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The investigation on the potential of coconut shell powder composite in term of carbon composition, surface porosity and dielectric properties as a microwave absorbing material

Abstract

Agricultural wastes are renewable resources that are potentially useful as microwave absorbing materials. This paper presents the investigation on the carbon composition, surface porosity of the raw coconut shell powder particles and the dielectric properties of coconut shell powder with epoxy resin matrix composites. From CHNS elemental analysis, it was found that the carbon composition of coconut shell powder is 46.700%. Presences of macropores (≈ 2μm) were detected in the SEM analysis of the coconut shell powder particles. Measurement on dielectric properties of the coconut shell powder composites was performed by using open-ended coaxial probe method over microwave frequency range of 1-8 GHz. The overall dielectric constant (εr') and dielectric loss factor (εr") of the composite with ratio 50:50 were 3.56 and 0.26, ranging from 3.35-3.76 and 0.21-0.30 respectively; whereas for composite ratio 40:60, the overall dielectric constant (εr') and dielectric loss factor (εr") were 2.97 and 0.21, ranging from 2.74-3.17 and 0.16-0.27 respectively. The electrical conductivity calculated based on measured εr" was 0.067 and 0.054 for composite ratio 50:50 and 40:60 respectively. The dielectric properties and electrical conductivity of the coconut shell powder composites were influenced by the greater presence of high dielectric material (coconut shell powder). This experimental investigation on the potential of the coconut shell powder with epoxy resin composites indicates that the ability of the composite to absorb and convert microwave signals is dependent on the carbonaceous materials of the composite. This result offers a great opportunity to diversify the use of coconut shell powder as microwave absorbing material.

Keywords; Carbon composition; Coconut shell powder; Dielectric properties; Macropores; Microwave absorbing material