World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:12, No:01, 2018

Ecofriendly Synthesis of Au-Ag@AgCl Nanocomposites and Their Catalytic Activity on Multicomponent Domino Annulation-Aromatization for Quinoline Synthesis

Authors : Kanti Sapkota, Do Hyun Lee, Sung Soo Han

Abstract : Nanocomposites have been widely used in various fields such as electronics, catalysis, and in chemical, biological, biomedical and optical fields. They display broad biomedical properties like antidiabetic, anticancer, antioxidant, antimicrobial and antibacterial activities. Moreover, nanomaterials have been used for wastewater treatment. Particularly, bimetallic hybrid nanocomposites exhibit unique features as compared to their monometallic components. Hybrid nanomaterials not only afford the multifunctionality endowed by their constituents but can also show synergistic properties. In addition, these hybrid nanomaterials have noteworthy catalytic and optical properties. Notably, Au−Ag based nanoparticles can be employed in sensor and catalysis due to their characteristic composition-tunable plasmonic properties. Due to their importance and usefulness, various efforts were developed for their preparation. Generally, chemical methods have been described to synthesize such bimetallic nanocomposites. In such chemical synthesis, harmful and hazardous chemicals cause environmental contamination and increase toxicity levels. Therefore, ecologically benevolent processes for the synthesis of nanomaterials are highly desirable to diminish such environmental and safety concerns. In this regard, here we disclose a simple, cost-effective, external additive free and eco-friendly method for the synthesis of Au-Ag@AgCl nanocomposites using Nephrolepis cordifolia root extract. Au-Ag@AgCl NCs were obtained by the simultaneous reduction of cationic Ag and Au into AgCl in the presence of plant extract. The particle size of 10 to 50 nm was observed with the average diameter of 30 nm. The synthesized nanocomposite was characterized by various modern characterization techniques. For example, UV−visible spectroscopy was used to determine the optical activity of the synthesized NCs, and Fourier transform infrared (FT-IR) spectroscopy was employed to investigate the functional groups present in the biomolecules that were responsible for both reducing and capping agents during the formation of nanocomposites. Similarly, powder X-ray diffraction (XRD), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS), thermogravimetric analysis (TGA) and energy-dispersive X-ray (EDX) spectroscopy were used to determine crystallinity, size, oxidation states, thermal stability and weight loss of the synthesized nanocomposites. As a synthetic application, the synthesized nanocomposite exhibited excellent catalytic activity for the multicomponent synthesis of biologically interesting quinoline molecules via domino annulation-aromatization reaction of aniline, arylaldehyde, and phenyl acetylene derivatives. Interestingly, the nanocatalyst was efficiently recycled for five times without substantial loss of catalytic properties.

Keywords : nanoparticles, catalysis, multicomponent, quinoline
Conference Title : ICAMN 2018 : International Conference on Advanced Materials and Nanomaterials
Conference Location : Sydney, Australia
Conference Dates : January 29-30, 2018