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Abstract

About the Amplification Factors in Organic Bioelectronic Sensors †

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Abstract: Several three-terminal organic bioelectronic structures have been proposed so far to address the needs for a variety of biosensing applications. The most popular ones utlized organic field-effect transistors immobilizing a layer of bio-recognition elements that are operated in an electrolyte that enables one to selectively detect both proteins and genomic analytes. These features along with the foreseen low-cost for their production, make them very appealing for point-of-care biomedical applications. However, organic bioelectronic transistors do not always exhibit a performance level beyond state-of-the-art electrochemical sensors, which have been dominating the field since decades. This review offers a perspective view, based on a systematic comparison between the potentiometric and amperometric electrochemical sensors and their organic bioelectronic transistors counterparts. The key-relevant aspects of the sensing mechanisms are reviewed for both, and when actually in place, the amplification factors are reported as the ratio between the response of a rationally designed transistor and that of a homologous electrochemical sensor. The functional dependence of the bioelectronic sensors responses on the concentration of the species to be detected enabling their correct analytical quantification, is also addressed.

Keywords: bioelectronic sensors; electrolyte-gated organic field-effect transistor; organic electrochemical transistors; electrochemical biosensors; amperometric and potentiometric sensors