



AN INVESTIGATION ON THE EFFECT OF CLAY TYPE AND COMPATIBILIZER CONTENT ON THE BARRIER AND MECHANICAL PROPERTIES OF BLOW MOLDED HIGH DENSITY POLYETHYLENE BASED NANOCOMPOSITES

S.Abdollahi, H.Garmabi

Department of Polymer Engineering and Color Technology, Amirkabir University of Technology, Tehran, Iran

Email: garmabi@aut.ac.ir, abdollahi87@aut.ac.ir

A Blow molding grade high density polyethylene (HDPE) was compounded with maleic anhydride grafted high density polyethylene (PEgMA) as a compatibilizer to enhance the dispersion of nanoclay particles using a lab scale twin screw extruder. Two types of nanoclays including an organically modified montmorillonite (OMMT), Cloisite 15A(C15A)), and an untreated clay (Cloisite Na⁺ (CNa)), were applied using a novel extrusion process. HDPE, PEgMA and pristine montmorillonite were melt blended in a twin screw extruder where direct injection of water into the melt was used to enhance the dispersion of the untreated nanoclay platelets. Nanocomposites including 4wt% of nanoclay and various clay to compatibilizer ratios (1:1,1:3) were prepared. The prepared compounds were used in a lab scale blow molding machine to produce 300 cc bottles. The effects of the compatibilizer content and the organoclay modifier (quaternary alkyl ammonium surfactant) on the mechanical properties of the nanocomposites and barrier properties of produced bottles were investigated. X-ray diffraction and dynamic rheometry showed that the nanocomposite structure depends on the compatibilizer content. X-ray diffraction showed that the clay interlamellar spacing increases as the compatibilizer amount increases. As a result of stronger clay-polymer interaction, by incorporation of higher loadings of the compatibilizer, enhancement of the tensile modulus was observed. As the compatibilizer level was increased, tensile modulus of the HDPE/ PEgMA(12%) /C15A(4%) nanocomposites was improved up to 30% compared with the polymer/compatibilizer blend. The solvent permeability of the HDPE/CNa nanocomposites presented lower permeability than the HDPE/ C15A samples. It seems that, although the organomodifiers may improve the clay dispersion, but they present a negative effect on solvent permeability of blow molded bottles.