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RESEARCH ARTICLE

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# Cellulose fiber from date palm petioles as potential reinforcement for polymer composites: Physicochemical and structural properties

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**Abstract**
First time, this study reports the effect of benzoyl chloride (BC), potassium permanganate (PP), and stearic acid (SA) treatments on the surface morphology, physical, chemical, structural, mechanical, and thermal properties of cellulosic fiber obtained from date palm plant petioles. Morphology analysis displayed the existence of protrusions on treated fiber surface, which stimulates the mechanical interlocking between the fiber and polymer matrix. Highest cellulose (67.22%) and lowest hemicellulose (9.25%), lignin (14.02%), ash (3.25%), wax (0.10%), and moisture (8.93%) content were observed in SA-treated fibers than others. Similarly, highest weight loss (20.80%), reduced diameter (0.3166 mm), and density (0.389 g/cc) were obtained in SA-treated fibers than the other fibers investigated. Outcomes of FT-IR spectra evident the presence of cellulose and partial removal of non-cellulosic constituents in BC-, PP-, and SA-treated fibers. Enhanced crystallinity index (69.5%) and crystallite size (7.43 nm) values of SA-treated fiber indicated the elimination of amorphous lignin and hemicellulose, and made the structure to be more crystalline which supports to obtain higher tensile properties (tensile strength of 489.07 MPa and tensile modulus of 9.4 GPa) than others. Maximal degradation temperature of SA-treated fiber was 328.86°C and also having kinetic activation energy of 90.7 kJ/mol.

**KEYWORDS**
Broido's plot, cellulose fiber, chemical treatments, mechanical and thermal properties, Weibull analysis

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