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Decentralized chemical analysis: Complimentary approaches based on molecular recognition and enzymatic reactions

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The growing importance of approaches such as telemedicine, point of care and sensing networks are creating a rising demand for systems that allow the access to chemical information at a speed and scale that cannot be reached by the traditional lab-centred schemes. New devices that can generate information outside the lab, in real time, with minimal or no human intervention and at affordable costs are required. The challenge is to develop systems that can simultaneously offer robustness, speed, affordability, simplicity of operation and scalable manufacturing. For this reason, potentiometry has emerged as one of the most promising tools in this area. In this presentation, we will be discussing two main strategies for the development of decentralized analytical tools using potentiometric detection. The complementarity of the two approaches will be discussed based on the results obtained for two biologically relevant targets: creatinine and glucose. First, we will focus on new chemical sensors for the management of chronic kidney diseases. We have developed a new synthetic receptor for the selective recognition of creatinine, i.e. the biomarker of kidney function. Discussion of the supramolecular interactions between the ionophore and the target and characterization of the resulting sensor will be presented. Its application in real-case scenarios will be described. Then, our preliminary results on a novel approach to build enzyme-based potentiometric sensors using polyelectrolytes will be introduced. These novel analytical systems allow the potentiometric detection of neutral organic molecules with an enhanced sensitivity and selectivity. The application of these systems to the determination of glucose in biological samples will be discussed.

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