Flax-Fabric-Reinforced Arylated Soy Protein Composites: Brittle-Matrix Behavior

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ABSTRACT: Biocomposites were successfully prepared by the reinforcement of soy protein isolate (SPI) with different weight fractions of woven flax fabric. The flax-fabric-reinforced SPI-based composites were then arylated with 2,2-diphenyl-2-hydroxyethanoic acid (DPHEAc) for 4 h to obtain arylated biocomposites. A new method was proposed to determine the amount of carbon dioxide evolved during the arylation of the soy protein in the presence of DPHEAc. Characterizations of the arylated and nonarylated biocomposites were done by Fourier transform infrared spectroscopy, thermogravimetric analysis, and dynamic mechanical thermal analysis. The results indicate that the arylated soy-protein-based composites exhibited mechanical behavior like brittle-matrix composites, which differentiated them from nonarylated soy-protein-based composites, which showed mechanical behaviour similar to polymer–matrix composites. In the arylated composites, there was clear evidence of a stick–slip mechanism, which perhaps dominated and, therefore, prevented easy deformation of the reinforced film. Scanning electron microscopy studies revealed cracks in the arylated soy protein composites when they were subjected to tensile tests.

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