**Chitosan supported bismuth oxyiodide : a powerful and highly efficient photocatalyst for water treatment**

Abdelmalik Brik a,c , Mustapha El Kadiri a, Taha El Assimi a , Hicham Ben Youcef c , Said Laassiri c, Geraldine Gouhier b , Abdellatif El meziane a , Abdelkrim El Kadib d , Mohammed Lahcini a,c \*

**a.** Cadi-Ayyad University, Marrakech, 40000 (Morocco)

**b.** Normandie University, Mont-Saint-Aignan, 76821 (France)

**c.** Mohammed VI Polytechnic University, 43150 Ben Guerir, (Morocco)

**d.** Euro-Mediterranean University, Fes, 30070 (Morocco)

*brikabdelmalik@gmail.com*

*m.lahcini@uca.ac.ma*

**Abstract**

The global water crisis (e.g. water shortage, water pollution, and water-related disasters) is one of the greatest risks the human society is currently facing. Recently, photocatalysis over semiconducting materials has emerged as a promising technology for wastewater treatment1. Thus, looking for inexpensive and highly efficient photocatalytic materials toward the complete degradation of water contaminants remains one of the most challenging tasks nowadays. Here, we report the preparation and photocatalytic application of a new hybrid material based on bismuth oxyiodide (BixOyIz) supported on chitosan. Actually, chitosan is a green and highly abundant polysaccharide obtained from the deacetylation of chitin; the second abundant biopolymer after cellulose2,3. This material was prepared by a simple, eco-friendly and cost-effective three-step process. The composition, structure and morphology of the obtained hybrid materials were investigated using scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), Uv-Vis diffuse reflectance spectroscopy (DRS), X-ray diffraction (XRD), raman spectroscopy and Fourier transform infrared spectroscopy (FTIR). The prepared materials were used as heterogeneous photocatalysts for degradation of methyl orange in aqueous media. Photocatalytic experiments revealed that the photocatalytic activity of the prepared materials is much higher than many reported photocatalytic materials. More importantly, the photocatalysts could easily be recovered by simple filtration with no significant loss of their activity after seven successive runs. The novelty of the present work lies in the combination of both adsorption and photodegradation in a single photocatalytic system. It is believed that chitosan plays two major roles in this photocatalytic system. On the one hand, chitosan acts as catalytic support to enhance the dispersion of photocatalytic species and to facilitate the recyclability of the materials, which is highly essential for large scale applications. On the other hand, chitosan provides a high surface area to enhance the adsorption of organic pollutants on the surface of the materials by improving the contact between the photocatalysts and the pollutant. Thus, the prepared photocatalytic system combines a remarkable adsorption capacity and high photocatalytic ability. Therefore, this contribution may offer a great opportunity for using bismuth-based nanomaterials in photocatalytic wastewater treatment, environmental protection-remediation using clean and renewable energy.

**Keywords:** Water pollution, Photocatalytic, Degradation, Bismuth oxyiodide, Chitosan, Methyl orange, Adsorption, Reusability.

**1 Rafiq, Asma, Muhammad Ikram, S. Ali, Faiza Niaz, Maaz Khan, Qasim Khan, and Muhammad Maqbool. "Photocatalytic degradation of dyes using semiconductor photocatalysts to clean industrial water pollution." *Journal of Industrial and Engineering Chemistry* 97 (2021): 111-128.** [**https://doi.org/10.1016/j.jiec.2021.02.017**](https://doi.org/10.1016/j.jiec.2021.02.017)

**2 Wu, Shaojie, Mingyang Li, Lili Xin, Hongming Long, and Xiangpeng Gao. "Efficient removal of Cr (VI) by triethylenetetramine modified sodium alginate/carbonized chitosan composite via adsorption and photocatalytic reduction." *Journal of Molecular Liquids* 366 (2022): 120160.** [**https://doi.org/10.1016/j.molliq.2022.120160**](https://doi.org/10.1016/j.molliq.2022.120160)

**3 Gonil, Pattarapond, and Warayuth Sajomsang. "Applications of magnetic resonance spectroscopy to chitin from insect cuticles." *International journal of biological macromolecules* 51, no. 4 (2012): 514-522.** [**https://doi.org/10.1016/j.ijbiomac.2012.06.025**](https://doi.org/10.1016/j.ijbiomac.2012.06.025)