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# ENGINEERING CHALLENGES IN ADVANCED WASTEWATER TREATMENT

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## Abstract

Wastewater streams and particularly industrial effluents tend to increase in volumes and to get more complex in terms of pollution. Nevertheless, nowadays the focus is directed towards recycling or reuse of treated wastewater so as to close the water use loop. Advanced wastewater treatment allows these possible applications by achieving good quality effluent to suit the new purposes, but the implementation of this treatment stage is a difficult task. This study gives an example on how to approach an advanced treatment process (ultrasonication), starting from laboratory experiments. An assessment of the ultrasonication process efficiency for the removal of a textile dye (Reactive Blue 19), from aqueous dye solutions is presented. The experiments were performed on an ultrasonic horn, at 20 kHz frequency. The ultrasonic parameters studied are: acoustic wave amplitude, power density (dependent on the surface of the tip), operating mode (pulse or continuous), initial dye concentration and energy consumption. By using process modeling (Matlab software), a linear model with interactions was proposed. The goal was to optimize both pollutant removal efficiencies and energy consumption, and the optimum results obtained are: 57% removal efficiency expressed as decolonization, 18.73% removal efficiency expressed as Total Organic carbon (TOC) reduction and $(4.98\pm0.17)*10^5$ kJ energy consumed, in the pulse operating mode and 44%, respectively 30.28%, and $(6.37\pm0.22)*10^5$ kJ, in the continuous operating mode, for 0.5 L sample. The optimization provides information on the best working conditions that can be applied for the treatment of aqueous dye solutions by using the ultrasonication process.

*Key words:* advanced wastewater treatment, modeling and optimization, Reactive Blue 19, removal efficiency, ultrasonication

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