PÔSTER - RESUMO - MATERIAIS E BIOMATERIAIS

SUSTAINABLE SUGARCANE BAGASSE–DERIVED SILICON OXIDE/MAGNETIC IRON OXIDE COMPOSITES IN POLYMERIC MATRICES FOR DYE PHOTODEGRADATION

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The growing demand for sustainable materials for environmental remediation has stimulated the development of functional composites derived from renewable resources like polymeric matrix and sugarcane. This growing need for sustainable solutions has stimulated the development of functional composites derived from renewable and low-cost resources, particularly agro-industrial residues. In this context, sugarcane bagasse emerges as an abundant biomass feedstock capable of generating value-added materials through controlled chemical processing. In the present study, silicon oxide (SiO2) was successfully obtained from sugarcane bagasse through chemical treatment followed by controlled calcination. This procedure yielded a biogenic silica characterized by high purity, predominantly amorphous structure, and porous morphology, features that are highly desirable for adsorption and catalytic applications [1]. The extracted silica was subsequently integrated with magnetic iron oxide (Fe3O4) nanoparticles synthesized via a co-precipitation method. The incorporation of Fe3O4 introduced magnetic responsiveness and catalytic functionality to the composite system. The resulting Fe3O4/PEG/SiO2 composite, embedded within a polymeric matrix based on polyethylene glycol (PEG), combines multiple advantageous properties. The silica component contributes high surface area and chemical stability, facilitating dye adsorption and enhancing interfacial contact with reactive species. Moreover, the resulting Fe3O4/PEG/SiO2 composite combined the high surface area and chemical stability of silica with the magnetic properties and catalytic activity of iron oxide towards photodegradation of dye. Meanwhile, the iron oxide nanoparticles provide magnetic separability and catalytic activity, promoting efficient photodegradation of organic dyes under light irradiation. The magnetic feature also enables easy recovery and reuse of the material, improving its practical applicability in wastewater treatment. Overall, this sustainable composite design demonstrates how renewable biomass-derived materials can be engineered into multifunctional platforms for environmental remediation. By integrating structural stability, catalytic efficiency, and magnetic recovery, the study advances the development of green technologies for dye-contaminated water treatment and supports circular economy strategies through biomass valorization.

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[1] P. Silva, T. Nguyen, J. Li, A. Mendes, R. Costa, A. S. Gonçalves and M. Oliveira, Sci. Rep., 15, 2390, (2025).

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