

Effects of Heat Treatment on the Mechanical Properties of Kenaf Fiber

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Abstract : Natural fibers have wide variety of uses (e.g., rope, paper, and building materials). One specific application of it is in the field of composite materials (i.e., green composites). Huge amount of research are being done in this field due to rising concerns in the harmful effects of synthetic materials to the environment. There are several natural fibers used in this field, one of which can be extracted from a plant called kenaf (*Hibiscus cannabinus* L.). Kenaf fiber is regarded as a good alternative because the plant is easy to grow and the fiber is easy to extract. Additionally, it has good properties. Treatments, which are classified as mechanical or chemical in nature, can be done in order to improve the properties of the fiber. The aim of this study is to assess the effects of heat treatment in kenaf fiber. It specifically aims to observe the effect in the tensile strength and modulus of the fiber. Kenaf fiber bundles with an average diameter of at most 100µm was used for this purpose. Heat treatment was done using a constant temperature oven with the following heating temperatures: (1) 160°C, (2) 180°C, and (3) 200°C for a duration of one hour. As a basis for comparison, tensile test was first done to kenaf fibers without any heat treatment. For every heating temperature, three groups of samples were prepared. Two groups of which were for doing tensile test (one group was tested right after heat treatment while the remaining group was kept inside a closed container with relative humidity of at least 95% for two days). The third group was used to observe how much moisture the treated fiber will absorb when it is enclosed in a high moisture environment for two days. The results showed that kenaf fiber can retain its tensile strength when heated up to a temperature of 160°C. However, when heated at a temperature of about 180°C or higher, the tensile strength decreases significantly. The same behavior was observed for the tensile modulus of the fiber. Additionally, the fibers which were stored for two days absorbed nearly the same amount of moisture (about 20% of the dried weight) regardless of the heating temperature. Heat treatment might have damaged the fiber in some way. Additional test was done in order to see if the damage due to heat treatment is attributed to changes in the viscoelastic property of the fiber. The findings showed that kenaf fibers can be heated for at most 160°C to attain good tensile strength and modulus. Additionally, heating the fiber at high temperature (>180°C) causes changes in its viscoelastic property. The results of this study is significant for processes which requires heat treatment not only in kenaf fiber but might also be helpful for natural fibers in general.

Keywords : heat treatment, kenaf fiber, natural fiber, mechanical properties

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