ELECTROCHEMICAL DEGRADATION OF PROCIION BLUE MX-R TEXTILE DYE ON BORON DOPED DIAMOND ELECTRODE

Selin Alaca, Bahadır K. Körbahti

Mersin University, Faculty of Engineering, Chemical Engineering Dept., Çiftlikköy, 33343 Mersin, Turkey
E-mail: selin.kkky@gmail.com; korbahti@mersin.edu.tr

In textile industries, large amounts of inorganic and organic chemical compounds including dyes are using and these are often found in the textile industry effluents. Textile dyes are organic chemical substances that are used in coloring of textile materials by dyeing and printing of fibers, yarns and woven/knit apparel [1]. The presence textile dyes cause undesirable impacts even if at very low concentrations [2].

In literature, physical treatment, chemical oxidation, adsorption, biodegradation, advanced oxidation processes, and electrochemical processes have been applied in decolorization and degradation of textile dyeing wastewater. Recently, electrochemical technologies, such as electrooxidation, electrodegradation, electrocoagulation, and electrofloation are becoming alternative wastewater treatment methods and replacing the conventional processes, because many industrial processes produce toxic wastewaters which are not easily biodegradable and requiring costly physical or physicochemical pretreatments [1].

It is known that the anode material is the most important parameter in electrochemical oxidation of organic compounds. Boron doped diamond (BDD) electrode has a great tendency in electrochemical applications including wastewater treatment processes due to its superior inert properties to the chemical compounds and resistance to the aggressive reaction conditions [3]. BDD is a feasible anode material since it has high O_2-overvoltage and large amounts of adsorbed hydroxyl radicals can be produced on its surface [4].

In this study, the electrochemical treatment of textile dyeing wastewater containing Procion Blue MX-R reactive blue dye was investigated on boron doped diamond (BDD) anode in the presence of NaCl electrolyte in a batch electrochemical reactor. The influence of operating parameters such as current density, electrolyte concentration, initial dye concentration, and reaction temperature were carried out in the range of 3-15 mA/cm², 0-10 g/L, 500-2500 mg/L, and 25-45°C, respectively. The experimental data were optimized using response surface methodology (RSM), the approximation functions were obtained, and the optimum operating conditions were determined by checking model adequacy. In the response surface optimized conditions, complete color removal and over 80% COD removal were obtained.

References