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EXPLORING PHOTOCATALYTIC ACTIVITY OF BISMUTH OXYHALIDES BIOX (X= CL, BR, I) ON DEGRADATION OF EMERGING POLLUTANTS

The auge of semiconductors in the second half of the 20th century brought a fast and without precedent technological advancement, characterized by high-speed communications and faster and more efficient processing devices. All this, was powered by already known semiconductors like silicon, germanium, and metal oxides, but also by novel and outstanding materials like the well-known families of II-VI, III-V semiconductors and alloys like mercury-cadmium telluride (HgCdTe). Elements like As, Hg, Cr, Te and so on were released without control to the environment and some highly contaminant semiconductors continue being produced. To mitigate this situation, alternative materials and techniques are employed to solve energetic and pollution issues, this is the case of bismuth-based materials and photocatalysis. Bismuth oxyhalides (BiOX, X=Cl, Br, I) are known for their ability to remove conventional pollutants due to their interesting properties including, a layered structure, band gap modulation, visible light absorption, suitable band edges potentials and cheap production methods. In this work, we explore the photocatalytic activity of BiOX on the degradation of harmful emergent contaminants such as ibuprofen and ciprofloxacin. The synthesis of these photocatalysts was achieved by a conventional solvothermal reaction varying solvents used. Bismuth and halogen sources were bismuth nitrate ($\text{Bi}(\text{NO}_3)_3$) and potassium salts (KCl, KBr, KI) in molar ratio of 1:1. Samples were characterized by X-Ray Diffraction (XRD), Diffuse Reflectance Spectroscopy (DRS) and Volumetric Absorption of N_2 . The photocatalytic activity was performed by measuring the absorption spectra of a common dye (Rhodamine B 'RhB') solution in order to find a relationship between solvent used and catalytic properties. The samples with the best performance on RhB were tested on ibuprofen and ciprofloxacin. Results indicated that BiOX removed approximately 40 % of ibuprofen in 240 minutes, and ciprofloxacin about 60 % in the same time.

Keywords

bismuth oxyhalides, photocatalysis, emerging pollutants, solvothermal synthesis, water treatment

Reference

H. Zhang, L. Liu, and Z. Zhou, Towards better photocatalysts: first-principles studies of the alloying effects on the photocatalytic activities of bismuth oxyhalides under visible light, *Physical Chemistry Chemical Physics* (2012) 1286-1292. <https://doi.org/10.1039/c1cp23516h>

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