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Abstract

2 Evaluation of a Microcantilever-Based Biosensor Surface for Specific Detection of Short–Chain Alcohols Using XPS and AFM

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This work describes the development and evaluation using a X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM) of a biosensor designed to enzymatic detection of short-chain alcohols. The biorecognition element, alcohol dehydrogenase, was immobilized on self-assembled monolayers deposited on top of silicon nitride microcantilevers. Biosensor assays provided detection of short-chain alcohols and evaluation of the influence of a biological element immobilization on the analytical performance of the device. The self-assembly process was performed by surface activation using 3-aminopropyltriethoxysilane, followed by glutaraldehyde and biomolecule binding. XPS and AFM were used to verify surface oxidation and reagent binding. The biosensor showed a response time shorter than 1 s, a total renovation of the bioactive layer after 10 min, a sensibility from 0.03 to 1.2 mL/L and a lifetime of 22 days. Its selectivity was analyzed through exposure to pure and mixed volatile solvents. Sensor sensibility was higher in the presence of short-chain alcohols family (methanol, ethanol and propanol) ranging from 0.45 to 0.85 kHz and practically null involving others polar or nonpolar solvents. The biosensor it showed less susceptible to humidity and the temperature variations, presenting a high quality factor, a faster response time, selectivity, sensitivity and durability.