PHOTODEGRADATION KINETICS OF HYDROCHLOROTHIAZIDE IN AQUEOUS SOLUTION BASED ON QUANTIFICATION OF ULTRAVIOLET RADIATION

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1. Introduction – Hydrochlorothiazide (HCTZ) is a thiazidic diuretic very frequently used in the treatment of hypertension, present in wastewater and coming to cause adverse health effects. Conventional biological treatments have not demonstrated to be effective to remove this pollutant in wastewaters. The AOPS (Advanced Oxidation Processes) represent an innovative alternative technology to eliminate these resistant compounds [1]. The aim of this study was to analyze the efficiency of ultraviolet (UV) radiation in the photodegradation of this pollutant.

For this objective, i) the quantum yield and photochemical kinetic parameters of the process was determined by UV photolysis of HCTZ with the influence of the different operating variables (initial concentration, pH media and chemical composition of different waters), ii) indirect photodegradation in presence of radical promoters (HO• and SO4•-) was also investigated.

2. Experimental - UV photolysis experiments were conducted using a photochemical reactor. It consisted of a 500 mL cylindrical glass vessel with an external jacket with a thermostatic bath surrounding the reactor. A low pressure vapor mercury lamp which emitted monochromatic radiation at 254 nm was used. Additional experiments were also conducted to evaluate the effect of radical promoters using hydrogen peroxide at initial concentrations of 3, 5, 7 and 10 ppm and equivalent concentrations of sodium sulphite and persulphate. HCTZ concentrations were measured by HPLC (novapak C18 column). The detection was performed at 310 nm using a mobile phase of acetonitrile and formic acid (70:30 in volume), the elution flow rate was 0.35 mL min\(^{-1}\) and the injection volume was 100\(\mu\)L in all samples [2].

3. Results and Discussion – The effect of the initial pH on the HCTZ degradation by UV radiation depends on the speciation, nevertheless, obtained \(X_{UV}\) results did not show a significant effect. The initial HCTZ concentration did not show a remarkable effect on the degradation rate (Figure 1). Regarding to the photodegradation process follows a first-order kinetic in all the studied cases. As it was expected, the obtained results in presence of radical promoters (peroxide, sulphite and persulphate) showed a very fast complete degradation (around 10min) in presence of UV radiation. However, the unique presence of radical promoters does not show any effect. Finally calculated values of \(k'_{E}\) in waters with different chemical compositions (ultrapure water and tap water) showed an increase of photodegradation rate in ultrapure water. Degradation rates in tap water decreases due to organic matter presence.

4. Conclusions – The results obtained in this study suggested that UV photolysis could be a promising technology for HCTZ degradation in wastewaters due to its resistance to conventional biological treatments.

5. References

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