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Detection of diabetes biomarkers using a gas sensor array deposited with a polymeric and polymeric organometallic sensing films

The diabetes is a chronic disease that is detected by measuring the glucose levels in the blood. A noninvasive alternative method was proposed for measuring the gas concentration emitted by individuals with this disease, where the compounds acetone (Ace) and ethanol (EtOH) are considered as biomarkers, and indicators of the disease. A gas sensor array was constructed using quartz crystal microbalance (QCM) with 30 MHz resonance frequency. Various sensing films with affinity for Ace, and EtOH biomarkers were deposited on the QCM electrodes. The polymers deposited over the QCM electrodes include ethyl cellulose (EC), poly[methylmethacrylate] (PMMA), Apiezon L, Apiezon T and poly[ferrocenylmethylphenylsilano] (PFS). The sensing films were deposited using the ultrasonic atomization method, where the QCM electrode was exposed to a micro-drops mist the polymeric solution. This mist was carried by an air flow of 100 mL/min until it reached the QCM surface, allowing the sensing film thickness to increase to approximately 200 nm on the QCM electrode. The gas sensor array was exposed to Ace and EtOH gases using volumes of 1, 5, 10, ad 15 µL injected into a static system for gas sensor response measurement at a temperature of 22℃, and 20 % relative humidity. We obtained gas sensor array sensitivity values ranging from 0.0018 to 0.810 Hz/ppm, and achieved a classification accuracy of 75 %, and 100 % for EtOH, and Ace gases, respectively.

Keywords

Polymers, QCM, Diabetes

Reference

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Author approval

I confirm

Author will attend

I confirm

Authors: RODRÍGUEZ TORRES, Marcos (Facultad de Ciencias Físico Matemáticas-Benemérita Universidad Autónoma de Puebla); Dr MUÑOZ AGUIRRE, Severino (Facultad de Ciencias Físico Matemáticas-Benemérita Universidad Autónoma de Puebla)

Co-authors: Dr LARA SÁNCHEZ, Nancy (Instituto Ciencias Químicas-Benemérita Universidad Autónoma de Puebla); Dr PERZABAL DOMINGUEZ, Josue Froylan (Facultad de Ingeniería Química-Benemerita Universidad Autónoma de Puebla); Dr BELTRÁN PÉREZ, Georgina (Benemérita Universidad Autónoma de Puebla); Dr CASTILLO MIXCOATL, Juan (Benemérita Universidad Autónoma de Puebla); Dr ALTUZAR AGUILAR, Victor (Facultad de Ciencias Físico Matemáticas-Benemérita Universidad Autónoma de Puebla); Dr MENDOZA BARRERA, Claudia (Facultad de Ciencias Físico Matemáticas-Benemérita Universidad Autónoma de Puebla)

Presenter: RODRÍGUEZ TORRES, Marcos (Facultad de Ciencias Físico Matemáticas-Benemérita Universidad Autónoma de Puebla)

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