Let it float, let it clean: upcycled biochar as floating platform for solar-driven BiOBr photocatalysis

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As the global population grows and industrial activities intensify, water pollution has become an urgent challenge, posing severe risks to ecosystems and human health [1]. The development of sustainable materials for water remediation has emerged as a strategic priority in the transition toward a circular economy [1]. Among current approaches, the use of waste-derived materials as functional components offers a dual benefit: mitigating environmental impact while generating added value. In this work, we upcycle commercial biochar pellets—derived from biomass waste—as floating supports for bismuth oxybromide (BiOBr), a visible-light-active photocatalyst. BiOBr was grown onto the biochar via a simple impregnation–precipitation method [2]. The resulting BiOBr/biochar composite combines floatability, tailored properties, and visible light absorption, enabling removal of a broad range of contaminants—including pharmaceuticals, dyes, and polyphenols—from simulated drinking water under solar irradiation over multiple reuse cycles (Figure 1). DFT calculations helped clarify the adsorption behaviour of selected polyphenols by the composite, shedding light on interactions at the material's surface. Scavenging studies revealed that photogenerated holes and superoxide radicals are the main reactive species involved, with oxygen vacancies on the BiOBr surface playing a key role in enhancing photocatalytic activity (Figure 1). These findings demonstrate the potential of waste-based materials as effective and sustainable platforms for sunlight-driven water remediation, aligning material design with environmental responsibility and circularity.

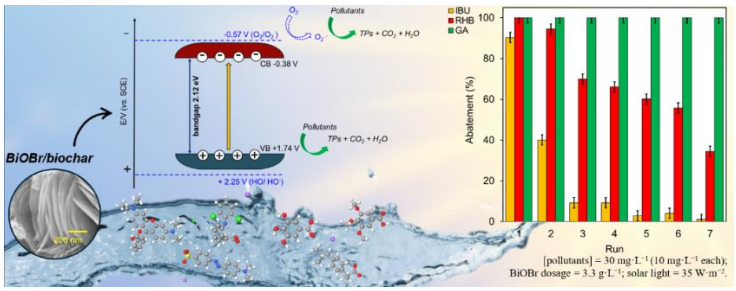

Figure 1: Hypothesized mechanism of solar-driven degradation and reuse performance of the floating BiOBr/biochar composite.

Keywords: *sustainable floating photocatalysts, wastewater remediation, circular economy.*

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Reference

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