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Effect of Steam Treatment On the Characteristics of Oil Palm Empty Fruit Bunch and Its Biocomposite

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EXTENDED ABSTRACT

The amount of wasted product from petroleum-based plastic in landfill has increased and currently, it lead to the environmental problem because it is not easily to degrade. Biocomposite is an alternative material that can be produced to reduce the usage of petroleum-based plastic [1]. The objective of this study is to determine the properties of biocomposite prepared from steam treated oil palm empty fruit bunch (EFB) with polypropylene (PP).

In this study, the EFB were treated with steam treatment at 120 °C for 30 min (Steam 30) and 60 min (Steam 60) by using autoclave to modify the fiber composition. Comparison were done with alkaline treatment of 5 wt% NaOH (NaOH). The treated and untreated EFB were characterized by using TGA and SEM to determine the thermal stability and surface morphology of the fibers. Biocomposite were prepared from treated and untreated EFB with PP at different fiber content (10 and 30 wt%) to find the right formulation of fiber and polymer. The biocomposite prepared using extruder and were pressed to sheet by hot press machine at 180 °C. Determination of tensile properties, thermal stability, morphology and water absorption of the EFB/PP biocomposites were studied.

Results showed steam treatment for Steam 30 sample partially removed silica bodies and other impurities without damaging the surface of EFB. The thermal stability for Steam 30-EFB improved to 283 °C compared to untreated EFB having thermal stability of 276 °C. Treated EFB is more stable compared to untreated EFB due to the partial removal of hemicellulose and lignin [2; 3]. Biocomposite prepared from Steam 30 had the highest mechanical properties compared to other samples i.e. untreated, Steam 60 and NaOH treatment. Hydrophobicity of treated fiber were improved especially for Steam 30 makes the physical interaction of fiber and polymer increased [4]. The tensile strength for Steam 30 with 10 wt% and 30 wt% of EFB loading was increased for 23.9% and 23.8%, respectively compared to untreated EFB/PP biocomposite. Steam 30 of EFB/PP biocomposite with 30 wt% fiber had the lowest water absorption which was 5.6% compared to untreated biocomposite having water absorption of 7.2% as shown in Fig 1. Eliminating hydrophilic hydroxyl groups from the fiber structure lead to decrease the water absorption of biocomposite [5].

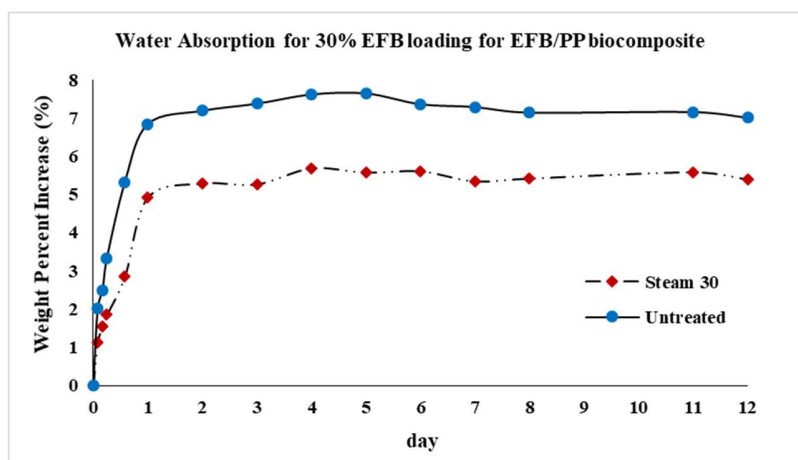


Fig. 1: Water Absorption for 30 wt% of EFB loading for untreated and Steam 30 EFB/PP biocomposite

In conclusion, this study shows that steam treatment able to improve the characteristic of EFB and lead to increase the compatibility between fiber and polymer. This will give the value added to the agricultural biomass to be used as filler in biocomposite production.

Keywords: Empty Fruit Bunch (EFB); Polypropylene (PP); Steam Treatment; Biocomposite; Alkaline Treatment.

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