

Thermo-mechanical properties of nanobiocomposites of Natural rubber and Starch

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Abstract

Starch nanoparticles were obtained by acid hydrolysis of Amylopectin rich maize starch (waxy starch). The size of these particles was observed to be around 40 nm from TEM analysis. The nanoparticles were isolated by ultracentrifugation and characterized by SEM and X-ray diffraction. SEM showed aggregation of nanoparticles into clusters of the size of few microns. The process of nanocrystal preparation was scaled up so as to use the nanocrystals for preparation of nanobiocomposites with Natural rubber by mastication technique on a two roll mixing mill. The composites were also prepared using untreated waxy starch and amylose rich starch (soluble starch). Upto 30 phr of the fillers were successfully incorporated leading to an enhancement in mechanical properties as the filler loading increases. The composites were characterized by mechanical properties and thermogravimetric analysis. Glass transition temperature was measured by DSC. It was observed that nanocomposites showed much better results than composites of waxy starch at all loadings. Both tensile strength and % elongation increased with increasing content of nanoparticles. The results were interpreted on the basis of morphology by SEM wherein the nanocomposites exhibited a single phase morphology indicating extremely uniform mixing. It was observed that starch could be a potential substitute for carbon black as filler.

Keywords : nanobiocomposite, natural rubber, starch, nanoparticles

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