Characterisation of alkaline treatment and fiber content on the physical, thermal and mechanical properties of ground coffee waste/oxo-biodegradable HDPE Biocomposites

Ming Yee Tan[1], Hoo Tien Nicholas Kuan[1*], Meng Chuen Lee[1]

[1]Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

*khtnicholas@unimas.my

Abstract

Effect of alkali treatment on ground coffee waste/oxo-biodegradable HDPE **(**GCW/oxo-HDPE) composites was evaluated using 5%, 10%, 15% and 20% volume fraction of GCW. The composites were characterize using structurally (fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM)), thermally (thermogravimetry analysis (TGA) and differential scanning calorimetry (DSC)), mechanically (tensile and impact test), and water absorption. FTIR spectrum indicated the eradication of lipids, hemicellulose, lignin and impurities after the treatments the lead to an improvement of the filler/matrix interface adhesion. This is confirmed by SEM results. Degree of crystallinity index was increased by 5% after the treatment. Thermal stability for both untreated and treated GCW composites were alike. Optimum tensile result achieved when using 10% volume fraction with enhancement of 25% for tensile strength and 24% for tensile modulus compared to untreated. Specific tensile strength and modulus had improved as the composite has lower density. The highest impact properties was achieved when using 15% volume fraction that lead to an improvement of 6%. Treated GCW composited show a better water resistance with 57% improvement compared to untreated. This light weight and ecofriendly biocomposite has the potential in packaging, internal automotive parts, lightweight furniture and other composite engineering applications.

Keyword: ground coffee waste, composite materials, mechanical testing, thermal properties, oxo-biodegradable polymer