Evaluation of Physical and Mechanical Properties of Polylactide/Rice Hull Filled Composite Plates

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Abstract

The influences of rice hull modification and content on the physical and mechanical properties of the polylactide (PLA) composite plates have been investigated in this paper. The rice hull was prepared by soda cooking at 170°C for 60 min and by crushing with a hammer miller. The mixture of the PLA and the rice hull was compounded in the extruder in the presence of fixed amounts of maleic anhydride and dicumyl peroxide. This was followed by compression moulding of the mixture under vacuum for 5 minutes in the Fortune Press to produce approximately 2 mm thick composite plates. The composite plates produced were subjected to flexural and tensile tests using the Instron while the morphology of the fractured surfaces was investigated by scanning electron microscopy. The results revealed that crushed and soda cooked rice hulls both acted predominantly as rigid fillers in the PLA matrix. Their presence did not impart any improvement of the strength of the composite plates. However, the tensile and flexural moduli of the composite plates were found to improve up to 0.46 and 1.1 GPa, respectively, due to addition of the rice hull fillers. The composite plates made of the rice hull pulps generally exhibited higher flexural properties than those produced from ground rice hulls as demonstrated by statistical analysis. This was due to enhancement of chemical interaction between the chemically modified rice hulls and the PLA matrix as also revealed on the nature of the fractured surfaces by SEM. The tendency of the composite plates to exhibit brittle failures was demonstrated by abrupt tensile fractures at lower strains