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Determination of Phenanthrene in Water using Solid-Phase Extraction and High-Performance Liquid Chromatography

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Structured Abstract

Background: Polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants (POPs) that contain two or more condensed aromatic carbon rings. Phenanthrene is considered as the largest pollutant in PAHs constituent in environmental compartment. It has 3-fused benzene rings. Sample preparation prior to the determination of organic pollutants including PAHs in water usually consists of several steps due to the complexity of the sample matrices. Although SPE uses a large volume of solvents, it is easy to automate and can analyse many samples in parallel.

Methods: Stock solution of phenanthrene (1000 mg/L) was prepared and diluted to construct a calibration curve at five concentration levels ranges from 0.5 to 10 mg/L. Spike samples of 5 ppm were used to evaluate the efficiency of SPE (C_{18}). Phenanthrene was eluted from C_{18} using hexane:acetone at different elution ratios and volume prior to high-performance liquid chromatography. Method validation of HPLC such as linearity, LOD, LOQ and accuracy based on percent recovery of phenanthrene was determined. Analysis of real water samples were was done using drain water collected from two selected area (Faculty of Applied Sciences and Mawar college).

Results: Identification of phenanthrene was done by injecting standard phenanthrene into HPLC UV-DAD detector set at wavelength of 254. Good recovery of phenanthrene (88.2%) was obtained using 3 mL acetone: hexane (1:3, v/v) as eluting solvent. The HPLC method demonstrated very good linearity (r^2 = 0.9999) for phenanthrene determination at various concentrations. Limit of detection and limit of quantification of phenanthrene were determined using signal-to-noise ratio, 0.11 and 0.37, respectively, phenanthrene. Analysis of drain waters collected from Faculty of Applied Sciences and Mawar College revealed no phenanthrene was not detected due to a very low concentration (below the detection limit).

Conclusion: Phenanthrene in water samples was successfully extracted by utilising C_{18} SPE cartridge. This approach offers a good recovery percent of 88.2%, minimises sample volume, and shortens analytical time. Limit of detection (0.11) and quantification (0.37) were determined using signal to noise ratios. No phenanthrene was detected from drain water samples may be due the sample collected very diluted and not expose to the sources of phenanthrene

Keywords: Phenanthrene, high-performance liquid chromatography, solid-phase extraction

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