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Obtaining and characterizing of Erucamide-Montmorillonite/ Silver Nanoparticles nanocomposites (Eu-MMT/NPAg)

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Antimicrobial nanocomposites have generated significant scientific and technological interest for use in active polymeric packaging and in medical-hospital polymeric devices.In this thematic,over the past decade,some scientific works have demonstrated that erucamide can be utilized as an excellent matrix for the development of nanocomposites with phases containing interesting physical and chemical properties,such as compatibilizing phases constituted by montmorillonite and antimicrobial phases constituted with oxides nanoparticles.In this work studies were performed to development nanocomposites with an erucamide matrix and containing montmorillonite phases and silver oxide nanoparticles (Eu-MMT/NPAg).It is expected that the erucamide allow rapid migration of antimicrobial nanoparticles to the surface of nonpolar polymers,while the montmorillonite aids in reducing the size of antimicrobial nanoparticles during its synthesis and increase the compatibilization of erucamide phases with the nonpolar polymeric materials.In this study, silver nanoparticles were synthesized in reaction media containing montmorillonite, resulting in the synthesis of silver nanoparticles with smaller average sizes,intercalated in the basal structure of montmorillonite.The synthesis processes of silver oxide nanoparticles were performed using the hydrothermal method with the evaluation of the effect of different temperatures between 80.0 and 85.0°C,different neutralization times between 3 and 5 hours,and different concentrations of silver precursor between 0.5 to 1.0 M.These procedures allowed establishing the optimal synthesis reaction conditions for obtaining the MMT/NPAg phase (montmorillonite/silver oxide nanoparticles),the optimum parameters being defined as a temperature of 85°C,a neutralization time of 4 hours and a concentration of the silver precursor equal to 1.0 M.The MMT/NPAg phase was incorporated into the molten erucamide matrix at a concentration of 15% (% w/w).The nanoparticles and nanocomposites were evaluated for their antibacterial activity against Staphylococcus aureus (gram-positive) and Escherichia coli (gram-negative) bacteria.The MMT/NPAg phase was characterized using scanning electron microscopy (SEM),transmission electron microscopy (TEM),x-ray diffraction (XRD),differential scanning calorimetry (DSC), thermogravimetry analysis (TGA), and Fourier-transform infrared spectroscopy (FTIR).The Eu-MMT/NPAg nanocomposites with the best antimicrobial activity were completely characterized with the same techniques. The results indicated the formation of silver nanoparticles intercalated and dispersed in montmorillonite, designated as MMT/NPAg with antibacterial activity.The results strongly suggest that Eu-MMT/NPAg nanocomposites have great potential application as an antimicrobial additive in polymeric materials.