Development of palladium-gold nanoporous microelectrode-based sensor for ethanol detection in saliva

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The detection of ethanol in biological fluids has gained significance in the context of road safety, particularly following the enactment of Law No. 11.705/2008, which enforces zero tolerance for alcohol consumption by drivers. Although breathalyzers are widely used, their effectiveness is limited to individuals with respiratory impairments. In this context, electrochemical sensors for saliva analysis emerge as promising and more accessible alternatives[1]. The present work aims to evaluate palladium-gold nanoporous structures for detecting ethanol in saliva. The surface of gold microelectrodes was modified by electrodepositing layers of nanoporous gold, nanoporous palladium, and nanoporous palladium-gold under hydrogen evolution conditions in acidic media (-4.0 V vs. Ag|AgCl), resulting in a foam-like structure with pores ranging from nanometers to micrometers in size. The ethanol oxidation reaction was investigated by cyclic voltammetry in an alkaline medium. While the palladium-modified electrode showed higher signal intensity, it was more affected by oxygen interference. In contrast, palladium-gold nanoporous electrodes exhibited lower oxygen interference and higher current density, making them more suitable for analytical applications. The analytical evaluation was performed under amperometric conditions at -0.1 V, with a linear range of 1 to 100 mM and a detection limit of 1.2 mM, a value lower than that of usual breathalyzers LD (2.2 mM). The results are promising; however, further optimization of the modification conditions, evaluation of other potential interferents, and analysis of ethanol in real samples are required.

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References:

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