

## **Enhancement of the mechanical properties and dimensional stability of oil palm empty fruit bunch-kenaf core and oil palm mesocarp-kenaf core hybrid fiber-reinforced poly(lactic acid) biocomposites by borax decahydrate modification of fibers**

### **ABSTRACT**

The surfaces of kenaf core fiber (KCF), oil palm empty fruit bunch fiber (EFBF), and oil palm mesocarp fiber (OPMF), were chemically modified using 5 wt.% aqueous sodium tetraborate decahydrate (borax) solution to enhance their hybrid fiber interface bonding with a polylactic acid (PLA) matrix. The untreated fibers (KCF, EFBF, and OPMF) and treated fibers (BXKCF, BXEFBF, and BXOPMF), were examined using chemical analysis, Fourier transform infrared (FTIR) spectroscopy, and scanning electron microscopy (SEM). The treatment caused minimal removal of lignin and significant elimination of hemicellulose and waxy substances. The treated and untreated KCF (5%), as a secondary fiber, was randomly mixed, respectively, with treated and untreated EFBF and OPMF (55%), melt-blended with PLA (40%), and subsequently compression-molded to form hybrid fiber-PLA biocomposites. The resulting composite is aimed to exhibit improvements in its mechanical properties and dimensional stability. The optimum results for tensile and flexural properties, as well as water uptake and thickness swelling, were observed for the borax-treated fibers in comparison with the untreated fibers. The BXEFBF-BXKCF-PLA biocomposites exhibited the best results. This work demonstrated that aqueous borax modification of natural fibers could offer a possible option to the most common mercerization method.

**Keyword:** Borax decahydrate; Oil palm empty fruit bunch fiber; Oil palm mesocarp fiber; Kenaf core fiber; Poly(lactic acid); Hybrid biocomposite