

The rise of paper-based electrochemical (bio)sensors

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Beyond the development of sensitive and accurate analytical devices, nowadays the attention is being focused particularly toward the lowering of three fundamental aspects: fabrication cost, user-tasks, and waste management. Among different materials, paper demonstrated a high synergy when coupled with facile fabrication technologies such as wax- and screen-printing, allowing the fabrication of sustainable “lab-in-a-hand”. Herein, we report the application of paper-based electrochemical platforms in all the relevant analytical fields, i.e. environmental, clinical, and food areas. By using all-in-one approach, organophosphorus pesticides were detected in river and waste waters at ppb levels. By exploiting the filtering and storing capabilities of filter paper, all the (bio)reagents necessary to carry out the electroanalytical assay were stored in a designed test area just around the screen-printed electrode nanomodified with carbon black/prussian blue nanoparticles. By using the same approach chloride ions were detected in sweat and serum samples using silver-based printed sensor. Office-paper was successfully used for the assembling of two different devices for practical uses in food and clinical samples. An alcohol oxidase-based biosensor was developed for the evaluation of ethanol in commercial beers. After the optimization of the analytical parameters, the biosensor allowed a facile quantification with a detection limit of 0.52 mM. The detection of zinc ions in serum and sweat was performed using a paper based bismuth-modified screen-printed electrode. Under the optimised conditions of the zinc ions were detected at ppm levels, in agreement with the concentrations usually found in serum and sweat samples.

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