**Abstract**

The main purpose of this article is to examine the surface free cerium oxide (CeO2) nanostructures prepared by different methods. CeO2 nanoparticles and nanorods were prepared by two different methods including precipitation and hydrothermal process. In precipitation process the nanoparticles were prepared at room temperature, while in hydrothermal process nanorods were prepared at high temperature. X-ray and electron diffraction analysis show the presence of CeO2. X-ray photoelectron spectroscopy (XPS) confirms the presence of CeO2 in both nanostructures. From BET, the specific surface area of nanorods (110 m2g−1) is found to be higher than nanoparticles (52 m2g−1). Also, the effect of morphology on their photodegradation of azo dye acid orange 7 (AO7) under UV–Visible light has been successfully investigated. The results show that the CeO2 nanorods synthesized by hydrothermal method have high surface area and exhibit improved performance in the photocatalytic activity.