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Preparation of an efficient electrocatalyst for oxalic acid oxidation based on Ag-doped ZSM-5 nanozeolites synthesized from bagasse

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Abstract

In this work, we report a new modified carbon paste electrode based on silver incorporated in ZSM-5 nanozeolite (Ag/ZSM-5/CPE) for oxalic acid (OA) electrooxidation. ZSM-5 nanozeolite was synthesized using amorphous silica extracted from bagasse (BGA) as silica source and were characterized by the X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier transform infrared (FT-IR), Brunauer–Emmett–Teller (BET), Barrett-Joyner-Halenda (BJH) and energy dispersive X-ray (EDS). Accumulated spherical nanoparticles were formed with range of closely particle size of 82-163 nm. Ag/ZSM-5/CPE was used to investigate the electrocatalytic oxidation of OA in 0.1 M PBS (pH= 2) solution by cyclic voltammetry, differential pulse voltammetry and amperometry. The current intensity of OA oxidation increases impressively on Ag/ZSM-5/CPE in the presence of OA. Additionally, amperometric studies displayed that this electrode as the sensor can detect OA in linear ranges of 16 μM – 0.18 mM and 0.18–4.0 mM with a detection limit of 5.5 μM (S/N=3). Excellent utilities of the fabricated modified electrode such as low detection limit, wide linear range of concentration and high sensitivity make it as good sensor for the selective determination of OA. Ag/ZSM-5/CPE was used for OA detection in real samples such as spinach and cabbage. Possible interferences such as ascorbic acid, tyrosine, uric acid, ethylene glycol, glyoxylic acid and dimethyl oxalate for the detection of OA at the Ag/ZSM-5/CPE were studied. The results exhibits that these compounds do not show any interference on OA measurement.

Keywords: Bagasse, ZSM-5 nanozeolite, Modified carbon paste electrode, Oxalic acid

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