Electrochemical sensing of Pb(II) and Cd(II) in decorative material of wood panel using nano-cellulose paper-based electrode modified using Graphene/Multi-walled Carbon Nanotubes/Bismuth film

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The yield of decorative material of wood panel is unceasingly rising with the increasing output of the wood panel. Parts of decorative materials contains soluble heavy metals, which will probably pollute the environment. To monitor the contaminations of Cd(II) and Pb(II), nanocellulose paper was used as the substrate, a room temperature ionic liquid was applied as a conductive binder to improve the conductivity, and a nanocomposite of graphene/multi-walled carbon nanotubes (G-MWNTs) was modified the electrode' surface to increase the specific surface area. The characteristics of the paper-based electrode (PBE) before and after functionalized with G-MWNTs were investigated by scanning electron microscopy, cyclic voltammetry, and electrochemical impedance spectroscopy. Moreover, bismuth film was electroplated on the G-MWNTs/PBE in-situ to improve the sensitivity for Cd(II) and Pb(II). The current responses of Cd(II) and Pb(II) were activated on Bi/G-MWNTs/PEB using square wave stripping voltammetry. Under the optimized paramters, the current responses of Cd(II) and Pb(II) were positive linear relation with a wide concentration range from 1 µg/L to 50 µg/L with the limits of detection were 0.2 µg/L (S/N=3). Finally, the Bi/G-MWNTs/PBE was successfully used as a useful probe to determine the Cd(II) and Pb(II) in decorative material of wood-based panel with good results.

Keyword: Wood panels, Screen-printed electrode, Paper-based electrode, Graphene, Multi-walled carbon nanotubes, Lead, Cadmium

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