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Enhanced photoelectrocatalytic performance of WO_3|ZnO heterojunction film for moxifloxacin oxidation

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Abstract

The environmental impact of wastewater contamination by antibiotic residues has become a significant concern in recent years. Advanced oxidation processes (AOPs) have emerged as viable and sustainable alternatives to address these effects. Among the various AOPs, electrochemically assisted heterogeneous photocatalysis, also known as photoelectrocatalysis, has gained attention as a promising and effective technology for mitigating such issues. In this context, the present study successfully fabricated FTO|WO_3|ZnO heterojunction films to enhance the oxidation of the antibiotic moxifloxacin in water. X-ray diffraction (XRD) analysis revealed that the ZnO and WO_3 films exhibited wurtzite and monoclinic crystal phases, respectively (Fig 1(a)). Band gap values, determined through UV-Vis diffuse reflectance spectroscopy (DRS), were 3.07 eV for ZnO and 2.67 eV for WO_3. Scanning electron microscopy (SEM) images revealed that the FTO|WO_3|ZnO heterojunction films possessed high porosity and a thickness of approximately 8.314 µm. The photoelectrochemical performance of these films was evaluated under polychromatic irradiation, with the heterojunction exhibiting a photocurrent density four times greater than that of the FTO|ZnO film, achieving a value of 160 µA/cm^2 at 0.7 V versus Ag/AgCl (Fig.1 (b)). In addition, the heterojunction exhibited a longer recombination time than the pure WO_3 film. Finally, the FTO|WO_3|ZnO film exhibited good photocatalytic performance, with approximately 48.00% degradation of MOX, confirming that the combination of materials favored a higher photocatalytic efficiency (Fig 1 (c)).

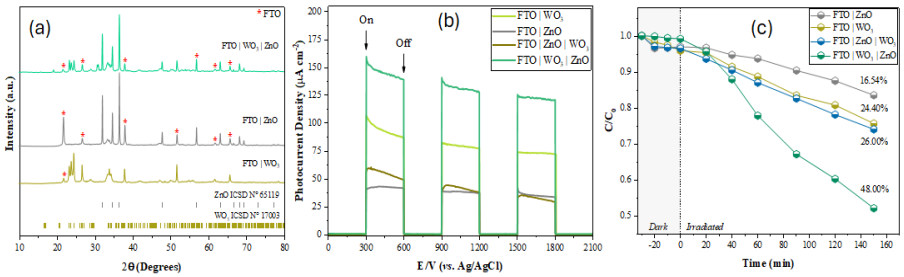

Figure 1. X-ray diffractograms (a), chronoamperometry with 300 s intervals between light and dark (b), and relative decay curve of MOX concentration, C/C_0, in the FHE configuration (c) for the films of WO3, ZnO, and their heterojunction.

Palavras-chave: Antibiotic residues, Wastewater treatment, POAs, Photoelectrocatalysis, Degradation efficiency.

References

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