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COMBINATION OF ADSORPTION, ELECTROCHEMICAL OXIDATION AND PHOTOCATALYSIS FOR THE TREATMENT OF CLINDAMYCIN-CONTAMINATED SOLUTIONS: A PROMISING APPROACH FOR THE REMOVAL OF EMERGING POLLUTANTS IN WATER BODIES

Resumo: With the development of science and more sensitive techniques, new contaminants known as Emerging Pollutants (EPs) can be found. A recent study on the presence of EPs in the urban water cycle in Latin America detected clindamycin (CLI), an antibiotic used in the treatment of various infections, in concentrations of up to 2,158 ng L-1 [1]. This emphasizes the importance of seeking alternative treatments, as this type of pollutant is not completely removed by conventional methods used in water and wastewater treatment plants. In this context, this study proposes the combination of adsorption, electrochemical oxidation, and photocatalysis techniques as a strategy for the treatment of solutions contaminated with CLI. For this purpose, granular activated carbon (GAC) was modified with TiO2 by the sol-gel method, and the obtained material was characterized by X-ray diffraction, revealing the formation of the anatase phase of TiO2, and Brunauer, Emmett, and Teller isotherms. The unmodified GAC showed a Type Ib isotherm, characteristic of microporous materials, while the modified GAC exhibited a Type H4 isotherm, commonly found in micromesoporous carbon compounds, where the adsorption step is a mixture of Types I and II, with greater uptake occurring at low values of p/p0 corresponding to the filling of micropores. For the treatment of solutions containing CLI, a basket-type electrode was developed using a stainless steel mesh with an open area of 41%, to which GAC particles were added. One hundred milliliters of solution with an initial CLI concentration of 10 mg L-1 and 0.1 mol L-1 Na2SO4 as a supporting electrolyte were treated. The degradation of CLI showed a pseudo-first-order behavior and was 14% more efficient in the photoelectrocatalytic process with the application of 50 mA and UV radiation (= 365 nm) for 2 hours. However, an antagonistic effect was observed, as the sum of the kinetic constants determined for the purely electrochemical (k=0.0102 min-1) or photochemical (k=0.0028 min-1) processes was higher than that determined for the combined process (k=0.0118 min-1). One of the main limitations of the photoelectrochemical treatment in this case is the stainless steel mesh, as it limits the irradiated area. However, this study opens a new approach towards the use of the basket-type electrode, allowing the use of particulate materials for the treatment of solutions contaminated with EPs.

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