Int. J. Electrochem. Sci., 15 **(2020)** 5664 – 5681

International Journal of
ELECTROCHEMICAL
SCIENCE
www.electrochemsci.org

Effects of electrochemical parameters on electropolymerisation of 2-nitro-p-phenylenediamine synthesised in an acidic medium

Ahmad S. Barham[1,], and Mohammad A. Kanan[2]*

[1] General Subjects Department, College of Engineering (CE), University of Business and Technology (UBT), Jeddah 21448, Kingdom of Saudi Arabia
[2] Industrial Engineering Department, College of Engineering (CE), University of Business and Technology (UBT), Jeddah 21448, Kingdom of Saudi Arabia
[*]E-mail: ahmad.s@ubt.edu.sa

doi: 10.20964/2020.06.54

Received: 27 January 2020 / *Accepted:* 22 March 2020 / *Published:* 10 May 2020

Electrochemical cyclic voltammetry (CV) was used to synthesise poly 2-nitro-p-phenylenediamine (2NPPD) as a thin film, on either 1.6 mm diameter gold electrodes (A= 0.02 cm^2) or on 3.0 mm glassy carbon (A= 0.07 cm^2) in 0.1 mol dm^{-3} sulfuric acid (pH 1.2). This study explores the electropolymerisation process of poly 2NPPD-modified electrodes, using a general factorial design. The morphological properties of the formed polymer were subsequently examined using scanning electron microscopy (SEM). Tree-like structures, with faint scratches, were observed on the electrode's surfaces. Interactions between the factors of scan rates and the type of electrode materials were both investigated. The rapid drop in the current, in all CV measurements, was proposed as an indication of electropolymerisation. Anodic current peak densities were selected as the response in the design study and, in order to ensure reproducibility, each run in this study was performed in triplicate. This study proposes the mechanism of the electrochemical polymerisation reaction. The diffusion coefficients were measured using the Randles-Sevcik equation, which confirmed that the electropolymerisation of the 2NPPD monomer is a linear diffusion-controlled process. When the concentration of the 2NPPD monomer was decreased, calculated diffusion coefficients also decreased.

Keywords: electropolymerisation; poly(2-nitro-p-phenylenediamine) (2NPPD); general factorial design; electrochemical cyclic voltammetry (CV); diffusion.

FULL TEXT

© 2020 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (http://creativecommons.org/licenses/by/4.0/).