Digital Image Correlation: Displacement Measurement Tool for Grape Cane Fibers

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*Abstract:* Displacement for tensile test of plant fibers is often measured indirectly by using the crosshead movement of Universal Testing Machine (UTM), incorporating the system compliance (Cs) correction following ASTM C1557-14. In addition, this method must carry out at three different gage lengths of the same material to establish the Cs correction values. Digital Image Correlation (DIC) is another measurement tool commonly used in composite material and has the potential to be used to measure the displacement of a single fiber bundle of plant fibers. Therefore, the objective of this study is to characterize the tensile properties of alkali-treated grape cane fibers at three concentration levels, measured by two different displacement methods. The treatment concentrations were labelled as N1, N3, and N5, respectively. The grape cane fibers were categorized into two fiber types, namely outer bark (OB) and inner bark (IB). Sample preparation for the DIC method and fiber elongation during the test to determine Young’s modulus will be highlighted. In general, treatment concentration influenced the tensile properties of grape cane fibers, regardless of the fiber types. Lower treatment concentrations resulted in better overall tensile properties. OB fibers had approximately six times higher tensile properties than IB fibers. Comparing the displacement methods to calculate Young’s modulus of these fibers, the DIC method produced better measurement with less variation when compared with the Cs method. The findings from these results showed that the DIC method can be one of the measurement methods for single bundles of plant fibers. In addition, this method can significantly reduce the number of test specimens and testing time.

*Keywords: digital image correlation, alkali treatment, tensile properties, bark fibers, non-wood fibers, agricultural waste, single-fiber tensile test*