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## CARBON-BASED ELECTRODES MODIFIED WITH PEROVSKITE MATERIALS

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### Introduction

Due to its diversity, performance, high oxidation–reduction characteristics, voltammetric / amperometric detection of biomolecules, electrical conductivity and electrocatalytic activity, perovskite oxides have received increasing attention. In addition, some perovskite materials are demanding because they help to improve electrode performance. Perovskite materials are used in the electrochemical detection of alcohols, glucose, hydrogen peroxide, gases and even emerging pollutants. The purpose of this research study was to characterize and to test modified electrode materials obtained from two commercial carbon based electrodes and two perovskite materials. Commercial boron-doped-diamond modified with LaCoO<sub>3</sub> (LaCoO<sub>3</sub>/BDD) and glassy carbon modified with CdCr<sub>2</sub>O<sub>4</sub> (CdCr<sub>2</sub>O<sub>4</sub>/GC) were tested for the detection of docetaxel (DCT) and sodium diclofenac (DCF) in water, which were chosen as target emerging pollutants.

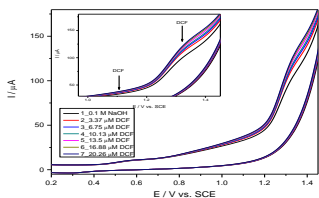
### Materials and methods

The electrochemical experiments were performed using an Autolab Potentiostat / Galvanostat PGStat 302 (EcoChimie, The Netherlands) controlled with GPES 4.9 software and three-electrode cell with saturated calomel electrode as reference (SCE), platinum electrode as counter-electrode and working electrode (CdCr<sub>2</sub>O<sub>4</sub>/GC and LaCoO<sub>3</sub>/BDD). The supporting electrolyte of 0.1 M NaOH solution was prepared using NaOH of analytical purity and distilled water. Cyclic voltammetry (CV) was the electrochemical technique applied for electrochemical characterization and analytical applications.

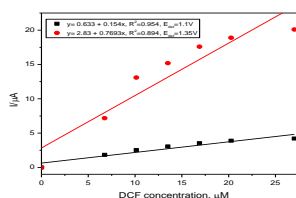
### Results and conclusions

The first stage of this study was to modify the commercial glassy carbon (GC) and boron-doped diamond (BDD) electrodes through simple immersion for 15 seconds in a 5 mg/ml concentration suspension of CdCr<sub>2</sub>O<sub>4</sub> respective LaCoO<sub>3</sub>. For the characterization of the two perovskite materials, the new electrodes obtained (CdCr<sub>2</sub>O<sub>4</sub>/GC and LaCoO<sub>3</sub>/BDD) were tested in the electrochemical detection of diclofenac and docetaxel. The CdCr<sub>2</sub>O<sub>4</sub>/GC electrode allowed DCF detection of two

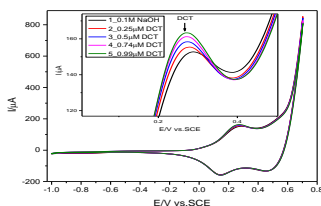
electrochemical potentials of 1.1V/SCE and 1.35V/SCE (Figure 1a). In the case of the LaCoO<sub>3</sub>/BDD electrode, the electrochemical detection of DCT occurred at the potentials of 0.14 V/SCE and 0.27V/SCE (Figure 2a). At the 1.1 V potential, the lowest sensitivity (4.96  $\mu\text{A}\mu\text{M}^{-1}\text{cm}^{-2}$ ) was obtained by testing the CdCr<sub>2</sub>O<sub>4</sub>/GC electrode for DCT detection (Figure 1b) and the best sensitivity (174.7  $\mu\text{A}\mu\text{M}^{-1}\text{cm}^{-2}$ ) was obtained in the case of DCF detection using the LaCoO<sub>3</sub>/BDD electrode at the potential of 0.27V/SCE. (Figure 2b).



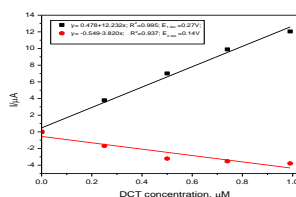
**Figure 1a.** Cyclic voltammograms recorded at the CdCr<sub>2</sub>O<sub>4</sub>/GC electrode in 0.1 M NaOH and in the presence of 3.37-20.3  $\mu\text{M}$  DCF.



**Figure 1b.** Calibration plots of the currents recorded at  $E_1 = 1.1\text{V/SCE}$  and  $E_2 = 1.35\text{V/SCE}$  versus DCF concentrations.



**Figure 2a.** Cyclic voltammograms recorded at the LaCoO<sub>3</sub>/BDD electrode in 0.1 M NaOH and in the presence of 0.25-0.99  $\mu\text{M}$  DCT.



**Figure 2b.** Calibration plots of the currents recorded at  $E_1 = 0.27\text{V/SCE}$  and  $E_2 = 0.14\text{V/SCE}$  versus DCT concentrations.

Based on the results of this study it can be concluded that boron-doped-diamond modified with LaCoO<sub>3</sub> (LaCoO<sub>3</sub>/BDD) and glassy carbon modified with CdCr<sub>2</sub>O<sub>4</sub> (CdCr<sub>2</sub>O<sub>4</sub>/GC) electrodes are appropriate for the electrochemical detection of docetaxel respective sodium diclofenac in water.

### Acknowledgement

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