ICCC 2021
The 8th International Color & Coating Congress

Evaluation of toxicity of Basic Violet-16 dye during electrochemical process purification from aqueous solutions: Bioassay using microorganisms

Kamal Hasani [a], Abdollah Dargahi [b,*] Mina Moradi [a], Mehdi Vosoughi

[a] Department of Environmental Health Engineering, School of Public Health, Ardabil University of Medical Sciences, Ardabil, Iran
[b] Social Determinants of Health Research Center, Ardabil University of Medical Sciences, Ardabil, Iran.

* **Corresponding author:** a.dargahi29@yahoo.com (A. Dargahi)

Kamalhasani.dudg@gmail.com

Introduction

Dyes are one of the most widespread environmental pollutants in the textile industry effluent which if discharged into aquatic ecosystem, can cause toxic and carcinogenic effects on humans and environment. Basic dyes are one of the most widely used materials for dyeing acrylic fibers, which are ionized in aqueous solution and produce colored cations, one of which is the cationic Violet 16 dye. Electrochemical process is one of the advanced oxidation processes (AOPs) that received special attention in the last decade due to their advantages and features. Bioassay is a method employed to assess the toxicity of municipal and industrial wastewaters and leachates and has been recommended by the US EPA to identify toxic pollutants and their effects on the environment. The aim of this study was to investigate the toxicity changes of violet-16 Basic dye during electrochemical treatment from aqueous solutions using bioassay method.

Materials and Methods

In this experimental-laboratory study, stock solution containing violet-16 dye with two iron electrodes was placed in a 250 ml reactor. After the experiments, the effect of pH (3-11), current density (1-5 mA/cm^2), initial concentration of dye (10-80 mg/L) and electrolysis time (5-60 min) was investigated and the optimal conditions to degradation of violet-16 dye via electrochemical process was obtained. Toxicity changes were investigated with culture and growth rate of E.coli (gram-negative) and Staphylococcus aureus (gram-positive) in inlet and effluent solution of the electrochemical process under optimal conditions using the control solution (Blank) and finally the percentage of growth inhibition for each bacterium were calculated.

Results and Discussion

The results showed that the violet-16 removal efficiency via electrochemical process under optimal conditions including pH = 4, current density of 5 mA/cm^2, initial concentration of dye =10 mg/L and electrolysis time of 60 minutes was 91.8% and the rate of reduction of effluent toxicity for E.coli and Staphylococcus aureus was 81.3% and 73.6%, respectively (Fig.1). The present study showed that the electrochemical process as a useful technique has high efficiency in removing violet-16 dye and reducing its toxicity from aqueous solutions. Ashrafi et al. studied the detoxification of industrial dyes using bacteria and results showed that the toxicity of effluent has been significantly reduced. Nadafi et al. used standard strains of E.coli and Staphylococcus aureus to evaluate for toxicity using a bioassay; their results showed that the reduction of E.coli and Staphylococcus toxicity in the outlet solution was 86.7% and 72.3%, respectively and these findings were significantly consistent with the present study.

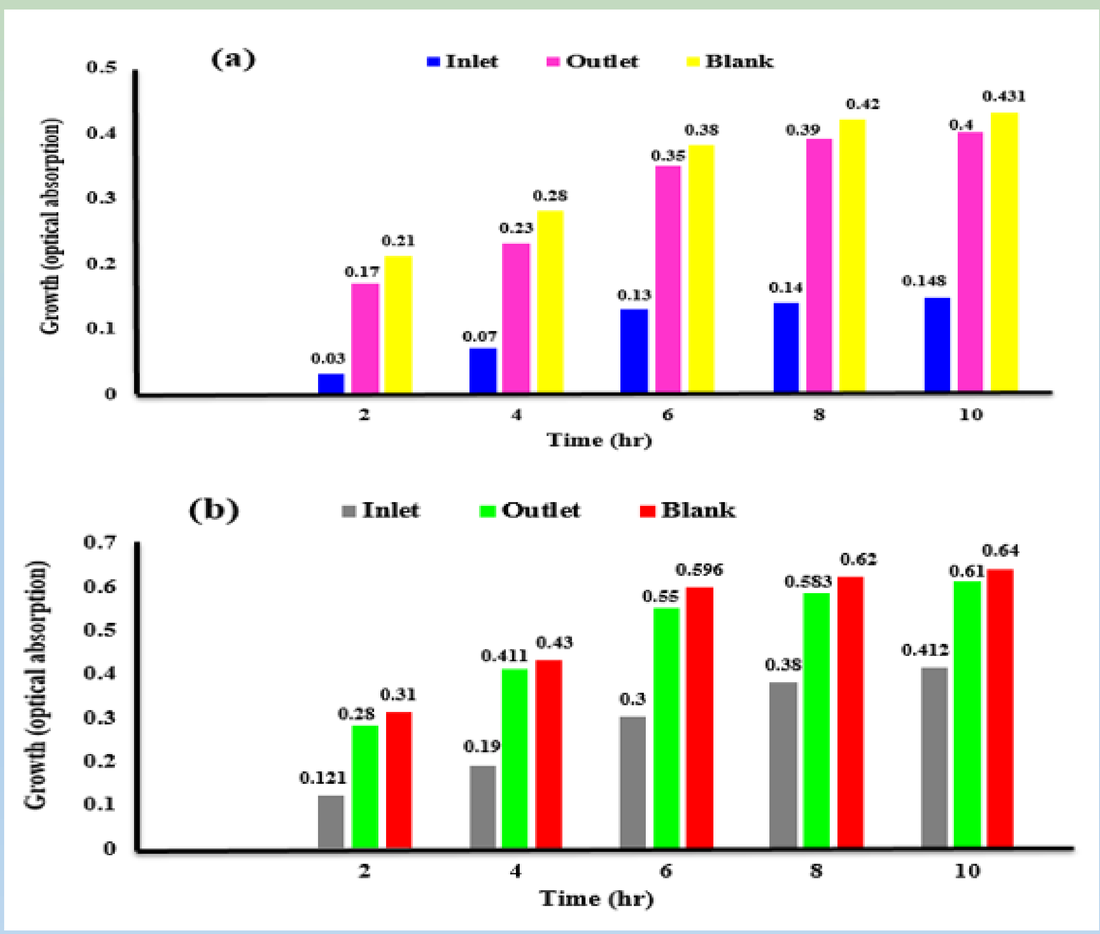

Fig. 1. (a) Growth trend of Escherichia coli (gram-negative) and (b) Staphylococcus aureus (gram-positive) in toxicity test under optimal conditions of electro/ persulfate process.