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Preparation of polystyrene/montmorillonite nanocomposites: optimization by response surface methodology (RSM)

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Abstract: Preparation of polystyrene (PS)-montmorillonite nanocomposites was carried out in 3 steps: purification and determination of the cation exchange capacity (CEC) of clay, synthesis of organoclay, and preparation of nanocomposites. In organoclay synthesis, 3 types of surfactants, long-chained (cetyltrimethylammonium bromide (CTAB)), short-chained (tetraethylammonium bromide (TEAB)), and ringed (benzyltriethylammonium bromide (BTEAB)), were used. Gallery distances of pure clay and organoclays (CTAB-O, TEAB-O, and BTEAB-O) were determined by X-ray diffraction (XRD) analysis as 1.25, 2.09, 1.52, and 1.63 nm, respectively. Preparation of nanocomposites was carried out by in situ polymerization. Composites, containing 2%, 4%, and 6% organoclay by mass, were characterized by XRD, thermogravimetric analysis (TGA), gel permeation chromatography (GPC), and transmission electron microscope (TEM). The synthesized nanocomposites showed an exfoliated structure and a higher decomposition temperature in comparison with pure PS. A new approach was tried in nanocomposite preparation using response surface methodology (RSM).

Key Words: Montmorillonite, organoclays, polymer, polystyrene, nanocomposites, RSM

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