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Electrolyte-Gated Field-Effect Transistors for sensing an Alzheimer's disease hallmark

S. Ruiz-Molina, S. Ricci, S. Casalini, M. Mas-Torrent
Institut de Ciència de Materials de Barcelona (ICMAB-CSIC): Molecular Nanoscience and Organic Materials, Campus UAB, Bellaterra, Barcelona, 08193, Spain
sruiz@icmab.es

Electrolyte-Gated Organic Field Effect Transistors (EGOFETs) have been investigated recently as a useful means for biological sensing. Their working principle is based on converting a chemical event into a readable electrical signal. These devices can be prepared at low cost and on flexible substrates and present high sensitivity and specificity. [1][2]
In this work, we report the study of $A\beta_{1\text{-}40}$ peptide aggregation kinetics using a label-free EGOFET immunosensor. Amyloid-beta 1-40 is a peptide present in the brain of the Alzheimer's disease (AD) patients. It tends to aggregate in oligomers, that are believed as major toxic effects in this pathology. Thus, they are considered as promising biomarkers for its diagnosis and therapy. [3]
The sensing element of EGOFETs resides at the Au gate-electrolyte interface. One strategy of Au surface engineering with antibodies has been developed. The validation of this protocol has been carried out using electrochemistry, employing Cyclic Voltammetry (C.V.) and Electrochemical Impedance Spectroscopy (E.I.S.) as characterization techniques. In the same way, the aggregation process has been characterized by EGOFET transfer characteristics, using PBS 1X as electrolyte.
The results show that the maximum oligomer species are found after 2 hours of incubation in both electrochemical and EGOFET characterization.
The final purpose is to combine the EGOFET with a microfluidic system paving the way towards the fabrication of simple and cost-effective devices that allows continuous measurements and more efficient diagnosis.

[1] M. Berto et al., "Label free detection of plant viruses with organic transistor biosensors" Sensors & Actuators: B. Chemical **281**, 150-156 (2019).

[2] S. Ricci et al., "Label-free immunodetection of α-synuclein by using a microfluidics coplanar electrolyte-gated organic-effect transistor" Biosensors and Bioelectronics **167** 112433 (2020).

[3] A. J. Veloso et al., "Electrochemical Immunosensors for Effective Evaluation of Amyloid-Beta Modulators on Oligomeric and Fibrillar Aggregation Processes" Anal. Chem. **86** 4901-4909 (2014)