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Journal of Chromatography A, 754 (1996) 1–2

JOURNAL OF CHROMATOGRAPHY A

Preface

This volume on environmental analysis contains an impressive collection of papers involving many of the well-established and emerging technologies for pesticide analysis. The chromatographic methods covered include packed and capillary gas chromatography (GC) with traditional element-selective detectors, GC with the atomic emission spectrometry detector, GC interfaced with mass spectrometry (GC–MS) and with tandem MS (GC–MS–MS), high-performance liquid chromatography (HPLC) with UV, fluorescence, and electrochemical detectors, coupled column HPLC, HPLC–atmospheric pressure chemical-ionization MS, supercritical fluid chromatography (SFC), thin-layer chromatography, and instrumental quantitative high-performance thin-layer chromatography with automated multiple development. Sample preparation methods applied include the use of on-line and off-line solid-phase extraction (SPE) with cartridges and disks, miniaturized extraction methods, supported liquid membranes, supercritical fluid extraction (SFE), matrix solid-phase dispersion extraction, and extraction on polyurethane foam and porous carbon. The complementary application of enzyme-linked immunosorbent assay (ELISA) and HPLC is also reported. Determinations of insecticides, herbicides, and fungicides in environmental (soil, water), agricultural (plant), food, animal, and human sample matrices are described.

The literature reporting new and improved techniques and applications for pesticide residue analysis has been growing recently at a very fast pace. In addition to the methods mentioned above, the following are areas in which significant progress and/or promise of future developments and increased use have been reported: development of methods for pesticide metabolites and bound pesticide residues; GC–ion-trap MS and GC–ion-trap MS–MS for qualitative and quantitative multiclass multiresidue GC analysis; HPLC with reversed-phase, polar bonded phase, ion-pair, and mixed functionality (multimodal) columns and detectors, such as UV, fluorescence, photodiode-array, coulometric electrode-array, electron-capture, and electrochemical detectors utilized singly or in multiple-detector systems; use of narrow- and micro-bore HPLC columns to increase analysis speed; coupled HPLC–MS and HPLC–MS–MS systems with thermospray, electrospray, and atmospheric-pressure chemical-ionization interfaces; automated coupled techniques such as coupled-column liquid chromatography, size-exclusion chromatography–GC, and HPLC–SFC–MS; multidimensional analytical systems combining GC and HPLC with multiple detectors; two-dimensional electron-capture negative-ion MS to detect femtogram levels of pesticides; advances in extraction, preconcentration, and cleanup methods, such as accelerated solvent extraction (liquid–solid extraction performed at elevated temperature and pressure), microwave-assisted solvent extraction, automated Soxhlet and solid-phase extraction, automated gel permeation chromatography cleanup, recovery of pesticides from aqueous liquid samples by solid-phase deposition followed by SFE, and automated evaporation of residue extracts with solvent recovery; flow-injection analysis for on-line liquid–liquid extraction coupled with chromatography; capillary electrophoresis (CE) and CE–MS for charge-based separation and detection of pesticide and metabolite residues in crops and other matrices; isomer- and enantiomer-selective determinations of pesticides by chiral high-resolution GC and MS; and

0021-9673/96/$15.00
PII S0021-9673(96)00446-3

biotechnology-based methods, such as immunoassays, bioassays, biosensors, and immunoaffinity chromatography cleanup on columns with antibodies immobilized on a support. Immunochemical methods such ELISA are being increasingly combined with other techniques such as classical extraction and cleanup procedures, SFE, HPLC, and GC–MS, and immunoaffinity chromatography has been coupled with MS. Many of these emerging technologies will undoubtedly be represented in papers contained in future special issues on pesticide residue analysis published by this journal.

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