



Ciprofloxacin removal from aqueous solutions by ozonation with calcium peroxide

Neda Javid^a, Zhila Honarmandrad^b, Mohammad Malakootian^{c,d,*}

^aDepartment of Environmental Health Engineering, Zarand School of Nursing, Kerman University of Medical Sciences, Kerman, Iran, Tel. +983431325105; email: n.javid1367@gmail.com

^bDepartment of Environmental Health Engineering, School of Public Health, Sirjan University of Medical Sciences, Sirjan, Iran, Tel. +989133950254; email: zhilahonarmandrad@yahoo.com

^cEnvironmental Health Engineering Research Center, Kerman University of Medical Sciences, Kerman, Iran, Tel. +983431325128; Fax: +983431325128; email: m.malakootian@yahoo.com

^dDepartment of Environmental Health, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran

Received 16 July 2019; Accepted 2 September 2019

ABSTRACT

Ciprofloxacin (CIP) belongs to the fluoroquinolones group and is widely applied in therapeutics. The presence of fluorine in CIP increases its stability in the environment. Advanced oxidation processes are among the most effective methods used to remove hazardous and resistant pollutants in the environment. This study aimed to determine the efficiency of the ozonation process with calcium peroxide for the removal of CIP from aqueous solutions. The removal efficiency of CIP and chemical oxygen demand under optimal conditions, that is, pH = 3, CIP concentration = 5 mg/L, concentration of CaO₂ = 0.025 mg/L, temperature = 25°C, ozonation rate = 1 g/min and contact time = 50 min, was obtained 95.6% and 80.1% as well as 85.4% and 73.6%, in synthetic and simulated wastewater samples (municipal wastewater + CIP), respectively. Thermodynamic studies have shown that CIP decomposition with ozonation and CaO₂ is an endothermic process. The kinetics of CIP decomposition followed the pseudo-first-order equation. The use of the ozonation process with calcium peroxide is an efficient method for CIP removal.

Keywords: Ciprofloxacin; Calcium peroxide; Advanced oxidation; Catalytic ozonation

* Corresponding author.