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Nano-magnetite/ionic liquid crystal modifiers of carbon nanotubes composite electrode for ultrasensitive determination of a new anti-hepatitis C drug in human serum

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Abstract

Direct-acting antivirals (DAAs) are promising redeemer for patients suffering from Hepatitis C virus (HCV). From the clinical point of view, it is crucial to determine the level of a newly introduced drug of the DAAs-class known as daclatasvir (DAC) in an effective and simple method. A newly designed conductive composite was fabricated based on manual casting of thin layer of ILC sandwiched between two layers of multi-walled carbon nanotubes followed by a layer of nano-magnetite iron oxide (CNTs/ILC/CNTs/FeNPs). The ILC allowed good interaction with CNTs that result in highly ionic and electronic composite with extended surface area for assembling the magnetite FeNPs. The composite is used as direct sensor for the determination of DAC. Compared to glassy carbon-CNTs (GC/CNTs), (CNTs/ILC/CNTs/FeNPs) showed five folds increase in the current for the oxidation of DAC. The sensor exhibited excellent electro-catalytic activity toward DAC determination in human serum in a wide concentration range $0.003 \mu\text{mol L}^{-1}$ to $15 \mu\text{mol L}^{-1}$. The detection limit and correlation coefficient are $0.383 \times 10^{-10} \text{ mol L}^{-1}$ and 0.993, respectively in the low concentration range $0.003\text{-}0.1 \mu\text{mol L}^{-1}$. The CNTs/ILC/CNTs/FeNPs sensor has been applied for the simultaneous determination of DAC with acyclovir (ACY) antiviral drugs and in presence of interfering compounds: ascorbic acid (AA), uric acid (UA), dopamine (DA) and paracetamol (APAP). The method presents good sensitivity and stability appropriate to be employed in quality control and routine quantification of drug in pharmaceutical formulations.

Keywords

MWCNTs; Ionic liquid crystal; Magnetite iron oxide; Daclatasvir; Anti-hepatitis C drugs; Human serum; Antiviral drugs.

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