THE MORPHOLOGY AND PROPERTIES OF EVA/MALAYSIAN EMPTY FRUIT BUNCH COMPOSITES

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ABSTRACT

Composites based on ethylene vinyl acetate copolymers (EVA18 and EVA28) containing different vinyl acetate (18 and 28% VA) contents and empty fruit bunch (EFB) fibre were studied in this project. The EVA-EFB composites were prepared by melt mixing using a Brabender Plastograph mixer. The structure and morphology of the composites were characterized using scanning electron microscopy (SEM) and Fourier-transform infrared (FTIR) spectroscopy. The SEM results showed an improved extent of interfacial adhesion between the polymer and the fibre with an increase in the amount of vinyl acetate in the copolymers. The DSC results revealed that the melting and crystallization enthalpies decreased significantly with increasing VA content, while the presence of EFB fibre had very little influence on the melting and crystallization behaviour of both EVA18 and EVA28. The thermogravimetric analysis showed that EVA18 is more thermally stable than EVA28 due to the larger amount of VA in EVA28, which increases the amorphous phase in the semi-crystalline material. The decomposition of EFB fibre seems to be retarded when incorporated into the EVA copolymers. Dynamic mechanical analysis (DMA) revealed that both the storage modulus and loss modulus decreased significantly with an increase in vinyl acetate content, and that these two properties observably increased with the incorporation of the fibre. The glass transition temperature also increased observably with increasing fibre loading, and decreased with an increase in the vinyl acetate content. The stress and strain at break showed a similar decrease with increasing fibre content for both EVA18 and EVA28, while Young's modulus increased much more significantly with increasing fibre content for EVA28. The reasons for this are (i) the very low Young's modulus of EVA28 compared to that of EVA18, and (ii) the slightly better interaction between EVA28 and the fibre because of the higher VA content of this copolymer. Generally it seems as if the improvement in interaction between EVA28 and EFB was not significant enough to overcome the inherent weak properties of EVA28, and that in this case it is probably better to use EVA18 when EVA/EFB composites with good properties are needed.