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MONTMORILLONITE NANOCLAY REINFORCED CARBOXYMETHYL CELLULOSE/HYDROPHOBIC TiO_2 NANOCOMPOSITE AS A BIODEGRADABLE FOOD PACKAGING MATERIAL

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Recent studies have been conducted on biodegradable polymer nanocomposites from a structural and functional perspective and their applications in food packaging due to triggered concerns of looking for materials and processes compatible with the environment. In this regard, due to its hydrophilic nature, titanium dioxide (TiO_2) underwent hydrophobic modification by stearic acid (SA, 3 w/w% of TiO_2) *via* a physical coating method using ethanol as the solvent to prepare functional carboxymethyl cellulose (CMC) based nanocomposite film appropriate for food packaging. The novel CMC-based ternary nanocomposite film was synthesized by incorporating 5 w/w% of sodium montmorillonite (Na^+MMT) and 1 w/w% of modified TiO_2 *via* a drop-casting method. As prepared, the modified TiO_2 and nanocomposite film were characterized by FTIR spectroscopy to demonstrate the interactions and PXRD and TGA analysis to investigate the crystallinity and thermal behaviour of the nanocomposite films, respectively. FTIR results showed that SA was closely and firmly combined with TiO_2 particles; therefore, the changes in surface characteristics of TiO_2 promoted the interaction between CMC, MMT, and TiO_2 in nanocomposite film. According to PXRD analysis, the CMC chains were loaded into the silicate layers' gallery to produce an intercalated nanomorphology. TGA analysis highlighted that physically coated SA in TiO_2 microcrystals had improved thermal stability. The performance of the nanocomposite films was demonstrated by moisture content and tensile tests. The results showed that modified TiO_2 decremented moisture content, tensile strength, and elongation at the break by 2.9%, 29.4%, and 27.0%, respectively. It was deduced that the long hydrocarbon chain of SA, which is non-polar, has conferred hydrophobicity to the nanocomposite, promoting the water-resistance and increasing the extensibility of the film.

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Keywords: CMC-based nanocomposite, Food packaging, Hydrophobicity, Surface modification, Titanium dioxide