Improving physicochemical properties of ENR/PVC thin film filled cellulose fibre

ABSTRACT

The composite thin film has a lot of potential and is particularly ideal owing to its unique characteristics such as good cross-link, high strength, and durability. The goal of this research was to create a flexible composite thin film of epoxidized natural rubber with polyvinyl chloride-filled cellulose (ENR/PVC/Cell). ENR/PVC thin films were fabricated using solution blending and phase inversion technique with the ratio of ENR: PVC 60:40 wt. %. Cellulose filler addition was varied at 1 %, 5 %, 10 %, 15 % and 20 % w/v. Physicochemical characterizations were carried out by Fourier transform infrared spectroscopy (FTIR), variable pressure scanning electron microscopy (VPSEM), thermogravimetric analysis (TGA) and mechanical properties (tensile strength). The comparison study of filler, metrics and thin film shows that the intensity of absorption peak at 3339 cm-1 of the -OH functional group have been increased when the cellulose filler is inserted into the ENR/PVC thin film. This attribute gives hydrophilicity properties to ENR/PVC/Cell thin film which provides benefits for future application. The addition of cellulose fillers causes the formation of pores on the thin film with thin film-filler and filler-filler interfaces interaction as displayed by VPSEM micrograph images. TGA analysis shows the addition of fillers in the matrix causes a temperature shift which is associated with the interaction between the matrix and the thin film. The lack of interaction between the cellulose and the ENR/PVC matrix disrupts stress force and agglomeration of the filler subsequently lowering the thin film flexibility and maximum stress strength. Modulus strain reveals the higher filler composition causes hindrance on chain movement by filler dispersion which resulted in weakness of thin film and break more easily. In conclusion, the developed ENR/PVC/Cell thin films are porous, have a high surface area, rigid and elastic with high thermal stability.