Effect of sonication on the treatment of polycyclic aromatic hydrocarbons (PAHs) in a petrochemical industry wastewater and toxicity evaluations

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ABSTRACT

The effects of temperature, sparging of N2 (15 and 30 min), H2O2 (100 mg/l, 500 and 2000 mg/l) and TiO2 (0.1 mg/l, 0.5 mg/l, 10 and 20 mg/l) concentrations on the sonication of the petrochemical industry wastewater taken from the influent of the aeration tank in a petrochemical industry treatment plant was investigated. Experiments were performed at a sonication frequency of 35 kHz, at a power of 650 W, and at temperatures increasing from 25 °C to 30 °C and 60 °C. Increasing the temperature from 25 °C to 60 °C did not contribute to the total COD, poly aromatic hydrocarbons (PAHs) and TOC removals after 60 min of sonication time while a temperature of 60 °C increased the removals of the aforementioned parameters from 54% to 72% and 92% after 120 and 150 min of sonication times. 15 and 30 min N2 sparging increased the PAH removals at short sonication times while no significant increases in PAH removals were observed after 150 min of sonication time at low temperatures. Similarly, N2 sparging did not significantly affect the PAH removals at high temperatures for all sonication times. Increasing the TiO2 and H2O2 concentrations did not contribute to the PAH removals at 60 °C at all sonication times. Sonication alone without TiO2 and H2O2 could provide higher PAH removals (92–98%) at 60 °C after 150 min sonication. The toxicity test performed with *Daphnia magna* showed that acute toxicity decreased significantly by 92–96% at the lowest TiO2 concentration of 0.1 mg/l and at H2O2 and TiO2 concentrations ≤ 100 and ≤ 0.1 mg/l, respectively.

Keywords: *Daphnia magna* toxicity assay; Petrochemical industry; Polycyclic aromatic hydrocarbons (PAHs); Sonication; N2; H2O2; TiO2

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