MODIFICATION OF GLASSY CARBON NANOPARTICLES USING TITANIUM NANOPARTICLES AS A PLATFORM FOR DETERMINING DICLOFENAC SODIUM

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Abstract
This article presents an investigation on the behavior of a chemically modified glassy carbon electrode as a sensing platform for the detection of Diclofenac Sodium. The study also explores the potential application of this electrode in analyzing real samples, including blood, urine, and wastewater. In addition, the synthesis of Titanium Nanoparticles and filaments used in the electrode modification was carried out using a novel method developed by our research group. This unique combination of materials has significantly enhanced the novelty of the technology, as no previous studies have reported such a combination.

Introduction
Considering the significance of dissolved solids (DS) in groundwater and its relevance to European Union legislation, various methodologies have been utilized to ascertain DS levels. These techniques encompass chromatography, specifically gas chromatography-mass spectrometry [1], as well as liquid chromatography [2]. The current study elucidates the alteration of a glassy carbon electrode (GCE) through the integration of micro flagellar nanotubes and titanium dioxide nanoparticles (TiO_2np) to serve as a substrate for the detection of diclofenac sodium (DS) in wastewater samples.

Experimental
The GC electrodes were modified using the drop-casting method. Initially, two solutions were prepared. In the initial experiment, a solution was prepared by combining chitosan (1 mg) with 5 mL of Acetic Acid (1%) and TiO_2 nanoparticles. In the second experiment, chitosan (1 mg) was utilized in a 5 mL solution of Acetic Acid (1%), along with TiO_2 nanoparticles and nanotubes of filaments. These components were prepared for the purpose of detecting diclofenac sodium (DS). Next, a volume of 3 μM of each solution was applied onto the GC electrode and subsequently dried to facilitate solvent evaporation at ambient temperature. The procedure was replicated on three separate occasions. Furthermore, the determination of the DS was conducted through the utilization of cyclovoltammetry (CV) technique, employing a computer-controlled AutoLab potentiostat (PGSTAT302N, and PGSTAT 12, EcoChemie, Utrecht, Netherlands) operated by GPES 4.7 software.

Results and discussion
The cyclovoltagrams (see Figure 1) show the behavior of the prepared modified sensors in the presence of DS. It can be observed at -0.6 V an oxidation peak appears because of the oxidation of the diclofenac. Also, there is no reverse peak appearing, which shows the irresistibility of the process in which the DS is oxidized, and the reduction reaction does not occur. Furthermore,

the anodic intensity peak was greatest when the TiO_2-4HIS-Chit/GCE was evaluated. The I_p was equal to 9.14μA which was 10 times greater than the peak reported by the TiO_2-Chit/GC electrode. Which probes the efficiency of the prepared filaments in the recognition of the DS.

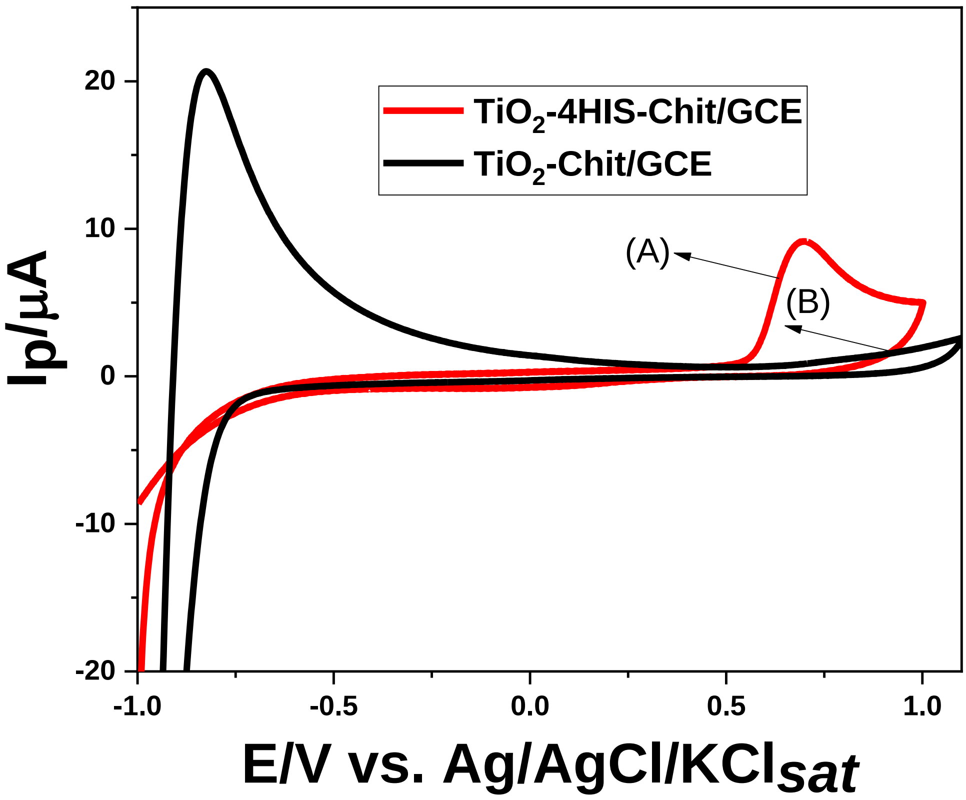

Figure 1. CV of GCE-4HIS-TiO_2Np (a) Chit-TiO_2Np/GCE, (b) in 10^{-3} M diclofenac. Experimental conditions: 0.1 M PBS (pH 4); scan rate, 50 $mV \cdot s^{-1}$, starting potential, -1 V vs. Ag/AgCl, KClsat.

Conclusion

The findings presented in this study demonstrate the efficacy of filament sensing and the enhancement of electrical properties in TiO_2 nanoparticles. In conclusion, it can be stated that the sensors developed in this study have demonstrated efficacy in detecting DS in wastewater samples. Furthermore, the robustness of this technology suggests its potential for application in online monitoring systems.

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