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Effect of surfactant on the particle size, photocatalytic activity and sensing properties of CeO_2 nanoparticles

Sher Bahadar Khan
Abdulaziz University, Saudi Arabia

Cerium oxide (CeO_2 1) nanoparticles (NP) have been synthesized hydrothermally in the presence of surfactant (urea) and studied the effect of surfactant on the particle size and ultimately on the chemical sensing and photo-catalytic properties of CeO_2. CeO_2 1 was characterized by field emission scanning electron microscopy (FESEM), Energy dispersive spectroscopy (EDS), X-ray powder diffraction (XRD), Raman spectrum, Fourier transform infrared spectroscopy (FTIR), and UV-visible absorption spectrum which revealed that the synthesized product is well crystalline cubic phase optically active nanoparticles. SEM images of CeO_2 1 showed that the synthesized product is composed of cumulative form of highly crytallinity spherical shape nanoparticles with an average diameter of ~ 12 ± 10 nm. Additionally, CeO_2 1 was utilized as redox mediator for the fabrication of ethanol chemi-sensor. The developed chemi-sensor showed an excellent performance for electrocatalytic oxidization of ethanol by exhibiting higher sensitivity (1.192 $\mu A.cm^{-2}.M^{-1}$) and lower limit of detection (9.7 μM) with the linear dynamic range of 17.0 μM ~ 1.7 M. Moreover, by applying to organic pollutant, CeO_2 1 degraded almost 50% of acridine orange in short time. By comparing with 2, CeO_2 1 showed lower particle size, lower limit of detection and higher sensitivity toward ethanol sensing and high photo-catalytic activity for degradation of acridine orange. It is concluded that reduction in the particle size enhances the active surface area of the CeO_2 which results in increase of chemical sensing and photo-catalytic properties of CeO_2.

sbkhan@kau.edu.sa