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Melamine functionalised multiwalled carbon nanotubes (M-MWCNTs) as a metal-free electrocatalyst for simultaneous determination of 4-nitrophenol and nitrofurantoin †

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Abstract

An innovative melamine functionalised multiwalled carbon nanotube (M-MWCNTs) based electrochemical sensor has been developed for the determination of environmental nitro-aromatic pollutants, such as 4-nitrophenol (4-NP) and nitrofurantoin (NFT). As-synthesized nanocomposites were characterised well by transmission electron microscopy (TEM), field emission-scanning electron microscopy (FE-SEM), elemental mapping, Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), thermogravimetric analysis (TGA), Raman spectroscopy and X-ray photoelectron spectroscopy (XPS). Significantly, the TEM confirmed that the melamine decorated MWCNTs were about 80 nm in size, whereas, when the Raman spectra were examined for an increase in the I_D/I_G ratio it was more than double which was in good agreement with results for the decoration of melamine functionalization on MWCNTs, *i.e.*, M-MWCNTs. Moreover, cyclic voltammetry (CV) and linear sweep voltammetry (LSV) studies of various concentrations of analytes, showed two distinct and well-separated reduction peaks which appeared at a potential of $E = -0.093$ V and −0.36 V *vs.* SCE for the electroreduction of NFT and 4-NP, respectively. The analytical parameters, *i.e.*, the LOD of the synthesised electrocatalyst were found to be 0.165 μM and 0.167 μM for 4-NP and NFT, respectively. The limit of quantification (LOQ) was calculated for both the samples, and were found to be 0.55 and 0.56 for 4-NP and NFT, respectively. Thus, the electrochemical sensor for 4-NP and NFT was found to be very sensitive, stable, low cost, and also applicable for real sample analysis.

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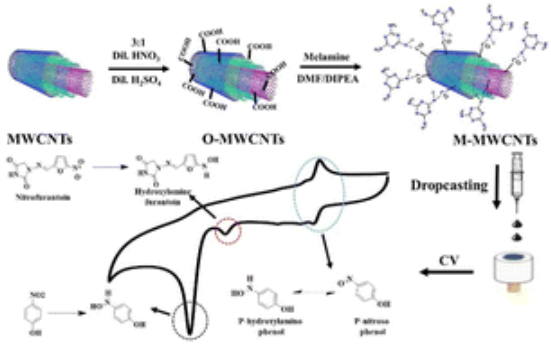

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