Paper-based electrochemical (bio)sensors: how?

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Despite substantial advances in sensing technologies, the development, preparation, and use of self-testing devices is still confined to specialist laboratories and users. Decentralized analytical devices will enormously impact daily lives, enabling people to analyze diverse clinical, environmental, and food samples, evaluate them and make predictions to improve quality of life, particularly in remote, resource-scarce areas. In recent years, paper-based analytical tools have attracted a great deal of attention; the well-known properties of paper, such as abundance, affordability, lightness, and biodegradability, combined with features of printed electrochemical sensors, have enabled the development of sustainable devices that drive (bio)sensors beyond the state of the art. Their blindness toward colored/turbid matrices (i.e., blood, soil), their portability, and the capacity of paper to autonomously filter/purge/react with target species make such devices powerful in establishing point-of-need tools for use by non-specialists. Depending on analytical requisites, different types of paper (filter, office) and configurations (1D, 2D, 3D) can be adopted. A wide overview regarding application ranging from DNA to heavy metals, through pesticides detection will be provided, with the aim in showing the potentialities of paper-based electrochemical biosensors for improving society involvement in monitoring.
The talk is aimed to provide general basis regarding the development of paper-based electrochemical strips for multiple applications. However, it should be noted that the term "paper" is too general: chromatographic paper, office paper and nanocellulose are only some of the paper-based substrates that can be exploited. The main question from non-experts is: which kind of paper should I use? The best answer is "it depends"! Answers depend on the application and the analytical need.

Research interests

Biosensors, point-of-care, nanomaterials, nanoengineering, lab on chip, microfluidics