Synthesis and characterization of silver/clay/starch bionanocomposites by green method

ABSTRACT

In this study, we report an effective process for preparing silver nanoparticles (Ag NPs) by using Green reduction method of AgNO3 in interlamellar space of Montmorillonite/Starch Bionanocomposites (MMT/Stc BNCs) suspension with moderate temperature. In here MMT, Starch, ɓ-D-glucose and AgNO3 were used as a solid support, stabilizer, green reducing agent and silver precursor, respectively. Bionanocomposites material based on MMT, starch and silver nanoparticles (Ag/MMT/Stc BNCs) were prepared by adding starch and silver nitrate respectively into montmorillonite (MMT) dispersions in double distill water solution. The crystalline structure, d-spacing of interlayer of MMT, the size distributions, surface Plasmon resonance and functional groups of synthesized Ag NPs in the MMT/Stc BNCs were characterized using Powder X-Ray Diffraction (PXRD), Transmission Electron Microscopy (TEM), UV-visible spectroscopy and Fourier Transform Infrared Spectroscopy (FT-IR). The results obtained from TEM showed that the Ag NPs prepared in the extra surface of MMT layers have larger than Ag NPs intercalated between MMT layers, the particle size of nanoparticles synthesized by this processes were from 9 to 39 nm. Powder X-Ray Diffraction analysis showed that the synthesized Ag NPs crystallized in face centered cubic (fcc) symmetry. With gentle heating, this system is a mild, renewable, inexpensive, and nontoxic reducing agent. The synthesized bionanocomposites are very stable in aqueous solution over a long period of time (i.e., 3 months) without any sign of precipitation. Silver nanoparticles in MMT/Stc suspension could be suitable to use various medical applications. Since MMT is viewed as ecologically and environmentally inert material and used for biological application such as cosmetics and pharmaceutical usage.

Keyword: Green chemistry; Silver nanoparticles; Bionanocomposites; Powder X-ray diffraction