Detection of carbendazim fungicide in water using a carbon paste electrode modified with pyrophyllite

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This work aims to design a pyrophyllite-modified carbon paste electrode for potential use in the detection of pesticides in aqueous solutions. Pyrophyllite is a phyllosilicate which consists of is an $AlO_4(OH)_2$ octahedron sheet between two SiO_4 tetrahedral layers (2:1 structure) (1). Mechanochemical activation introduces structural disorder, causing amorphization and reducing particle size and an increase in the chemical reactivity of material [2]. After milling, the structural and morphological characterization of natural pyrophyllite clay and mechanically modified pyrophyllite was done. It is observed that with increasing milling time, particle size decrease and specific area increase. However, for ore pyrophyllite from a deposit in Parsovići, Bosnia and Herzegovina, up to 20 minutes of milling, the specific surface area increases and the particle size decreases. After that, the agglomeration process becomes more pronounced. It has been shown that the best structural and morphological characteristics are those when pyrophyllite is milled for 15 minutes for construction of the electrode. The electrochemical characteristics of this electrode were investigated by cyclic voltammetry in 1 mM $K_4Fe(CN)_6$ in 0.1 M KCl and 0.5 M H_2SO_4 and differential pulse "striping" voltammetry in Britton-Robinson buffer at pH 4 , 6 and 8. The best results were obtained at pH 4. It was shown that the maximum at +0.96 V *vs.* Ag/AgCl electrode originates from carbendazim oxidation at pH 4 in Britton-Robinson buffer. Good stability and sensitivity were shown by the electrode containing 50% carbon paste and 50% pyrophyllite mechanically modified for 15 minutes in a ball mill. The developed method is linear in the range from 1 ppm to 10 ppm with r = 0.999 and a detection limit of 0.3 ppm.

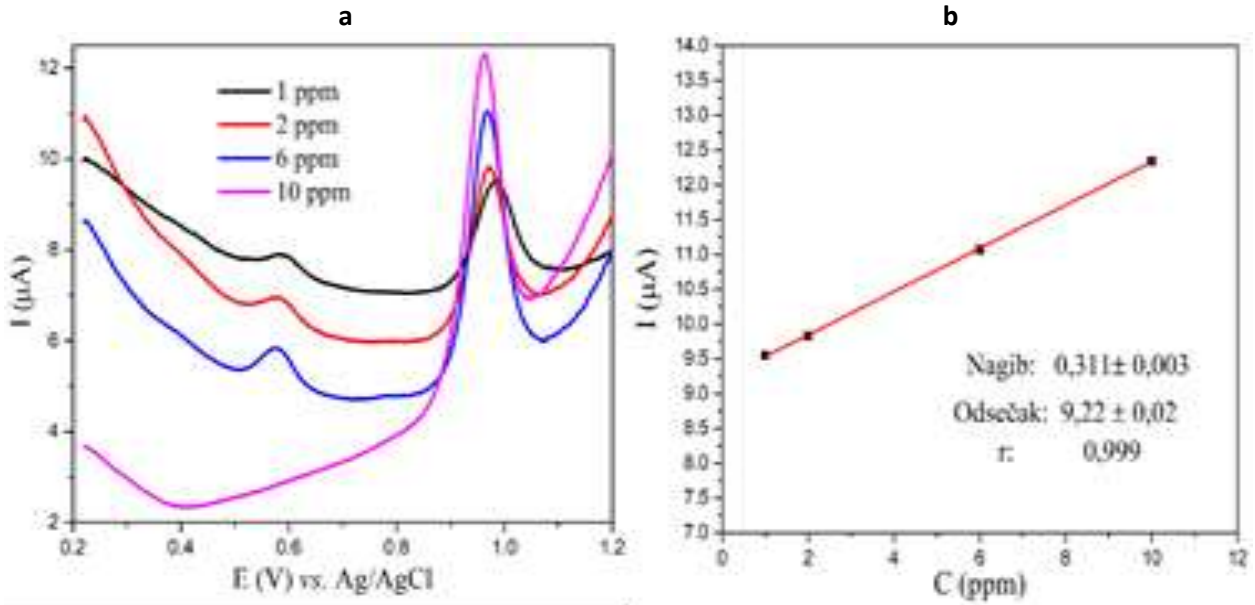

Figure 1. a) Differential pulse voltammogram for determination of carbendazim in Britton-Robinson buffer at pH 4; b) Dependence of current on concentration of carbendazime for a pyrophyllite-modified carbon paste electrode with paraffin oil as a binding fluid for the detection of carbendazime in Britton-Robinson buffer at pH 4 in the concentration range from 1 ppm to 10 ppm

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