TRANSITION METAL DICHALCOGENIDES BASED NANOHYBRID SENSORS AS USEFUL DEVICES IN FOOD POLYPHENOLS ANALYSIS

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Nanomaterials (NMs) have become elective analytical tools able to improve the performances and give rise to new opportunities, for both constructions of analytical devices and implementation of analytical methods. On the other hands, polyphenolic compounds (PCs) still continue to attract exceptional attention, for their well-known health benefits, for their technological role and also marketing [1]. In the last years, following the line traced by graphene, transition Metal Dichalcogenides (TMD) have emerged as electrode material for analytical purposes due to large available surface area and structural versatility [2]. TMDs are compounds with a general structure MX_2 where M is a transition metal and X is a chalcogen. These nanomaterials show unique electrical, optical, mechanical and catalytic properties along with large surface area. Despite, widely employed in energy conversion and storage, their properties have not yet been widely and deeply studied for (bio)sensing purposes. Herein, for the first time, the ability to detect polyphenols belonging to different chemical classes on an effective and regenerable carbon black/molybdenum disulfide nanohybrid screen-printed electrode (SPE-CB/MoS_2) is demonstrated. The proposed SPE-CB/MoS_2 merges the ability of CB to improve the electrochemical response with the proprieties of MoS_2 to totally prevent polyphenols irreversible polymerization and adsorption onto the electrode surface occurring at classical 'carbon-based' electrodes. The proposed CB/MoS_2 sensor showed significantly improved analytical performances, noteworthy, the MoS_2 anti-fouling ability has been demonstrated for the first time using both PCS/flavonoids standards and complex samples thus proved to be an unexpected and useful characteristic. In brief, a regenerable and totally anti-fouling (classical catechins/polyphenols analysis drawback) screen-printed electrode (SPE) based on TMD for the cocoa (CO) catechins (CT) and olive oil PCs rapid quantification has been successfully realized [3,4]. Moreover, during this study, a new natural polyphenolic electrochemical mediator has been discovered. In particular, has been demonstrated the ability of cocoa powder (CO) and pure catechins (CT), to act as effective electrochemical mediators when electrodeposited onto carbon black (CB) modified screen-printed electrodes (SPE-CB). As proof of applicability, the SPE-CB-CT/CO has been employed for the detection of free (GSH) and total (GSH+GSSG) glutathione in blood samples. Definitely, this work contributes to further prove that nanomaterials (in this case TMDs and CB) are unique and useful analytical tools able to both tailor 'customize sensors' and giving rise to new analytical opportunities.

References

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