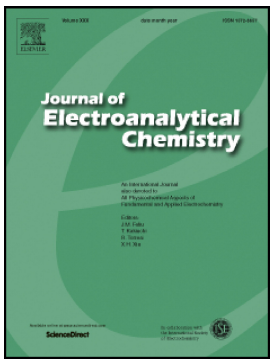

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Electrochemical oxidation of salicylic acid at ITO substrates modified with layer-by-layer films of carbon nanotubes and iron oxide nanoparticles

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Abstract

Ultrathin films comprised by a tetralayer repeating unit of anionic carbon nanotubes (CNT-PABS), cationic iron oxide nanoparticles (MAGNP), and cationic poly(diallyl dimethylammonium) hydrochloride (PDAC) are deposited onto ITO substrates and tested for electrochemical oxidation of salicylic acid (SA). Cyclic voltammetry shows that while bare ITO substrates are insensitive to SA, those modified with the tetralayer film are capable of carrying out its oxidation while providing anodic current density (at +1.14 V) that scales asymptotically with the number of tetralayers. Fouling caused by SA oxidation subproducts is prevented by cleaning the electrodes in methanol:water mixtures at potentiostatic condition. The electrodes used for at least 7 consecutive runs show a sensitivity variation coefficient of only 0.58%. The electrodes respond linearly (r^2=0,999) to SA in the range 6-100 µmol L^{-1}, with sensibility = 0.357 µA cm^{-2}/ µmol L^{-1}; limit of detection = 0.105 µmol L^{-1} and limit of quantification = 0.319 µmol L^{-1}. Cinnamic acid interferes the electrodes´ response only when is present in concentrations equal or above that of SA. Electrochemical impedance spectroscopy indicates that MAGNP decreases the charge transfer resistance and increases the diffusion admittance at the electrode/SA solution interface. Because CNT-PABS are relatively more expensive, our results suggest they could be eventually replaced by or conjugated to MAGNP layers without causing significant losses in the electrode`s performance for SA detection.