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Electrochemical sensing using carboxylated multiwalled carbon nanotubes

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Carbon nanotubes (CNTs) have demonstrated great advantages in electrochemistry. The application of CNTs most widely employed so far has been the construction of various detection devices, such as gas sensors, electrochemical detectors and biosensors [1]. The main advantage of their use is related to the increase of the electrodes surface area and of the electron transfer rates, improving sensors sensitivity. Besides, their sorption capability of different analytes can be used to improve sensors selectivity [2].

Unfortunately, as-synthesised, CNTs are generally impure and have very low solubility in either organic solvents or aqueous solutions. Chemical treatments, such as oxidation using mineral acids, are widely applied for both purification, removing metallic impurities and improve CNTs solubility (CNT_{ox}). Molecular debris is a by-product of this treatment, commonly referred as carboxylated carbonaceous fragments (CCFs) [3]. Washing with dilute aqueous base removes much of CCFs, producing CNTs with increased purity; the base converts acidic groups to their conjugate salt, increasing the solubility of CCFs in water. The importance of the formation of these CCFs is not established as well as their role on the properties of oxidized CNTs.

In this study, commercially available screen-printed electrodes (SPEs) were modified with suspensions of CNT treated with mineral acids during different times. The CNT_{ox} were characterized by thermogravimetric analysis (TGA) and the morphology of the CNT_{ox}-modified SPEs were characterized by scanning electron microscopy (SEM)..

The relation between the CNTs oxidation time and the catalytic properties of the CNT_{ox}-modified SPEs is analysed considering the voltammetric detection of hydroquinone (HQ). The influence of CCFs on the catalytic properties of the electrochemical sensors is also studied.

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