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"Gheorghe Asachi" Technical University of Iasi, Romania

ADVANCED OXIDATION OF AN AZO DYE AND ITS SYNTHESIS INTERMEDIATES IN AQUEOUS SOLUTION: EFFECT OF FENTON TREATMENT ON MINERALIZATION, BIODEGRADABILITY AND TOXICITY

Sanja Papić, Igor Peternel, Željko Krevzelj, Hrvoje Kušić*, Natalija Koprivanac

University of Zagreb, Faculty of Chemical Engineering and Technology, 19 Marulicev trg, 10000 Zagreb, Croatia

Abstract

The objective was to study the degradation of azo dye C.I. Acid Orange 7 (AO7) and intermediates for its synthesis sulphanilic acid (SA) and 2-naphthol (2-N) by Fenton process. Full factorial design and response surface methodology were applied to model the system behavior influenced by studied process parameters ($[Fe^{2+}]$ and $[H_2O_2]$).
Optimal process conditions were determined on the basis of mineralization efficiency. The effectiveness evaluation of applied treatment process was conducted on the basis of UV/VIS, TOC, COD, BOD_5 and toxicity measurements. Fenton reagent ratio 1:62-68 ($[Fe^{2+}]\approx1.5$ mM and $[H_2O_2]=100$ mM) yielded the highest TOC reductions for AO7, SA and 2-N (53 %, 44 % and 52 %, respectively), along with the complete decolorization of azo dye solution and degradation of aromatic fragments in solutions after 60-min treatment.
Three synthetic wastewaters are characterized as non-biodegradable before Fenton treatment ($BOD_5/COD\leq0.22$). After 60-min treatment biodegradability of all three wastewaters was improved; BOD_5/COD ratios ranged from 0.38 to 0.52. The values of EC_{50} showed that all pollutants in investigated concentrations are toxic, while remarkable toxicity reduction after the treatment was noticed only in the case AO7; in the case of other two pollutants the formation of toxic by-products can be assumed.

Key words: azo dye, biodegradability, Fenton process, intermediates, mineralization, toxicity

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* Author to whom all correspondence should be addressed: e-mail: hkusic@fkit.hr; Phone: +38514597160; Fax: +38514597143