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Multiwalled carbon nanotubes/polypyrrole/SiO_2 composite prepared by electrodeposition technique as a new solid phase microextraction sorbent for preconcentrationon of BTEX

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Abstract

BTEX is the collective name of benzene, toluene, ethylbenzene, and the xylene isomers (p, m, and o-xylenes), all being harmful volatile organic compounds (VOCs). Human exposure to these compounds can have serious damaging effects on the kidneys, heart, lungs, and the nervous system [1]. BTEX are emitted to the environment from an extensive variety of sources including combustion products of wood and fuels, industrial paints, adhesives, degreasing agents and aerosols [2]. Exposure to BTEX can occur by ingestion, inhalation or absorption through the skin. Maximum contamination levels (MCLs) according to the U.S. Environment Protection Agency (EPA) for benzene, toluene, ethylbenzene, and xylenes are 0.005, 1, 0.7, and 10 mg L^{-1}, respectively, and concentrations above MCL in air and water seriously affect human health [3]. There is, therefore, a vital need to develop simple and cheap analytical methods with low detection limits for the quantification of BTEX. A novel polypyrrole-carbon nanotubes-Silicon dioxide (PPy-CNT-SiO_2) composite film coated stainless steel wire, was fabricated through electrochemical deposition and used for the extraction of BTEX compounds, followed by gas chromatographic analysis. The new PPy-CNT-SiO_2 fiber coating showed better analytical performance than PPy-CNT fiber. Under the optimized conditions, the detection limits (S/N=3) were in the range of 0.005–0.02 ng mL^{-1} and the limits of quantification (S/N=10) between 0.01–0.06 ng mL^{-1}. The relative standard deviations (RSDs) for one fiber (repeatability) (n=5) were obtained from 3.9 up to 6.4% and between fibers or batch to batch (n=3) (reproducibility) for one fiber in the range of 6.0–8.5%. The proposed method was successfully applied for determination of BTEX compounds in water sample, and the recoveries were from 91–106.7%.

References:

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