Removal of Dexamethasone Sodium Phosphate (DSP) in liquid phase by Using Advanced Oxidation Processes (AOPs)

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The occurrence and the fate of pharmaceuticals residues in wastewater treatment and in the environment has attracted an increasing interest during the last decade and have posed a new challenge to professionals for wastewater recovery as well as to the pharmaceutical industry. The removal of many of pharmaceutical compounds, during municipal wastewater treatment, has showed to be incomplete and unsuitable. As a result, residues of these compounds have been detected in surface waters in concentrations ranging from the ng L^{-1} up to the mg L^{-1} level. Advanced Oxidation Processes (AOP) are commonly designed to produce hydroxyl radicals (HO•) that react efficiently with most organic compounds present in the water. Photo-catalysis has emerged as viable alternative for removing micro-pollutants and other organic contaminants from surface, ground and wastewater. The catalyst used in this study was the semiconductor titanium dioxide (TiO_2) chosen for its properties: high resistance to corrosion, low toxicity and low costs. The aim of this work was the application of photo-catalysis for the degradation of dexamethasone sodium phosphate (9-fluoro-11β,17-dihydroxy-16α-methyl-21-(phosphonooxy) pregna-1,4-diene-3,20-dione disodium salt). This pharmaceutical compound is one of the most potent corticosteroids with anti- inflammatory and immunosuppressive properties. It has been widely used to treat inflammation, allergy and diseases related to adrenal cortex insufficiency. DSP is also known to reduce neointimal hyperplasia in arteries and has been used for coating drug- eluting stents for local drug delivery to prevent restenosis.

Photochemical reactions were carried out by using a solar simulator and kinetic parameters were determined. Identification of the photoproducts was performed by liquid chromatography system coupled to a hybrid linear quadrupole ion trap (LTQ) – Fourier-transform ion cyclotron resonance (FT-ICR) mass spectrometer. The standard solution used as control in the darkness did not show any significant degradation during the experimental time. Data of the DSP degradation fitted well a pseudo first order kinetic curve and the half-life was 30 min.

Four photoproducts have been successfully identified.

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