

## Investigation on the microwave properties of kenaf and rice-husk fiber reinforced PLA composite utilizing one-port coaxial transmission line reflection method

### ABSTRACT

The paper investigates the microwave properties of natural fiber reinforced biodegradable plastic composites in order to recognize their potential as alternatives to common printed circuit board (PCB) for electronic communication industries. Thus, the paper reports on measured dielectric properties for two new composites under study: Kenaf/Poly Lactic Acid (PLA) and rice husk/PLA and their results are compared. The sample is made from equal weight percentage loading (50% wt - 50%wt) of kenaf and PLA. Another sample has also equal weight percentage loading (50% wt - 50%wt) of rice husk and PLA. The complex dielectric permittivity ( $\epsilon = \epsilon' - j\epsilon''$ ) and loss tangent ( $\tan \delta$ ) of the two samples of natural fibers plastic composites have been studied in the frequency range of 500 MHz to 10 GHz. The dielectric permittivity is measured by scattering parameter (S-parameter) using a Vector Network Analyzer (VNA). The concentration dependence of permittivity and loss tangent is analyzed for each sample. It is observed that from 500 MHz to 3.32 GHz, real permittivity ( $\epsilon'$ ) values are consistent throughout the wide frequency range, at approximately 3.3. However, the permittivity seems to decrease at higher frequencies starting from 3.35 GHz for both samples, down to 2.5 at 10 GHz. Measured results show that kenaf/PLA mixture has higher permittivity ( $\epsilon'$ ) than the rice husk/PLA composite across the wide frequency range. Meanwhile, loss tangent ( $\tan \delta$ ) is low and remains similar for both types of fiber compositions.

**Keyword:** Microwave property; Coaxial transmission lines; Biodegradable plastics; Fiber reinforced