**UNIVERSITI TEKNOLOGI MARA**

# PERFORMANCE OF ETHYL VINYL ACETATE/LOW DENSITY POLYETHYLENE/NANO MAGNESIUM HYDROXIDE VIA ULTRASONIC COMPOUNDING

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# ABSTRACT

The effects of nano-MH loading on mechanical and thermal properties of EVA/LDPE/nano-MH at different ultrasonic frequency were studied. The best formulation was selected based on the distribution of nano-MH loading and ultrasonic frequency. A range of nano-MH loading which is from 0 pph to maximum of 20 pph with ultrasonic extrusion 0 kHz, 50 kHz and 100 kHz frequencies have been used in order to improve the mechanical and thermal properties as well as flame retardancy ability. It was found that, 10 pph of nano loading with 100 kHz ultrasonic assisted has greater mechanical properties compared to the nanocomposite without ultrasonication. Further increased of nano-MH loading, decreased the mechanical properties. From the overall evaluation of mechanical properties, it was found that 10 pph of nano-MH has shown the best performance among all the samples tested for the EVA/LDPE/nano-MH composites. Melt Flow Index (MFI) test shows that the higher the amount of nano-MH loading in the EVA/LDPE blends, the lower the MFI values, indicating low mobility of the melted sample flows through the nanocomposite blending. It was observed from Scanning Electron Microscopy (SEM) that 10 pph of nano-MH loading has better dispersion compared to other loading of nano-MH based on the distribution of the nano-MH in the blending while sample with 100 kHz frequency shows more uniform dispersion of nano-MH among all the EVA/LDPE composites tested analysed using Transmission Electron Microscopy (TEM). Increasing the nano-MH loading for 100 kHz improved the degradation temperature and increased in char residual percentage as indicated by the TGA results and a better process and phase stability evidence was captured in the DSC test. Hence, 10 pph of nano-MH loading with ultrasonic frequencies of 100 kHz was selected as the best formulation to be proceed with radiation process at varying dose from 0 to 150 kGy for further improvement. The effect of irradiation on the degree of crosslinking formed in the nanocomposite was analysed by using Gel Content test. It was observed that, the gel content increased as the radiation dosage increased indicating that application of irradiation has shown to be effective in crosslinking formation of EVA/LDPE/nano-MH blends. The mechanical and thermal properties of the radiated samples were also analysed. It shows that increasing the dosage of irradiation will increase the tensile strength but only up to 100 kGy and it starts to decrease when the dose increased to 150 kGy. Similar trend of result was also observed for the flexural strength.  Increasing the irradiation dose resulted in reduction in elongation at break and izod impact. Therefore, from the overall mechanical and thermal properties analysis, the radiation effects have improved the performance of the nanocomposite as it produced the crosslinking. Flame retardancy analysis was done using Limiting Oxygen Index (LOI) and UL-94 test. It appears that limiting oxygen index increased with increasing of irradiation dosage in EVA/LDPE/10 pph nano-MH loading. The UL-94 test shows that the sample with 10 pph, 100 kHz frequency and 150 kGy dose has the best flame retardancy behaviour. As a conclusion, this study has demonstrated that ultrasonic method can enhance the dispersion of nano-MH loading and electron beam irradiation treatment on the EVA/LDPE/nano-MH blends could enhance the mechanical, thermal and flammability properties of the nanocomposite.

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