# Improvement on Mechanical and Dynamic Properties of Palm Fiber/Pla Composites by Fiber Treament

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**Abstract**
In this work, oil palm empty fruit bunch (OPEFB) reinforced polylactic acid composites were fabricated by hot-compress. The OPEFB fibers were treated by γ- aminopropyl trimethoxysilane (APS) and coated with polylactic acid (PLA) in varied percentage (5%, 10% and 15%). The treatment reaction was analyzed by FTIR and the effect of fiber treatment on the flexural and dynamic mechanical properties of OPEFB/PL composites were examined. The flexural properties of composites were increased with increasing of fiber coating and improved by introduction of APS. It was also observed that the APS treated fibers had improved the dynamic mechanical properties of the composites respectively.

**Keywords**: Fibre treatment; Biodegradable composite

## Introduction

In regards to environment, the focus to explore the beneficial of natural fibers has become great demand. Compared to the inorganic fibers, natural fibers are low density, recyclable, biodegradable and have relative high strength and stiffness [1]. Thus they had created a potential to be used in composite application. However the major drawback in natural fiber composites is related to interaction between natural fiber and matrix. Since the properties of composites are influenced by adhesion fiber-matrix, therefore a treatment to improve this interaction is really needed [2].
In this research, composites were prepared from polylactic acid (PLA) in combination with oil palm empty fruit bunch fiber (EFB). The objective is to characterize the mechanical and dynamic properties of composites, influenced by fiber treatment and coating.

## Experimental

Composites having 3 mm thickness were prepared by sandwiching the fiber mat between two layers of polylactic acid (PLA) sheets using hot-compress. Prior to hot-compress, fiber mat was treated with 1% γ-aminopropyl trimethoxysilane (APS) and coated with various compositions of PLA (5%, 10% and 15%).
Flexural test were performed on the composites using Tensilon/UTM-4 machine based on standard JIS K7203 and the dynamic mechanical test was carried out in the flexural mode by using DMS110 (Seiko Electronic Ltd)

## Results and Discussions

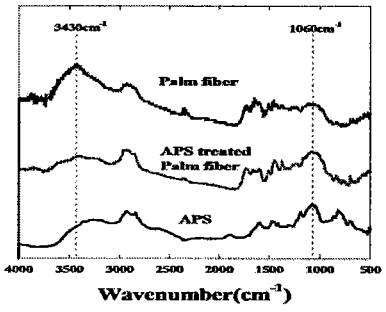


Fig.1 IR spectrum of palm fiber, APS treated palm fiber and APS

The reaction of fibre treatment has been observed by FTIR. Figure 1 shows the IR spectrum of palm fiber; APS treated palm fiber and APS only. The peak of SiO ($3430cm^{-1}$) is observed on treated fibre and the peak of OH ($1060cm^{-1}$) is disappeared reveal the reaction occurred after the APS treatment.
Fig. 2 and 3 show the effect of fiber treatment by APS on the flexural properties of EFB/PLA composites. It can be seen that

the treated composites show higher flexural strength and modulus compared to the untreated composites, resulted from better stress transfer from matrix to fiber due to good bonding between the matrix and fiber [3].

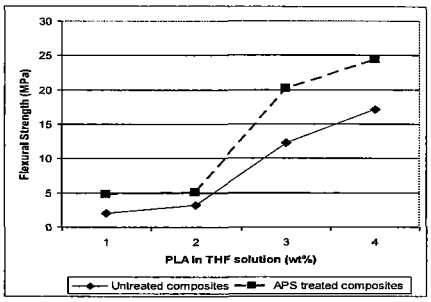


Fig. 2: Flexural strength of untreated palm/PLA and treated palm fiber/PLA composites.

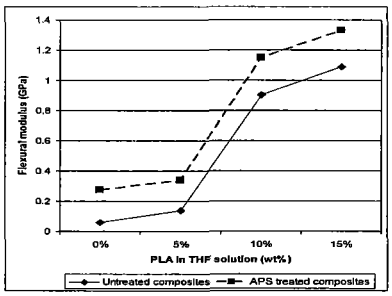


Fig. 3: Flexural modulus of untreated palm/PLA and treated palm fiber/PLA composites.

The effect of APS fiber treatment on dynamic properties is shown in Fig. 4 and 5. The second tan δ peaks of composites with 10% and 15% of PLA coating in Fig. 5 are observed shifted from 100°C to 120°C as incorporation of APS fiber treatment indicating a greater interfacial adhesion between fiber and matrix which decreases the polymer chain mobility [3].

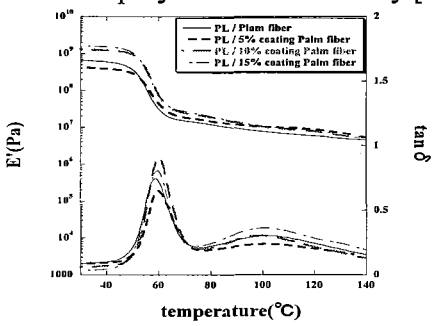


Figure 4: Effect of fiber coating on storage modulus and tan δ of palm fiber/PLA composites without APS fiber treatment.

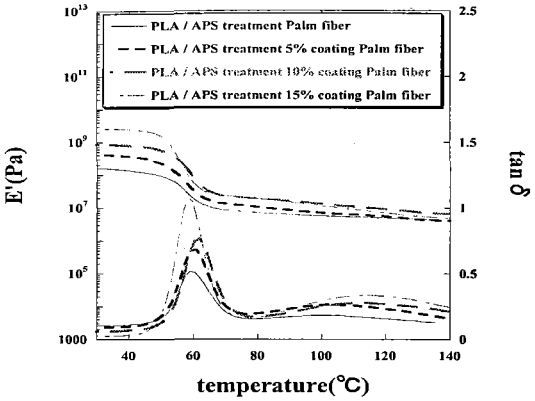


Figure 5: Effect of fiber coating on storage modulus and tan δ of palm fiber/PLA composites with APS fiber treatment.

## CONCLUSIONS

The APS treatment on fiber is contributed to improve the interfacial reaction between matrix and fiber and increased the mechanical and dynamic mechanical properties of composite.

## REFERENCES

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