

Operating parameters and synergistic effects of combining ultrasound and ultraviolet irradiation in the degradation of 2,4,6-trichlorophenol

ABSTRACT

The sonophotodegradation of 2,4,6-trichlorophenol (TCP) in a homogeneous aqueous system was investigated. The effectiveness of sonolytic, photolytic and sonophotolytic oxidation processes in the degradation of aqueous solutions of TCP was investigated by applying ultrasonic waves or ultraviolet radiation or a combination of these two techniques. The optimum operating parameters for the horn-type sonicator and the UV-A lamp were determined along with the effect of temperature on the TCP degradation. It was found that an increase in acoustic intensity and UV lamp intensity was proportional to an increased efficiency of the sonolytic and photolytic degradation of TCP. However, an increase in the solution temperature caused the TCP to evaporate resulting in the first-order kinetic rate showing the presence of a synergistic effect at temperatures between 10 °C and 20 °C, an additive effect at a temperature of 30 °C and an antagonistic effect at temperatures of 40 °C and higher.

Keyword: Photolysis; Sonolysis; Sonophotolysis; 2,4,6-trichlorophenol