# Enhanced decomposition of Reactive Blue 19 dye in ultrasound assisted electrochemical reactor

**Abstract**

Textile industry effluents contain reactive dyes that may harm our receiving waters. A typical reactive blue (RB) 19 dye is frequently detected in significant concentrations in textile industry effluents. Such dyes have generally shown resistance to decomposition and tend to persist in the environment for long periods and multiply the impacts to water and environment. Therefore, the present investigation focused on high-rate decomposition of a typical reactive dye RB-19 under various ultrasound and electrochemical process conditions. The decomposition of unhydrolyzed and hydrolyzed forms of reactive blue (RB) 19 dye by ultrasound assisted electrochemical process was investigated using various parameters including dye concentration, pH, ultrasonic frequency and reaction time. Reaction kinetics, organic carbon and mechanism for dye decomposition were determined using UV-Visible spectrophotometry, TOC (total organic carbon) analysis and Gas chromatography-Mass spectrometry (GC-MS). Almost complete 90% color removal and a maximum of 56% TOC removal for 50 mg $L^{-1}$ dye concentration of unhydrolyzed RB 19 dye was achieved at an ultrasonic frequency of 80 kHz, pH of 8 after 120 min. GC-MS analysis showed that a sonoelctrochemical treatment of unhydrolyzed RB 19 dye for 30 min resulted in the formation of products e.g. acetic acid, benzoic acid etc with the complete removal of dye. For hydrolyzed dye, a treatment of 10 min was enough and the results were comparable with 30 min treatment of unhydrolyzed dye. Kinetics of ultrasound assisted electrolysis showed that the dye decomposition followed $1^{st}$ order. The ultrasound assisted electrolysis for dye decomposition and hence decolorization proved to be more effective and the total energy consumption reduced to half as compared with simple electrolysis/ sonochemical

decomposition. Therefore, ultrasound assisted electrolysis was found to be more effective technique for dye decomposition of an otherwise environmentally persistent reactive dye.

**Keywords:** Dye decomposition, ultrasound assisted electrochemical process, reactive blue 19 dye, ultrasonic cavitation, wastewater treatment

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