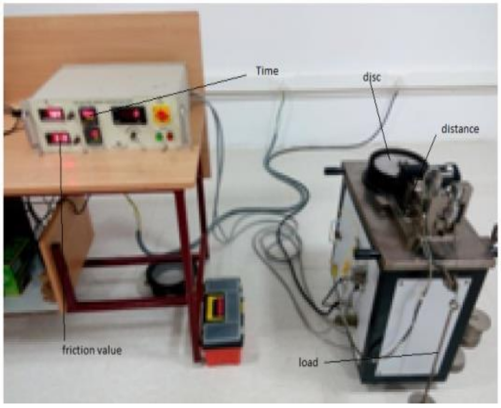


Fig.1. Snap shot of Wear testing machine

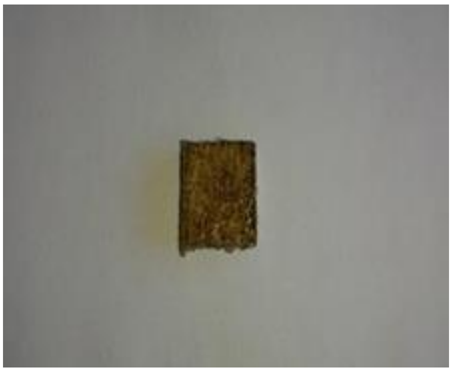
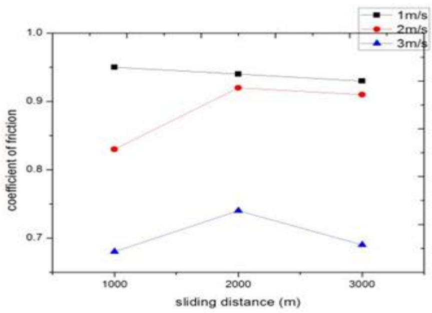


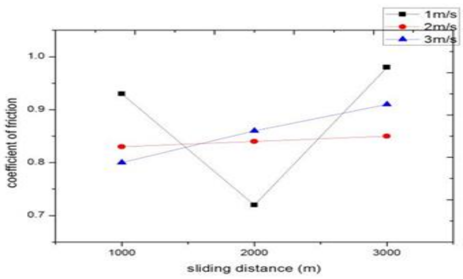
Fig. 2. Photo of Wear piece

III. RESULT AND DISCUSSION

A. Coefficient of friction



(a)



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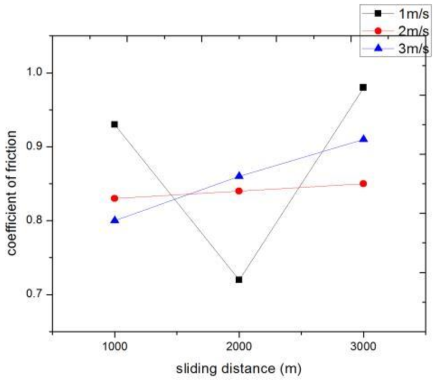


(c)

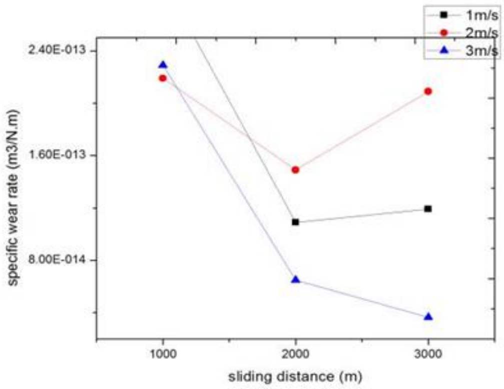
Fig.3. Effect fiber loading on the coefficient of friction of composites a). 10N b).20N c).30N

For the U30 wear test process in the10N, 20N, 30N load, the coefficient of friction and specific wear rate were calculated and plotted in the graph

The coefficient of friction mainly depends on the load and sliding distance. The above graph was plotted between sliding distance and coefficient of friction. From the graph, it was noted that for testing condition U30 at 10N for 1m/s it has been constantly decreasing. In 2m/s, the coefficient of friction is increased up to 2000m gradually and it holds steady-state in distance of3000m. In 3m/s, the sliding distance in 2000m it is having a high coefficient of friction. It was observed from the graph(b) that coefficient of friction decreased to 0.7 when the testing condition of 2000 m and 1 m/s since it has the poor interlocking between fiber and matrix. It was observed from the graph(c) that the 1m/s on 2000m having a high coefficient of friction. The 3m/s is sliding increased from 1000m-3000m.

B. Specific wear rate

The U30 10N, 20N, 30N specific wear rate graphs are as follows



(a)

Retrieval Number: A10701291S419/2019©BEIESP
DOI:10.35940/ijeat.A1070.1291S419
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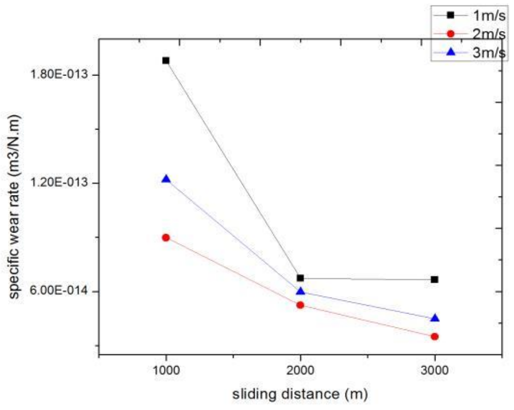
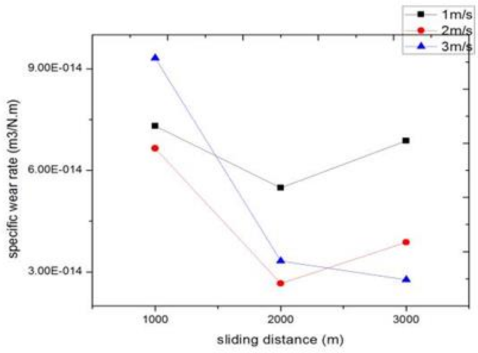


(b)



(c)

Fig.4 Effect of fiber loading on the specific wear rate of composites (a). 10N (b). 20N (c).30N

C. Microscopic image.

The wear surface of specimen microscopic image (Fig 5) is shown in the magnification of higher and lower for 30 N, 3 m/s condition. The figure shows that the worn surface of the fiber and indicates the wear debris

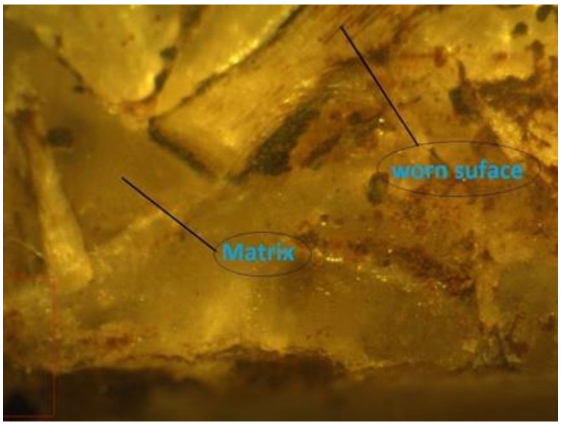


Fig 5. Micropic view of worn sample.

IV. CONCLUSION

The following conclusions are made
a). The composites are made by using the compression moulding technique.
b).In wear test, for the testing condition 30 N and 3 m/s, whenever the sliding distance increases the COF also increased linearly.

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AUTHORS PROFILE

Dr. G. Kalusuraman is currently working as Associate Professor in the Department of Mechanical Engineering, Kalasalingam Academy of Research and Education, Anand nagar, Krishnankoil-626126, India He has 10 years teaching as well as research experience. He is a reviewer for two reputed journals He is a Member of Indian Society for Technical Education. His area of interests are polymer composite, materials characterization, tribology.

Dr. I. Siva is currently working as Professor in the Department of Mechanical Engineering, Kalasalingam Academy of Research and Education, Anand nagar, Krishnankoil-626126,India He has 15 years teaching as well as research experience. He is a reviewer more than 10 reputed journals He is a Member of Indian Society for Technical Education .His area of interests are polymer composite, materials characterization, tribology..