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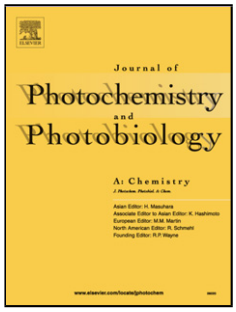

Title: Individual and simultaneous degradation of the antibiotics sulfamethoxazole and trimethoprim in aqueous solutions by Fenton, Fenton-like and photo-Fenton processes using solar and UV radiations

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<AT>INDIVIDUAL AND SIMULTANEOUS DEGRADATION OF THE ANTIBIOTICS Sulfamethoxazole AND TRIMETHOPRIM IN AQUEOUS SOLUTIONS BY FENTON, FENTON-LIKE AND PHOTO-FENTON PROCESSES USING SOLAR AND UV RADIATIONS

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'Declarations of interest: none'

Highlights►

<ABS-Head><ABS-HEAD>Graphical abstract
<ABS-P>
<ABS-P><xps:span class="xps_Image">fx1</xps:span><ABS-HEAD> ► Highlights ► Photodegradation of sulfamethoxazole (SMX) and trimethoprim (TMP) was studied. ► SMX triplet state has more energy that the TMP one, which justifies their behavior. ► The systems UV or Solar/H_2O_2, UV or Solar /H_2O_2/Fe^{2+} or Fe^{3+} were investigated. ► ZMX and TMP byproducts were identified and the degradation mechanisms were analyzed. ► The removal and degradation rates of SMX and TMP were influenced by the water matrix.
<ABS-HEAD>ABSTRACT
<ABS-P>The aim of this study was to compare the effectiveness of advanced oxidation processes (AOPs) based on Fenton and Fenton-like reagents with Solar and UV radiation (UV, UV/H_2O_2, Solar, Solar/H_2O_2, UV/H_2O_2/Fe^{2+}, UV/H_2O_2/Fe^{3+}, Solar/H_2O_2/Fe^{2+} and Solar/H_2O_2/Fe^{3+}) for the single and simultaneous degradation of the antibiotics sulfamethoxazole (SMX) and trimethoprim (TMP) in aqueous solution. For direct photolysis processes, the degradation rate of SMX was highly enhanced, whereas that of TMP was slightly reduced, when the solution pH was increased from 3 to 12. The different photolytic behavior of SMX and TMP was investigated by DFT calculations, estimating in both cases the relative energies of the ground singlet state, the first excited singlet state, and the first triplet state. SMX triplet state is about 21 Kcal mol^{-1} above the TMP triplet state, which justifies the higher photodegradation obtained for SMX. The removal percentages of both antibiotics in the photo-Fenton and photo-Fenton-like systems were much greater than those in the conventional Fenton processes. Additionally, in both photo-Fenton processes, the degradation rates of SMX and TMP were faster by applying UV radiation than solar radiation. Complete mineralization of SMX was achieved in UV/H_2O_2 process; however, the Solar/H_2O_2/Fe^{3+} system yielded a maximum extent of mineralization of 42% for TMP. SMX and TMP photodegradation by-products were identified in UV, UV/H_2O_2, Solar, and Solar/H_2O_2/Fe^{3+} systems. The removal percentages and rates of degradation of SMX and TMP were influenced by the water matrix. It was shown that the Solar/H_2O_2/Fe^{3+} system