



# Effect of ultrasonication on alkaline treatment of empty fruit bunch fibre: Fourier Transform Infrared Spectroscopy (FTIR) and morphology study

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## ABSTRACT

This study highlights the usage of ultrasonication method in NaOH surface modification of empty fruit bunch (EFB) fibre. Fibres were characterized by Scanning Electron Microscopy (SEM) and Fourier Transform Infrared Spectroscopy (FTIR). The EFB treated by ultrasonication assisted alkali treatment shows better morphology with smoothed surface and less impurities. Furthermore, it was found that disappear of peak between 2900 and 1700 cm<sup>-1</sup> (C–H) evidenced the removal of hemicellulose on EFB fibre surface by alkali treatment. Moreover, Ultrasonication assisted alkali method illustrate the excellent value in enhancing the tensile stress of EFB fibre compared to other technique. The results suggest that ultrasonication assisted alkali treatment have the potential to be used in industry as the surface modification method.

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## 1. Introduction

In Malaysia, there are more than 5,000,000 ha of oil palm were cultivated and making the country world's largest exporter of oil palm [1]. Approximate 93 million tonnes of EFB fibres are produce per year. Empty fruit bunch (EFB) fibre is one of the lignocellulose biomass waste from palm oil industry, conventionally it used as energy sources in boiler [2]. EFB fibres have the properties like light weight, nonabrasive and biodegradable which suitable to be used as reinforcing agent for plastic and composite application [3]. However, hydrophilic native property of EFB fibre leads to weak interface due to poor interfacial adhesion between EFB fibre surface and polymer matrix [4]. In order to overcome the drawbacks, surface treatment of EFB fibre is required such as physical and chemical treatments, to modify the surfaces by increasing surface roughness and remove impurities. Moreover, the surface modification

treatment could enhance the number of hydroxyl groups active side or incorporate new functional groups, which enhance the bonding ability between fibre surface and matrix.

Ultrasonication assisted method could further improvise the mechanism of surface modification, where ultrasonication creates strong and irregular environmental chemistry in the solution through the generation of numerous tiny cavities that possible to expand and implode [5]. As a series of ultrasonic waves are produced to flow through the solution, this phenomenon creates a significant amount of heat. Ultrasonication technique can lead to fibre refining, regulated residual compressive stress and fibre size reduction, all of which are beneficial for improving mechanical strength of natural fibre reinforced materials. The influence of ultrasonication involves both physical and chemical effects [6].

This study emphasized on morphology of different EFB fibre treatment through Scanning Electron Microscopy (SEM). Fourier Transform Infrared Spectroscopy (FTIR) technique was used to investigate the ultrasonication influence in EFB fibre alkaline treatment. Furthermore, the fibre strength was measured by using universal testing machine and tensile strength was recorded.

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