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Nanomaterials-based Electrochemical Sensors for the Detection of Emerging Contaminants

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Extended Abstract

Recently, acetaminophen, estrogen and bisphenol-A have become emerging contaminants in water systems and environment due to their increased presence in water that causes adverse effects in health and aquatic ecosystems [1-4]. The first two contaminants are the result of the increased human excretion and improper disposal [1,2]. Although the concentrations of these contaminants are very low, typically in the nanomolar range, acetaminophen's long-term exposure to individuals can cause increased mortality, as well as heart, gastrointestinal, and kidney diseases, and estrogen is toxic and can cause breast and prostate cancers. Estrogen is a plasticizers' derivative chemical, resulting from leaching from packaging materials such as feeding bottles, water bottles, and beverage cans into food and water. Exposure to bisphenol-A can also adversely affect on brain, thyroid, and reproductive organs, leading to neurodegenerative, cardiovascular, and carcinogenic diseases due to its toxic behaviour [3,4]. Therefore, frequent monitoring of these contaminants is critical to predict their exposure and adverse effect to humans. Conventional analytical techniques such as liquid chromatography and enzymelinked immunosorbent assay are commonly used for detecting these contaminants [3]. However, recently, electrochemical sensing techniques have shown much promise for simple, rapid, and precise detection of these contaminants. These electrochemical sensors are simple to fabricate and have small footprint, high sensitivity, and require minimal sample preparation. In electrochemical sensing, the sensing electrode transduces by binding or reacting with analytes (contaminants) into a measurable signal [1-4]. Nanomaterials are now widely used to design the sensing electrodes due to their high surface to volume ratio, excellent catalytic activity and tunable electronic properties, providing more binding sites and stronger signals that is very important for the fabrication of high-performance sensors to detect trace level detection of these contaminants [1-4]. In this presentation, we will report on our recent advances of nanomaterials-based electrochemical sensors for the detection of acetaminophen, estrogen and bisphenol-A. We will explain our results using graphene oxides, multiwall carbon nanotubes, and beta-cyclodextrins and focus on the research challenges, and future perspectives of the detection of the emerging contaminants.

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