*Environmental Engineering and Management Journal*

*September 2021, Vol. 20, No. 9, 1467-1476*
*http://www.eemj.icpm.tuiasi.ro/; http://www.eemj.eu*

***"Gheorghe Asachi" Technical University of Iasi, Romania***


# ELECTROCHEMICAL DECOLORIZATION OF DISPERSE BLUE-1 DYE IN AQUEOUS SOLUTION

**Kanayo Oguzie[1,2*], Emeka Oguzie[1], Simeon Nwanonenyi[1], Johnkennedy Edoziem[1], Ladislav Vrsalović[3]**

*[1]Africa Centre of Excellence in Future Energies and Electrochemical Systems (ACE-FUELS), Federal University of Technology Owerri, PMB 1526, Owerri, Imo State, Nigeria*
*[2]Department of Environmental Management, Federal University of Technology Owerri, PMB 1526, Owerri, Imo State, Nigeria*
*[3]Faculty of Chemistry and Technology, Department of Electrochemistry and Materials Protection, University of Split, Ruđera Boškovića 35, 21000 Split, Croatia*

## Abstract

An electrochemical oxidation procedure using graphite electrodes was employed for decolorizing Disperse Blue-1 dye in aqueous solution, with NaCl as supporting electrolyte. The effects of various factors such as electrolysis time, initial dye concentration, pH, temperature, current density and supporting electrolyte on the dye removal process were studied. Decolorization efficiency increased steadily with electrolysis time, current density and electrolyte concentration, but decreased with increasing dye concentration, while showing a nonlinear trend with pH, with maximum efficiency of 90% obtained at pH 7. Increasing the system temperature from 28 to 50 $^{o}$C caused decolorization efficiency to increase, especially at low dye concentration, reaching 96% at 25 mg/L. Decolorization efficiency was subdued at high dye concentrations, even with high current densities. This effect was however overcome by increasing the supporting electrolyte concentration. Density functional theory-based quantum chemical computations showed the amine functions in the p-phenyldiamine moieties to be the reactive sites for oxidative decolorization of disperse blue 1 dye. In summary, electrochemical oxidation using graphite electrodes effectively decolorized Disperse Blue-1 dye in aqueous solution.

*Key words:* decolorization, density functional theory, electrochemical treatment, Fukui indices

*Received: October, 2020; Revised final: February, 2021; Accepted: March, 2021; Published in final edited form: September, 2021*

[*] Author to whom all correspondence should be addressed: e-mail: kanayo.oguzie@futo.edu.ng; Phone: +234 8037069183