

Application of dispersive liquid-liquid microextraction as a simple assisted clean-up and preconcentration technique for GC/MS determination of selected PAHs extracted from sewage sludge by Soxhlet and ultrasound assisted extraction method

S. Ahmad Mokhtari^a, Mehdi Farzadkia^{b,c}, Ali Esrafil^{b,c}, Roshanak Rezaei Kalantari^{b,c}, Mitra Gholami^{b,c,*}

^aDepartment of Environmental Health Engineering, School of Public Health, Ardabil University of Medical Sciences, Ardabil, Iran, email: s.a.mokhtari@gmail.com (S.A. Mokhtari)

^bDepartment of Environmental Health Engineering, School of Public Health, Iran University of Medical Sciences, Tehran, Iran, email: farzadkia.m@iums.ac.ir (M. Farzadkia), a.esrafil@iums.ac.ir (A. Esrafil), rezaei.r@iums.ac.ir (R.R. Kalantari)

^cResearch Center for Environmental Health Technology, Iran University of Medical Sciences, Tehran, Iran, Tel. +989123906308, Fax +98 21 88622707, email: gholamim@iums.ac.ir, gholamimitra32@gmail.com (M. Gholami)

Received 16 April 2016; Accepted 28 August 2016

ABSTRACT

Herein, two different extraction methods (Soxhlet and ultrasound assisted extraction) along with dispersive liquid-liquid microextraction (as an assisted clean-up and preconcentration technique) were applied for the measurement of selected polycyclic aromatic hydrocarbons (PAHs) in sewage sludge. The measurements were made using gas chromatography-mass spectrometry (GC-MS). The extraction efficiencies of the above-mentioned methods were investigated and subsequently compared. Briefly, high amounts of sludge were gently heat-dried and sieved and the resulting solids (5 g for the Soxhlet extraction and ultrasound assisted extraction each) were then subjected to the corresponding extraction method. To clean-up, after completion of the extraction phase, the extract was dried under a gentle stream of nitrogen and then diluted with acetone (1.5 ml) and finally passed through a PTFE syringe filter. Further on, tetrachloroethylene (C₂Cl₄, 12 µl) was added to the acetone solution and the resulting mixture was rapidly added to a vessel containing deionized water (5.0 ml) for assisting the clean-up process and further preconcentration. Afterwards, the sedimented organic phase (5 ± 0.5 µl) was withdrawn and injected into the GC/MS (1.0 µl) for identification and quantification of the PAHs. Some differences between the two methods were observed for reproducibility and limits of quantification and were determined to be insignificant and significant, respectively. Overall, Soxhlet extraction had better extraction efficiency compared to that of the Ultrasound assisted extraction for the PAHs.

Keywords: Soxhlet extraction, Ultrasound assisted extraction, Dispersive liquid-liquid microextraction, Sewage sludge

*Corresponding author.