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Sensitive Electrochemical Sensor for Simultaneous Detection of Endocrine Disruptors, Bisphenol A and 4- Nitrophenol Using $La_2Cu_2O_5$ Modified Glassy Carbon Electrode

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Abstract : Bisphenol A (BIS A) and 4 Nitrophenol (4N) are the most prevalent environmental endocrine-disrupting chemicals which mimic hormones and have a direct relationship to the development and growth of animal and human reproductive systems. Moreover, intensive exposure to the compound is related to prostate and breast cancer, infertility, obesity, and diabetes. Hence, accurate and reliable determination techniques are crucial for preventing human exposure to these harmful chemicals. Lanthanum Copper Oxide ($La_2Cu_2O_5$) nanoparticles were synthesized and investigated through various techniques such as scanning electron microscopy, high-resolution transmission electron microscopy, X-ray diffraction, X-ray photoelectron spectroscopy, and electrochemical impedance spectroscopy. Cyclic voltammetry and square wave voltammetry techniques are employed to evaluate the electrochemical behavior of as-synthesized samples toward the electrochemical detection of Bisphenol A and 4-Nitrophenol. Under the optimal conditions, the oxidation current increased linearly with increasing the concentration of BIS A and 4-N in the range of 0.01 to 600 µM with a detection limit of 2.44 nM and 3.8 nM. These are the lowest limits of detection and the widest linear ranges in the literature for this determination. The method was applied to the simultaneous determination of BIS A and 4-N in real samples (food packing materials and river water) with excellent recovery values ranging from 95% to 99%. Better stability, sensitivity, selectivity and reproducibility, fast response, and ease of preparation made the sensor well-suitable for the simultaneous determination of bisphenol and 4 Nitrophenol. To the best of our knowledge, this is the first report in which $La_2Cu_2O_5$ nano particles were used as efficient electron mediators for the fabrication of endocrine disruptor (BIS A and 4N) chemical sensors.

Keywords : endocrine disruptors, electrochemical sensor, Food contacting materials, lanthanum cuprates, nanomaterials
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