Mycotoxin detection by graphene field-effect transistor

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Grape yards that can be contaminated by mold. Credit: Biosense Institute

The struggle for living space concerns not only people and animals but can refer also to molds. When mold (fungi) contaminated the food in case of bad environment for its development it states to produce second metabolites—mycotoxins—to prevent of growth of another fungus on the same substance. One some of mycotoxins do not effect on animals and people others can cause the drastic effect on health. Nowadays the

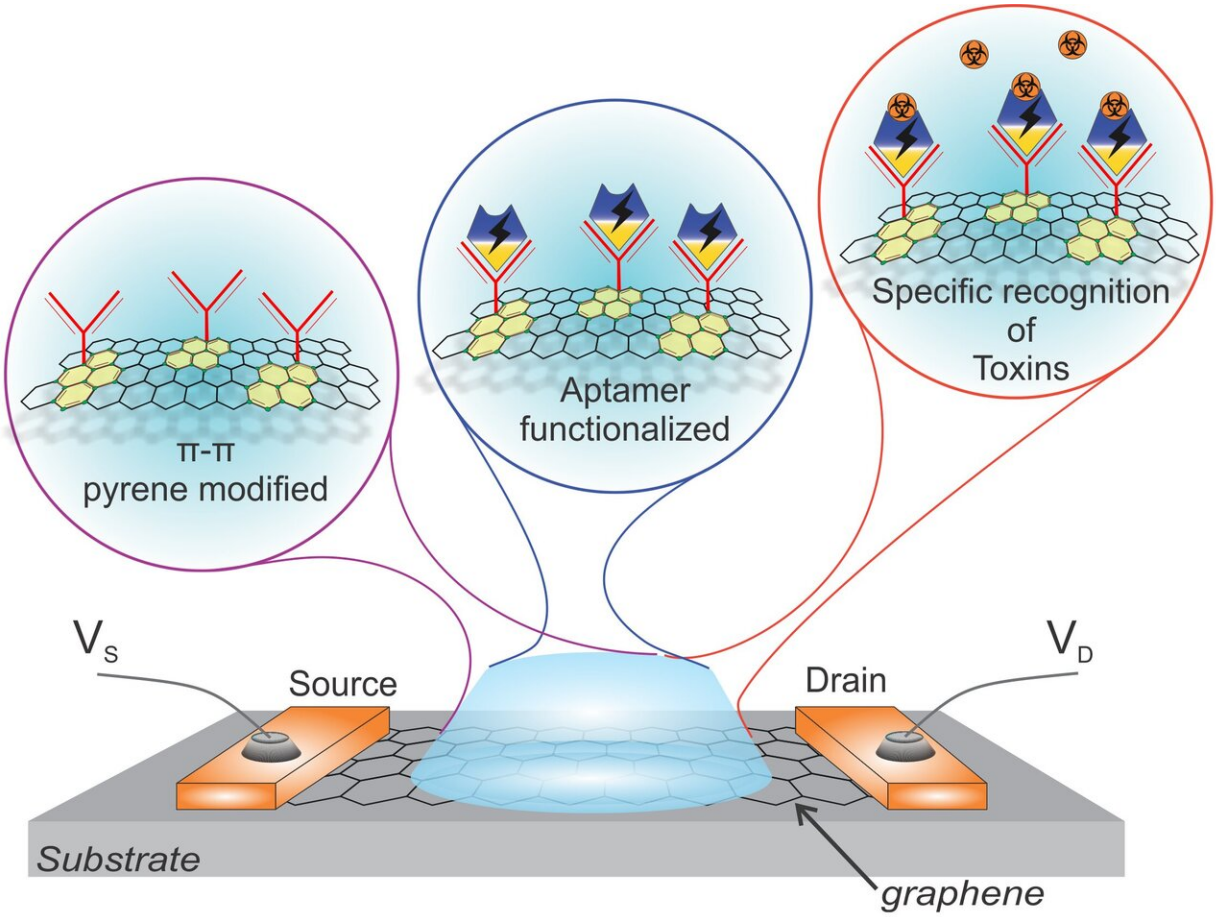
common method for food and feed analysys on mycotoxins is based on complicated analysts based on High Performance Liquid Chromatography methods.

An international team of researchers from Biosense Institute (Serbia), National Research University of Electronic Technology (Russia), and The University of Texas at Austin (U.S.) has developed a in-field fast mycotoxin sensor based on graphene field effect transistor (GFET). The authors utilize both the micro-technology fabrication method to produce GFET to be able work in liquid and the biological functionalization by covalent binding to the surface the biological recognition element based on specific aptamer. The changes in aptamer configuration during the binding with mycotoxins lead to gating effect on charge carries in graphene channel.

The authors demonstrated the high speed of ochratoxin A (OTA) detection in buffer solution and in reals samples (spiked wine). They demonstrated high sensitivity to OTA concentration down to 4 pg/mL for the 5 min response time. Moreover the authors demonstrated the regeneration of the sensor by washing in urea solution that makes multiple usage possible.

This study provides a first step in progress of multyarray on-chip graphene-based sensors development for multiple mycotoxins analysis in food and beverages. Developing the microtechnology-compatible technology for local and selective aptamer binding can provide sensors with numerous transistors for specific component analysis. Additionally, such GFET-based sensors can be easy integrated to IoT and mobile phone platforms. The study shows that the fully integrated mycotoxin sensor with high sensitivity, fast response, and high dynamic range of toxins concentrations is feasible by proper graphene FET functionalization.

The researchers discuss their technology further in *Toxins*, an MDPI publication.



Scheme of graphene FET with recognition molecules attached. Credit: Biosense Institute

More information: Nekrasov, N.; Kireev, D.; Emelianov, A.; Bobrinetskiy, I. Graphene-Based Sensing Platform for On-Chip Ochratoxin A Detection. Toxins 2019, 11, 550. doi.org/10.3390/toxins11100550

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