

Area: ANA

Investigation of Cu/CuO electrode application in e-liquids studies

Emily Clara Aguiar Welter (PG),^{1*} Cleber Antonio Lindino (PQ),²emilycawelter@gmail.com¹Programa de Pós-Graduação em Processos Químicos e Biotecnológicos, UTFPR; ²GIPEFEA, Centro de Engenharias e Ciências Exatas, UNIOESTEPalavras Chave: *Electrochemistry, Voltammetry, Glycerol, Electronic Cigarette.*

Highlights

Cu/CuO electrode was applied for electrochemical analysis of e-liquids. E-liquids are liquid solutions used in electronic cigarettes. Electronic cigarettes use is increasing dramatically worldwide. The Cu/CuO electrode synthesis was efficient, and the material proved to be sensitive to the analyzed samples. Cyclic and differential pulse voltammetry showed selective responses. Differential pulse voltammetry was chosen for the analysis. Distinct voltammetric profiles were observed for the analyzed samples. The proposed method presents potential for application in e-liquid studies, offering an easier, faster, cheaper, and more eco-friendly alternative to conventional techniques.

Abstract

Smoking is one of the most common addictions today. It is extremely harmful to health and causes chemical dependence on nicotine, a substance capable of affecting the brain's neuroplasticity. With the premise of a supposedly safer alternative to conventional cigarettes, electronic cigarettes have emerged and are becoming increasingly widespread throughout the world. The substances responsible for producing the vapor are different proportions of glycerol and propylene glycol, found in the "e-liquids", liquid solutions used in these devices that provide nicotine doses to users. With the possible regulation of electronic cigarettes in Brazil and recent discoveries of health problems associated with electronic cigarette use, studies about this topic have become necessary. Considering the electro-oxidation reactions of the substances present in e-liquids, the use of Cu/CuO electrode in electrochemical systems was investigated, applying cyclic voltammetry (CV) and differential pulse voltammetry (DPV) techniques, and evaluating the electrode's selectivity towards samples of glycerol (0,7 g L⁻¹), propylene glycol (0,7 g L⁻¹), a analogous solution of the product (Glycerol 0,7 g L⁻¹ + Propylene glycol 0,7 g L⁻¹) and two distinct brands of e-liquids (2%), with sodium hydroxide (NaOH) 0,1 mol L⁻¹ as solvent and support electrolyte. An experimental plan 2⁴ was carried out to determine the best analysis parameters. Differential pulse voltammetry was chosen to carry out the assays, making it possible to identify different peaks for each sample, using a potential range from -0.9 to 0.7 V. The method proved effective for the determination of the substances, presenting characteristic values for each sample. Figure 1 and 2 shows the distinct voltammetric profiles between the analyzed samples [1].

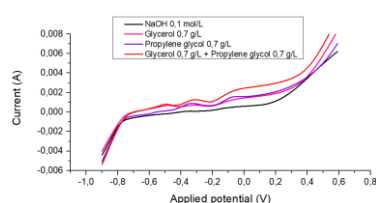


Figure 1. DPV of glycerol and propylene glycol (0,7 g L⁻¹) and the analogous solution, in NaOH 0,1 mol L⁻¹. Temp. 25 °C. Ref. electrode: Ag/AgCl/KCl sat. Scan speed: 0,04 V s⁻¹.

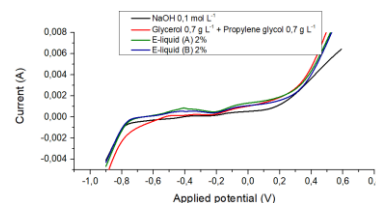


Figure 2. DPV of analogous solution and e-liquids (2%), in NaOH 0,1 mol L⁻¹. Temp. 25 °C. Ref. electrode: Ag/AgCl/KCl sat. Scan speed: 0,04 V s⁻¹.

[1] WELTER, Emily Clara Aguiar. Investigação da utilização do eletrodo de Cu/CuO em estudos de e-liquidos. 2025. Monografia (Bacharelado em Química) – Universidade Estadual do Oeste do Paraná, Toledo, 2025

Acknowledgments

To PETq, FNDE and UNIOESTE.

31º Encontro de Química da Região Sul- Unioeste – Campus Toledo