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Ultrasonic degradation of ibuprofen from the aqueous solution in the presence of titanium dioxide nanoparticles/hydrogen peroxide

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ABSTRACT

Ibuprofen is an analgesic and anti-inflammatory drug that has been extensively used and besides known as a pollutant in the aquatic environments. The aim of this study was to determine the efficiency of ultrasonic process in presence of titanium dioxide nanoparticles catalyst as well hydrogen peroxide for degradation of ibuprofen from the aqueous solutions. For this reason, ibuprofen sonolysis was assessed in water at an ultrasound frequency of 35 and 1000 (kHz), titanium dioxide nanoparticles catalyst concentrations (2–80 mg/l), ibuprofen concentrations (2–100 mg/l), hydrogen peroxide concentrations (50–200 mg/l), retention time 15–120 min, and pH (3–11). The determination of ibuprofen concentration in aqueous solution was carried out by spectrophotometer. The highest ibuprofen degradation was 92.58 % that occurred at 35 kHz frequency, 90 min retention time and pH = 3. Ibuprofen degradation rates were increased by increasing hydrogen peroxide doses with the highest degradation rates of 98% observed for 200 mg/L hydrogen peroxide concentration and 120 min. In the optimum conditions, the highest total organic carbon degradation occurred in the sonocatalyst process (77% at 90 min). In conclusion, our findings show the ultrasonic waves combined with titanium dioxide nanoparticles catalyst had the highest efficiency for the degradation of ibuprofen from aqueous solutions. Moreover, the parameters of hydrogen peroxide concentrations, pH, frequency, total organic carbon, and sonication time were effective in degrading ibuprofen efficiency.

Keywords: Ultrasonic power; Catalyst; Hydrogen peroxide; Pharmaceutical pollution

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