

RESEARCH ARTICLE

Fabric phase sorptive extraction for the determination of 17 multiclass fungicides in environmental water by gas chromatography-tandem mass spectrometry

Maria Celeiro¹  | Lua Vazquez¹ | Piyaluk Nurerk² | Abuzar Kabir³  |
Kenneth G. Furton³ | Thierry Dagnac⁴  | Maria Llompart¹ 

¹CRETUS Institute, Department of Analytical Chemistry, Nutrition and Food Science, Faculty of Chemistry, Universidade de Santiago de Compostela, Santiago de Compostela, Spain

²Center of Excellence for Innovation in Chemistry, Department of Chemistry, Faculty of Science, Prince of Songkla University, Hat Yai, Songkhla, Thailand

³Department of Chemistry and Biochemistry, International Forensic Research Institute, Florida International University, Miami, FL-33199, USA

⁴Agronomic and Agrarian Centre (AGACAL-CIAM), Unit of Organic Contaminants, Apartado 10, A Coruña, Spain

Correspondence

Maria Celeiro and Maria Llompart, Laboratory of Research and Development of Analytical Solutions (LIDSA), CRETUS Institute, Department of Analytical Chemistry, Nutrition and Food Science, Faculty of Chemistry, Universidade de Santiago de Compostela, E-15782, Santiago de Compostela, Spain.
Email: maria.celeiro.montero@usc.es; maria.llompart@usc.es

Coauthors: Lua Vazquez: PhD Student; Abuzar Kabir: Assistant Professor; Kenneth G. Furton: Professor; Thierry Dagnac: PhD Researcher; Maria Llompart: Associate Professor.

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A rapid environmental pollution screening and monitoring workflow based on fabric phase sorptive extraction-gas chromatography-tandem mass spectrometry (FPSE-GC-MS/MS) is proposed for the first time for the analysis of 17 widespread used fungicides (metalaxyl, cyprodinil, tolylfluanid, procymidone, folpet, fludioxonil, myclobutanil, kresoxim methyl, iprovalicarb, benalaxyl, trifloxystrobin, fenhexamid, tebuconazole, iprodione, pyraclostrobin, azoxystrobin and dimethomorph) in environmental waters. The most critical parameters affecting FPSE, such as sample volume, matrix pH, desorption solvent and time, and ionic strength were optimized by statistical design of experiment to obtain the highest extraction efficiency. Under the optimized conditions, the proposed FPSE-GC-MS/MS method was validated in terms of linearity, repeatability, reproducibility, accuracy and precision. To assess matrix effects, recovery studies were performed employing different water matrices including ultrapure, fountain, river, spring, and tap water at 4 different concentration levels (0.1, 0.5, 1 and 5 µg/L). Recoveries were quantitative with values ranging between 70–115%, and relative standard deviation values lower than 14%. Limits of quantification were at the low ng/L for all the target fungicides. Finally, the validated FPSE-GC-MS/MS method was applied to real water samples, revealing the presence of 11 out of the 17 target fungicides.

KEYWORDS

environmental water monitoring, fabric phase sorptive extraction, fungicides, gas chromatography-tandem mass spectrometry, sample preparation

Article Related Abbreviations: µSPE, micro-solid-phase extraction; ACN, acetonitrile; ANOVA, analysis of variance; BAµE, bar-adsorptive microextraction; CW 20 M, carbowax 20 M; DLLME, dispersive liquid-liquid microextraction; EI, electron impact; EtAc, ethyl acetate; FPSE, fabric phase sorptive extraction; FS, full scan; HF-LPME, hollow fiber-liquid-phase microextraction; LPME, Liquid-phase microextraction; MeOH, methanol; MSD, mass spectrometer detector; PCAP-PDMS-CAP, poly(caprolactone-dimethylsiloxane-caprolactone); PCB-30, 2,4,6-trichlorobiphenyl; PDMS, polydimethylsiloxane; SBSE, stir-bar sorptive extraction; THF, tetrahydrofuran; TQ, triple quadrupole.