Abstract No: PO-05

A study on mechanical properties of a polymer composite based on areca nut fiber

H. A. C. Madubhashani[1*], V. A. Senaviratne[1] and B. M. K. Pemasiri[1]

[1]Department of Physics, University of Peradeniya, Sri Lanka
chathurikamadubashini95@gmail.com*

Plant-based raw food items such as fruits and vegetables are damaged during storage and transportation due to high temperatures, water vapours, mechanical shocks and vibrations, microorganisms, etc. This study is aimed at developing a packaging material using areca nut fibers and Chemifix as an effective substitute for available packaging materials. The areca nut husks were used to extract the fibers. The fibers were extracted by the retting process, and the extracted fibers were subjected to alkali treatment. The samples were made by combining Chemifix with areca nut fibers in various ratios to obtain 0% wt, 9% wt, 11% wt, 14% wt, 20% wt, 25% wt, and 30% wt fiber content in the prepared composite samples. A pure Chemifix sheet and commercially available cardboard, gypsum, and medium-density fiberboard (MDF) were used as reference materials. The prepared composite samples' density, thermal conductivity, water absorption, Young's modulus, tensile strength, and elongation were measured and compared with those of the reference samples. The density and thermal conductivity of the composite samples with 20%, 25%, and 30% areca nut fiber weight percentages ranged from 350 to 700 kg m^{-3} and 0.2 to 0.3 W m^{-1} K^{-1}, respectively. The density and thermal conductivity of the reference samples (0% wt) were 1372 kg m^{-3} and 0.78 W m^{-1} K^{-1} respectively. 9% wt and 11% wt fiber containing composite samples showed high resistance to water absorption. The other four composite samples absorbed more water than 100% of the sample mass. However, a low water absorption rate was present in all composite samples than in the commercial samples tested in this study except gypsum board. Young's modulus and breaking point of samples with 20% wt, 25% wt and 30% wt were in order of 10^8 N m^{-2} and 10^7 N m^{-2} respectively. The elongation of the samples decreased with the increasing fiber content. The reference sample (0% wt) had an elongation exceeding 100%. This study reveals that the prepared composite samples with a moderate fiber content (20%) show promising properties suitable for the storage and transportation of raw plant products.

Keywords: Areca nut fibers, Bio composite, Chemifix, Packaging material, Thermal conductivity.