World Academy of Science, Engineering and Technology
International Journal of Bioengineering and Life Sciences
Vol:12, No:10, 2018

X-Ray Diffraction and Crosslink Density Analysis of Starch/Natural Rubber Polymer Composites Prepared by Latex Compounding Method

Authors : Raymond Dominic Uzoh

Abstract : Starch fillers were extracted from three plant sources namely amora tuber (a wild variety of Irish potato), sweet potato and yam starch and their particle size, pH, amylose, and amylopectin percentage decomposition determined accordingly by high performance liquid chromatography (HPLC). The starch was introduced into natural rubber in liquid phase (through gelatinization) by the latex compounding method and compounded according to standard method. The prepared starch/natural rubber composites was characterized by Instron Universal testing machine (UTM) for tensile mechanical properties. The composites was further characterized by x-ray diffraction and crosslink density analysis. The particle size determination showed that amora starch granules have the highest particle size (156 × 47 µm) followed by yam starch (155× 40 µm) and then the sweet potato starch (153 × 46 µm). The pH test also revealed that amora starch has a near neutral pH of 6.9, yam 6.8, and sweet potato 5.2 respectively. Amylose and amylopectin determination showed that yam starch has a higher percentage of amylose (29.68), followed by potato (22.34) and then amora starch with the lowest value (14.86) respectively. The tensile mechanical properties testing revealed that yam starch produced the best tensile mechanical properties followed by amora starch and then sweet potato starch. The structure, crystallinity/amorphous nature of the product composite was confirmed by x-ray diffraction, while the nature of crosslinking was confirmed by swelling test in toluene solvent using the Flory-Rehner approach. This research study has rendered a workable strategy for enhancing interfacial interaction between a hydrophilic filler (starch) and hydrophobic polymeric matrix (natural rubber) yielding moderately good tensile mechanical properties for further exploitation development and application in the rubber processing industry.

Keywords : natural rubber, fillers, starch, amylose, amylopectin, crosslink density
Conference Title : ICCMB 2018 : International Conference on Chemical Materials and Biomaterials
Conference Location : Rome, Italy
Conference Dates : October 30-31, 2018