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# A comparative study of the common persulfate activation techniques for the complete degradation of an NSAID: The case of Ketoprofen

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## Abstract

This work assessed the treatment of ketoprofen (KTP) using persulfate (PS) based Advanced Oxidation Process (AOP) activated thermally, chemically ( $\text{Fe}^{2+}$ ) or by UV. KTP degradation was optimized by manipulating several experimental parameters to achieve efficient KTP and its byproducts removal. Parameters included: PS concentration,  $\text{Fe}^{2+}$  concentration, temperature, pH, dissolved ions e.g.  $\text{Cl}^-$ ,  $\text{HCO}_3^-$ , and humic acids (HA). Results showed that: (i) KTP degraded significantly in UV only systems in contrary to thermal and chemical systems where KTP was resistant in PS free solutions; (ii) KTP degradation extent increased with the increase in  $[\text{PS}]_0$  while it was highly dependent on the  $[\text{Fe}^{2+}]_0:[\text{PS}]_0$  molar ratio; (iii) The activation energy ( $E_A$ ) calculated in thermal activation experiments was found to be  $157.02 (\pm 8.9) \text{ KJ mol}^{-1}$ ; (iv) The highest % reaction stoichiometric efficiency calculated only in thermal systems reached 38%; (v) Sequential KTP additions showed that the UV system was the most sustainable, followed by the thermal system while the chemical system was the least sustainable. (vi) KTP dissolved in a non-treated waste water matrix was best removed along with present coliforms in UV system. KTP transformation products were identified by HPLC/MS and a degradation reaction pathway was suggested. This study led to the conclusion that UV/PS systems are the most economically efficient among the three investigated PS-based systems.

**Keywords:** Ketoprofen, Persulfate, Heat, UV,  $\text{Fe}^{2+}$ , degradation.

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