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Degradation of C.I. Acid Red 51 and C.I. Acid Blue 74 in Aqueous Solution by Combination of Hydrogen Peroxide, Nanocrystallite Zinc Oxide and Ultrasound Irradiation

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Abstract: Journal of Advanced Oxidation Technologies2018; 21(1)www.jaots.netDOI:10.26802/jaots.2017.0022Journal of Advanced Oxidation Technologies 2018; 21(1)Article ID-20170022Article:Degradation of C.I. Acid Red 51 and C.I. Acid Blue 74 in Aqueous Solution by Combination of Hydrogen Peroxide, Nanocrystallite Zinc Oxide and Ultrasound IrradiationInsaf Ould Brahim*1,3, Mohamed Belmedani1,Ahmed Haddad3, Hocine Hadoun2,Ahmed Belgacem11Laboratory of transfer phenomena, Faculty of Mechanical and Processes Engineering, University of Sciences and Technology Houari Boumediene, BP n 32 El Alia bab ezzouar 16111 Algiers, Algeria2Nuclear Research Center of Algiers, 2 Bd Frantz Fanon, 16035, Algiers, Algeria3Research Center in Industrial TechnologiesCRTI, P.O.Box 64, Cheraga 16014 Algiers, Algeria *iouldbrahim@gmail.comPhone: 00213-20-77-67Fax: 00213-21-34 -20-19AbstractThis study illustrates the degradation of food dyes, C.I. Acid Red 51 (erythrosine E127) and C.I. Acid Blue 74 (indigo carmine E132) by sonocatalysis using an ultrasonic frequency of 37 kHz and a power of 150 W in the presence of heterogeneous catalysts ZnO and peroxide hydrogen (H2O2). The adsorption process for the two dyes on the ZnO nanocrystalline which satisfies the Freundlich model appears not effective because the elimination of the two food dyes does not exceed 35%. In order to improve the removal, the sonocatalytic process (AD-OX) has been investigated. At this purpose, effect of operating parameters such as initial dye concentrations, H2O2(0-0.75M) and initial pH on the sonochemical degradation was investigated. It was observed that when the adsorption-catalysis was assisted by the ultrasonic and H2O2 a considerable yields has been achieved and about 86% and 97% of E127 and E132 were removed for 10 mg L-1and 50 mg L-1respectively. To understand the behavior of dye degradation, structure of the zinc catalyst before and after the sonocatalytic process was characterized by meanX-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR) and scanning electron microscopy (SEM).Results showed thatthe ZnO particles before and after sonocatalysis were crystallized in the hexagonal wurtzite phase and the size distribution indicates that most of the particles are in the range of 300 and 600 nm. Finally, ADMI and COD analysis were performed in order toquantify the residual color in solution and evaluate the efficiency of the dye mineralization. Results showed that the treatment of food dyes by US-ZnO-H2O2process increased color degradation (ADMI)and mineralization efficiency (COD) by more than 50% and 76% respectively.

Keywords : Advanced oxidation process, sonocatalysis