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EFFECT OF STYRYL/OIL FUNCTIONALIZED INTERCALANT OF MONTMORILLONITE REINFORCER ON THERMAL AND MECHANICAL PROPERTIES OF BIO-BASED POLYMER NANOCOMPOSITES

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Summary: Bio-based polymeric materials have been attracting increasing attention over the past two-decades since the prices for petroleum-based polymeric materials increase and their resources diminish. Recent studies have been focused on bio-based polymers derived from plant-based renewable resources as alternatives to petrochemical ones due to their market potential and global sustainability [1]. Among them, acrylated epoxidized soybean oil (AESO) have been widely used as a renewable resource in production of polymeric materials. In the literature, different chemical methods were used to make polymers and composite materials [2-3] from different plant oil triglycerides. On the other hand, mechanical properties of triglyceride-based polymers are lower than those of synthetic polymers which limits their commercial applications. Recently, a great attention has been paid to bio-based polymer nanocomposites, in particular to those in which nano-sized clay platelets are dispersed in a bio-based polymer matrix. Montmorillonite (MMT) clay, having a high aspect ratio, is one of the most commonly used nano-sized clays in preparation of polymeric nanocomposites.

In this study, we report an effective route for the in-situ preparation of exfoliated AESO/styrene based polymer nanocomposites by introduction of styryl fuctionalized and oil-based intercalant to interlayer galleries of MMT clay. The intercalant possesses both reactive double bond for polymerization reaction and alkyl chains of coco oil with different chain lengths as "AESO- compatible spacers" for the clay layers. The current design of the intercalant is expected to allow polymer molecules grown from both AESO and styrene monomers inside the clay galleries and also from edges/surfaces of the silicate layers of MMT. The resultant nanocomposites were characterized by X-ray diffraction (XRD) and transmission electron microscopy (TEM). The effect of increased nanoclay loading in thermal and mechanical properties was investigated by thermogravimetric analysis (TGA) and dynamic mechanical analysis (DMA). The nanocomposite materials exhibited improved thermal stability and dynamic mechanical properties as compared to neat polymer. The nanocomposite with exfoliation dominant structural morphology showed the highest storage modulus around Tg which is about 480 % higher than that of neat AESOPS, even with a clay content as low as 3 wt % [3].

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