Fast on-site detection of Ochratoxin A by the graphene-based field-effect transistors

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Mycotoxins are a widespread contaminant in food and feed produced as second metabolites of *Asperagillus* and *Penicillium genera* microfungi [1,2]. Ochratoxin A is a mycotoxin that can be found in a wide range of food, from cereals to wine, which is why it has to be regularly monitored by different standardized methods. To date, methods like high-performance liquid chromatography-mass spectrometry or enzyme-linked immunosorbent assay (ELISA) are very prominent tools for Ochratoxin A monitoring, but they require highly trained and qualified staff, as well as controlled laboratory environment, which hinders the in-field use and do not promote low-cost and easy-to-use current and future demands [3,4]. In this research, we report on a specific biosensing tool for the detection of Ochratoxin A, based on lithography-fabricated array of graphene field-effect transistors (G-FETs) on a single silicon chip. G-FETs are assembled with specific aptamers, used as a recognition element on the graphene channel as a transducer deposited via pyrene-based linker (Figure 1). The biosensor showed high sensitivity to Ochratoxin A with the limit of detection of 1.4 pM and a response time of the order of magnitude 10 s. The biosensor is tested on a real red wine samples with a response time of 50 s, showing promising results for future research.

References:

[1] X. Guo, F. Wen, N. Zheng, M. Saive, M.-L. Fauconnier, J. Wang, Front. Chem. 8 (2020), 195.
[2] A.T. Mata, J.P. Ferreira, B.R. Oliveira, M.C. Batoréu, M.T. Barreto Crespo, V.J. Pereira, M.R. Bronze, Food Chem. 176 (2015) 455–464.
[3] M.Z. Zheng, J.L. Richard, J. Binder, Mycopathologia. 161 (2006) 261–273.
[4] Y. Dong, T. Zhang, X. Lin, J. Feng, F. Luo, H. Gao, Y. Wu, R. Deng, Q. He, Microchim. Acta. 187 (2020) 179.

Figures:

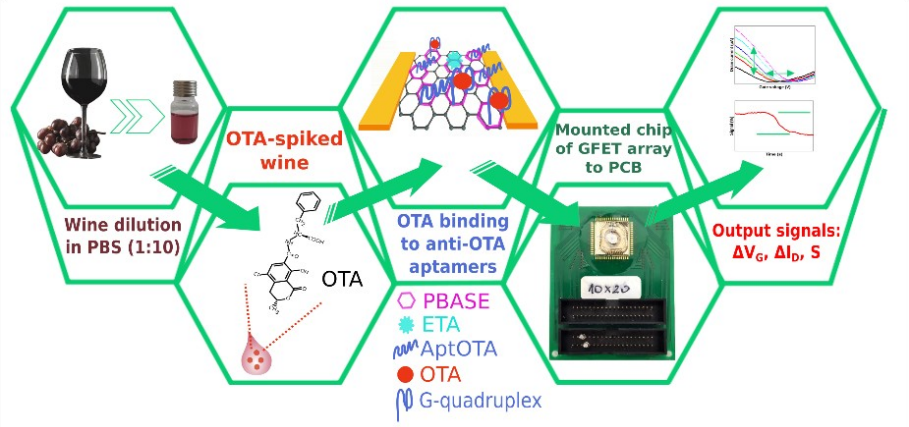

Figure 1: A schematics of G-FET-based biosensor development for Ochratoxin A detection