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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 N_2(g) (15 and 30 min), H_2O_2 (100 mg/l, 500 and 2000 mg/l) and TiO_2 (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 N_2 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. Similary, N_2 sparging did not significantly affect the PAH removals at high temperatures for all sonication times. Increasing the TiO_2 and H_2O_2 concentrations did not contribute to the PAH removals at 60 °C at all sonication times. Sonication alone without TiO_2 and H_2O_2 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 TiO_2 concentration of 0.1 mg/l and at H_2O_2 and TiO_2 concentrations ≤ 100 and ≤ 0.1 mg/l, respectively.

Keywords: *Daphnia magna* toxicity assay; Petrochemical industry; Polycyclic aromatic hydrocarbons (PAHs); Sonication; N_2; H_2O_2; TiO_2

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