CHEMISTRY JOURNAL OF MOLDOVA. General, Industrial and Ecological Chemistry. 2023, 18(1), 28-37
ISSN (p) 1857-1727 ISSN (e) 2345-1688
http://cjm.ichem.md
http://doi.org/10.19261/cjm.2023.1027

SYNTHESIS AND CHARACTERIZATION OF ZINC OXIDE AND CERIUM DIOXIDE NANOPARTICLES WITH POSSIBLE APPLICATION FOR NITRITE IONS REMOVAL IN WATERS

Zainab Abdul-Zahra and Rashed Rasheed [*]

Chemistry Branch, Applied Sciences Department, University of Technology, Al-Wehda nbhd., Baghdad 19006, Iraq
[*]e-mail: Rashed.T.Rasheed@uotechnology.edu.iq; phone: (+964) 07801670470

Abstract. Nitrite ion, a characteristic pollutant, can be removed from water by reverse osmosis, distillation, or ion exchange resin. In this study, we removed it by using ZnO and CeO_2 nanoparticles. First, zinc hydroxide and cerium hydroxide were prepared by the hydrothermal method and heated at 90°C to dry. Second, they were annealed at 400°C to produce nanoparticles of ZnO and CeO_2, respectively. The obtained samples were characterized by X-ray diffraction to ascertain their structure and chemical composition. The surface morphology analysis of the nanoparticles was performed using scanning electron microscopy. Atomic force microscopy was employed to characterize the imaging surface and ascertain the surface roughness. The functional groups present at the surface of the nanoparticles were investigated using the Fourier transform infrared spectroscopy method. The optical properties of these particles were investigated using the UV-visible spectroscopy. Further, the produced nanoparticles were used to adsorb NO_2^- ions from aqueous solutions. The results showed that the nanoparticles which were heated at 90°C (hydroxide forms) presented a higher activity for nitrite ions removal than those that were heated at 400°C (oxide forms). This may be related to nitrite ions preferential adsorption to hydroxide forms rather than to oxide forms; in both cases (90°C and 400°C), zinc oxide nanoparticles presented higher nitrite removal activity.

Keywords: zinc oxide, cerium dioxide, nanoparticle, nitrite ion, pollutant, environment.

Received: 12 January 2023/ Revised final: 26 March 2023/ Accepted: 28 March 2023