Advanced oxidation processes for eliminating non-steroidal anti-inflammatory drug - ketoprofen

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Keywords: ketoprofen; electro-Fenton; hydroxyl radicals; degradation; mineralization; toxicity

Abstract:

Due to increase usage of non-steroidal anti-inflammatory drugs (NSAIDs), more and more researches revealed the detection of ingested pharmaceutical compounds and their metabolites in the soil, sludge, wastewater treatment effluents, surface and ground water. Lower elimination efficiency of these compounds by wastewater treatment plants with continuous discharge of pharmaceuticals into the environment resulted in a potential hazardous effect on environment and human health. It is thus highly demanded to develop eco-friendly techniques for eliminating these persistent pharmaceuticals and their degradation products. Electrochemical advanced oxidation processes (EAOPs) offer great advantages with high efficiency and environmental compatibility, reacting with the pollutants till total mineralization, leaving only water, carbon dioxide and inorganic ions.

We chose ketoprofen which has been already found in aqueous environment. The aim of this study is to investigate the electro-oxidation of this pharmaceutical by electrochemical advanced oxidation processes: electro-Fenton and anodic oxidation. From the obtained results, we can conclude that the degradation rate increases by increasing applied current. The removal ability of the treatments follows the order: electro-Fenton with BDD anode > electro-Fenton with Pt anode > anodic oxidation with BDD anode. The similar trend was also observed in the mineralization treatments of ketoprofen aqueous solution. The evolution of the toxicity during treatments was monitored using Mictotox method, based on the fluorescence inhibition of bacteria

vibrio fischeri. It was observed no much inhibition difference between electro-Fenton treatments using BDD (BDD (·OH)) or Pt (Pt (·OH)) anodes. On the other hand, luminescence inhibition lasted longer for lower current values. The shift of luminescence inhibition peaks with the applied current intensity can be attributed to formation rate of the ·OH (as function of applied current) and consequently the evolution of the intermediates at different rate vs. electrolysis time.

As conclusion, the electro-Fenton process seems to be an efficient method in the mineralization of ketoprofen aqueous solutions and, as a consequence, in the removal of its toxicity, since this process is able to eliminate not only the initial pollutants but also its oxidation intermediates.

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