

List of abbreviations

AED Atomic emission detector
APCI Atmospheric pressure chemical ionization
AAPAs Alkyl alkylphosphonic acids
APAs Alkylphosphonic acids
ANOVA Analysis of variance
CWAs Chemical Warfare Agents
CWs Chemical Weapons
CWC Chemical Weapons Convention
CRCs Convention Related Chemicals
CE Capillary electrophoresis
CI Chemical ionization
CID Collision induced dissociation
DLLME Dispersive liquid-liquid microextraction
DEHP Di-(2-ethylhexyl) phosphate
DiPrAE *N,N*-diisopropylaminoethanol
DBAE *N,N*-dibutylaminoethanol
DHE Dihexyl ether
DAAPs *O,O'*-dialkyl alkylphosphonates
DPrMP Dipropyl methylphosphonate
DEiPrP Diethyl isopropylphosphonate
DMMP Dimethyl methylphosphonate
DEEP Diethyl ethylphosphonate
DBMP Dibutyl methylphosphonate
DBEP Dibutyl ethylphosphonate
DHMP Dihexyl methylphosphonate
DOMP Dioctyl methylphosphonate
DDMP Didecyl methylphosphonate
EI Electron ionization
ESI Electrospray ionization
EPA Ethylphosphonic acid
EMPA Ethyl methylphosphonic acid
EIC Extracted ion chromatogram
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EF Enrichment factor
EDEA *N*-ethyldiethanolamine
ENB 1-Ethyl-2-nitobenzene
FID Flame ionization detector
FTIR Fourier transform infra-red
EME Electromembrane extraction
GC Gas chromatography
GC-MS Gas chromatography-mass spectrometry
HF-LPME Hollow fiber liquid phase microextraction
HFLLLME Hollow fiber liquid-liquid-liquid microextraction
HepMPA *n*-Heptyl methylphosphonic acid
HMPA *n*-Hexyl methylphosphonic acid

IT Ion trap
IBHBI 1,3-imidazolium-bis-(1-hexyl-benzyl-imidazolium) trifluoride
iPrMPA Isopropyl methylphosphonic acid
iPrOMP Isopropyloctyl methylphosphonate
iBMPA Isobutyl methylphosphonic acid
LLE Liquid-liquid extraction
LPME Liquid phase microextraction
LC Liquid chromatography
LC-MS Liquid chromatography-mass spectrometry
LC-MS/MS Liquid chromatography-tandem mass spectrometry
LOD Limit of detection
LOQ Limit of quantification
MS Mass spectrometry
MS/MS Tandem mass spectrometry
MPA Methylphosphonic acid
MMPA Methyl methylphosphonic acid
MDEA *N*-methyldiethanolamine
NPD Nitrogen-phosphorous detector
NMR Nuclear magnetic resonance
NBMI 1,9-Nonanediyl-bis-(3-methylimidazolium)bisfluoride
NPOE 2-Nitrophenyl octyl ether
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NPPE 2-Nitrophenyl pentyl ether
OPCW Organization for the Prohibition of Chemical Weapons
OPT Official Proficiency Test
OCAD OPCW Central Analytical Database
PMPA *n*-Pentyl methylphosphonic acid
PiPrPA *n*-Pentyl iso-propylphosphonic acid
PinMPA Pinacolyl methylphosphonic acid
QTOF Quadrupole time-of-flight
QqQ Triple quadrupole
ROP Recommended Operating Procedures
RI Retention indices
RSD Relative standard deviation
RSM Response surface model
SPE Solid phase extraction
SPME Solid phase microextraction
SDME Single drop microextraction
SLM Supported liquid membrane
TEA Triethanolamine
TEHP Tris-(2-ethylhexyl) phosphate
TIC Total ion chromatogram
UHPLC-QTOF Ultra-high performance liquid chromatographyquadrupole time-of-flight
WWI World War I

WWII World War II

μ -EME Microfluidic electromembrane extraction

Chapter 1: Introduction, review of literature, objectives and plan of work

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