Synergistic Effect of Combined Electrocatalysis and Ozonation for Efficient Tetracycline Removal in Different Media

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Advanced oxidation processes (AOPs), including electrocatalysis and ozonation, are potent for degrading persistent pollutants [1]. This work evaluates the degradation of tetracycline (TC) in aqueous and ethanolic solutions using a commercial $Ti_{0.7}Ru_{0.3}O_2$ anode [2]. After 30 minutes, electrocatalysis alone removed 98.6% (water) and 92.5% (ethanol) of the TC. Ozonation yielded lower removals of 61.2% (water) and 67.5% (ethanol), a difference linked to the generation of less reactive radicals in the ethanolic medium. Remarkably, the combined electrocatalytic ozonation process demonstrated a strong synergistic effect, achieving ~99% degradation in both solvents in only 10 minutes. Calculations of energy consumption and synergy indices confirmed that this synergy was more pronounced in ethanol, leading to a more efficient and rapid treatment.

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References:

[1] Y. Amangelsin, Y. Semenova, M. Dadar, M. Aljofan, G. Bjørklund.. Antibiotics. 12, 3, 440 (2023)
[2] V. Krstić, B. Pešovski.. Hydrometallurgy. 185, 71-75 (2019)