Unmasking 17α-ethinylestradiol presence in diverse water matrices

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As our collective environmental concerns are being more and more addressed and discussed, certain compounds and molecules such as pharmaceutical and personal care products (PPCP) and endocrine-disrupting chemicals (EDC) are becoming the prime focus of various legislations, regulations and laws across a multitude of countries [1, 2]. Hormones, as is the case of 17α-ethinylestradiol (EE2), cannot be fully removed from the water during the processes that occur inside wastewater treatment plants and find their way into natural bodies of water, where their presence is pernicious on the environment, thus making their detection in water bodies an urgent matter [3]. In this work, we present and analyze a sensor device able to detect traces of the synthetic hormone 17α-ethinylestradiol (EE2) below 10^{-9} M in matrices of different complexity, namely, ultrapure (UW), mineral (MW) and tap waters (TW). The sensor is composed of ceramic solid supports with interdigitated electrodes with and without a polyethylenimine (PEI) and poly(sodium 4-styrenesulfonate) (PSS) layer-by-layer (LbL) thin-film deposited on it. The device's response was analyzed through both loss tangent and capacitance spectra and the data was examined by principal component analysis (PCA), a statistical analysis method [4]. While both kinds of spectra illustrated that it was possible to discriminate clearly the different matrices, loss tangent spectra however allowed for the detection of EE2 concentration. Detection limits values achieved in this work were lower than the ones found in literature.

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