Short Communication

Electrochemical Biosensor for the Determination of Sufentanil in Human Plasma and Urine based on TiO₂-Graphene Composite modified carbon paste electrode

Hongchao Zhang*, Youli He

Department of Clinical Medicine, Heze Medical College, Heze, 274000, China

*E-mail: furuiteng345678@126.com

Received: 2 May 2021/ *Accepted:* 29 June 2021 / *Published:* 10 August 2021

In this work, the synthesis of TiO₂ and graphene nanocomposite modified carbon paste electrode (TiO₂-GO/CPE) as an electrochemical biosensor for the detection of sufentanil in human plasma and urine was investigated. The modified Hummers approach was used to synthesize GO nanosheets, and the hydrothermal approach was used to produce TiO₂-GO nanocomposite. Due to the interaction of TiO₂ nanoparticles with GO, structural studies of the produced nanocomposite using SEM and XRD revealed that TiO₂ nanoparticles in anatase structure had been anchored to GO's nanosheets surface. Electrochemical studies using CV revealed that TiO₂-GO/CPE had higher electrocatalytic current and lower potential than GO/CPE and CPE for determination of sufentanil due to the synergetic effect of high electrical conductivity of GO nanosheets and intercalation of TiO₂ nanoparticles on nanocomposites. The sensitive, stable, and rapid response of TiO₂-GO/CPE was demonstrated in amperometric tests for the detection of sufentanil. The limit of detection, sensitivity and linear range for the determination of sufentanil was obtained at 0.07nM, 4.1070μA/μM, and 1 to 10 μM, respectively. The ability of TiO₂-GO/CPE as a sufentanil sensor in prepared real samples of urine and human plasma showed that the performance of TiO₂-GO/CPE to determine sufentanil in real samples was adequate and acceptable.

Keywords: Sufentanil detection; Hydrothermal technique; TiO₂ Nanoparticles; Graphene oxide; Amperometry

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