Dry Sliding Wear Behavior of Coconut Spathe Fibre Reinforced Epoxy Composites

S.Karthik\textsuperscript{1*}, V.P.Arunachalam\textsuperscript{2}
\textsuperscript{1}Asst Professor, Dept. of Mech Engg, Sri Krishna College of Engg. and Tech, Coimbatore-641008, Tamil Nadu
\textsuperscript{2}Professor, Dept. of Mech Engg, SNS College of Technology, Coimbatore-641035, Tamil Nadu
*Corresponding author E-Mail ID: karthik.prince20@gmail.com, Mobile: 9788719854

Abstract
The present work depicts the effect of alkali treated Coconut Spathe fibre reinforced with epoxy composites. Dry sliding wear behavior of the composites is studied by varying the volume fraction of the fibre/matrix. Increase in fibre volume fraction contribute to improved wear of the composite samples and 25\% Vf is found to be optimal fibre volume fraction for this study. SEM analysis revealed that micro cracking, interfacial de-bonding and micro ploughing are the possible wear mechanism which governs the wear behavior of the composites.

1.Introduction

International Journal of Pure and Applied Mathematics
Volume 119 No. 12 2018, 2251-2258
ISSN: 1314-3395 (on-line version)
url: http://www.ijpam.eu
Special Issue
and Coir Fibre Reinforced Polyester Composites. Pramendra et al [6] studied the wear and dynamical mechanical behavior of jute/flax/hemp reinforced hybrid composites for Tribological application. Extensive literatures has been reported on polymer composites with different parameters like sliding distance, fibre content, abrasive particle size, chemical treatment on fibre surfaces[7,8,9]. Dhivya et al[10] studied the effect of alkali treatment of coir fibre reinforced hybrid composites. The extensive literature review reveals that there is scope to work on chemically modified fibres and their effect on dry sliding wear condition. In this regard an attempt has been made to study the wear behavior of alkali treated coconut spate fibre reinforced with epoxy resin and to understand the the effect of fibre volume fraction on different load conditions of the composites.

2. Materials and methods
In this current work fibres extracted from Coconut Spathe is used for reinforcement with polymer matrix. Epoxy Resin LY556 and hardener HY951 is used as matrix for this work.

2.1 Alkali treatment of fibers
The extracted fibres are subjected to alkali treatment with 5% of NaOH[11] solution. The surface of the fibers reacts with alkali solution which results in removal of hydroxyl group present in the fibres. Then the fibres are washed thoroughly with distilled water and dried under room temperature to remove the alkali content present in the fibre.

2.2 Composite fabrication
The chemically modified fibres are reinforced with epoxy resin and hardener for different volume fractions such as 10, 15, 20, 25 and 30 Vf. Steel moulds are used to fabricate cylindrical pin type specimens of length 35mm and diameter of 10mm. Figure.1 shows the steel moulds used for fabrication and the specimens fabricated.
2.3 Sliding wear test
The fabricated composite samples are subjected to sliding wear test using pin on disc test setup. The rotating disc is made up of EN32 hardened with a surface roughness of 0.6µm Ra and 72 HRC. Figure 2 shows the wear test setup used for this research work. The wear test was carried out at constant sliding velocity of 1.4m/s by varying the load from 10N to 30N.
3. Results and Discussions

3.1 Sliding wear
Dry sliding wear behavior of the above prepared composite samples are tested under different load conditions and it was found that increase in fibre volume fraction resulted in improved wear resistance. Figure 3 shows the wear behavior of the composite samples under different loading conditions. It was found that upto 25% Vf there was improvement in wear and beyond that decrease in wear was observed. This is due to insufficient matrix distribution which results for reduced wear.

![Graph showing wear behavior under different loads](image)

**Fig.3 Effect of Load on wear vs Fibre Volume fraction**

3.2 Morphology Analysis
The surface morphology of the wear specimens are analyzed with the help of scanning electron microscope. In general the wear mechanism is governed by three different mechanisms such as micro ploughing[12], micro cutting[13] and micro cracking[14]. Due to improper compatibility between fibre and matrix, fibre pullouts were observed which is shown in figure 4a as a result reduced wear was observed. With further increase in load (30N) severe damage was produced by fracture as a result matrix crack was observed which is shown in figure 4b. Figure 4c depicts

![Graph showing wear behavior under different loads](image)
effective bonding between fibre and the matrix due to alkalization of fibre surfaces as a result reduced cavity formation was observed.

Fig.4 a) SEM Image of wear specimens indicating fibre pullout b)Matrix crack c)Reduced cavity formation

4. Conclusion
Based on the dry sliding wear behavior of Coconut Spathe fibre reinforced epoxy composites the following observations are derived.

- Increase in fibre volume fraction the wear resistance of the composites can be improved significantly.
- Alkali treatment of the fibre resulted in improved interfacial bonding between fibre/matrix.
- The chemical treatment on the fibre surface restricted crack to propagate which in turn improved the wear resistance of the composites.
- The surface morphology analysis has revealed the cause of wear such as micro cracking, micro ploughing and fibre/matrix de-bonding.
Reference
