



# IMMUNOCHEMICAL METHODS

## for Environmental Analysis

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Concern over rising costs and increasing sample loads has led to the development of immunochemical methods for measuring environmental contaminants. Immunoassays are immunochemical detection methods based on a reaction between a target analyte and a specific antibody. Quantitation can be performed by monitoring a color change or by measuring radioactivity or fluorescence. Many immunoassays have been developed for environmental compounds that are difficult to detect by conventional methodologies.

The recent rapid growth in immunochemical methods is attributed in part to the availability of polyclonal and monoclonal antibodies for a variety of compounds of environmental significance. For example, specific antibodies have been developed for many pesticides (1-20), industrial chemicals (21-28), microbial toxins (29, 30), organophosphorus chemical agents (31), protein products from microorganisms (32), and various biomarkers of exposure such as DNA adducts (33, 34).

Table I on p. 80 A summarizes some of the immunoassays currently available for environmental analysis. Pesticides have been the primary focus of immunoassay developmental work; however, some work has been directed toward industrial chemicals

(21-28), explosives (24), and pollutants leaking from underground gasoline storage tanks (27). Another driving force in the development of immunochemical methods is the need for rapid and simple tests that can be performed on site without requiring sample transfer to an analytical laboratory. Field-portable immunoassays enable rapid determination of target compounds needed to effectively direct hazardous waste site remediation and cleanup. Many field methods can be used by personnel unfamiliar with analytical chemistry methodologies.

In this REPORT we will provide a brief overview of the major applications of immunochemical methods and describe some of the activities of regulatory agencies. This will be followed by a discussion of the important elements of an environmental

## REPORT

immunochemical method—antibodies and haptens—and the various immunoassays available for both laboratory and field use. Advantages and disadvantages of immunoassays will be addressed, and examples of method performance will be given. Finally, we will address potential applications of immunoaffinity techniques and conclude with future research areas for immunochemical methods.

Immunoassays are used for the direct determination of target compounds in environmental samples; immunoaffinity chromatography is used for specific separations of target compounds in complex matrices. The same antibodies used in an immunoassay can be used to develop immunoaffinity techniques. Specific antibodies immobilized onto a chromatography column have made it

possible to preconcentrate specific compounds from environmental samples before their determination. In this case, the sample extract is passed through the immunoaffinity column containing an immobilized antibody and the target analyte is retained by the specific antibody. By altering physical or chemical conditions, one can remove the analyte from the immunoaffinity column and quantitate it by either immunoassay or instrumental analysis. Recently this technique was used to detect aflatoxins.

Other areas in which immunochemical methods have found unique applications are antibody-based biosensors (35, 37) and personal exposure monitors (PEMs). A biosensor is a device that contains a biological component (e.g., enzymes, antibodies, or cell receptors) intimately connected to a transducer (e.g., electrochemical, optical, piezoelectric, or thermistor solid-state devices). Whenever an interaction occurs between the target analyte and the biological component of the biosensor, some property of the transducer is altered and subsequently measured. Vo-Dinh and co-workers (37) have reported a regenerable immunochemical-based fiber-optic sensor for detection of benzo[a]pyrenetetraol. This type of device uses an antibody that is immobilized at the sensing terminus of the fiber-optic probe and allows remote, *in situ* measurements.

PEMs based on immunoaffinity can monitor breathing-zone air for specific compounds. Similar immunoaffinity sampling devices can be deployed to collect pesticide spray drift and to sample industrial effluents. The feasibility of direct monitoring of pentachlorophenol (PCP) using a soluble antibody contained in a permeable membrane tube is being investigated (38).

Immunoaffinity PEMs have several important attributes distinct

# Immunochemical Methods For Environmental Analysis

**Sabine Zange**

A decorative graphic consisting of a red circular shape with a white center, partially obscured by a white horizontal bar that extends from the left edge of the slide.

## **Immunochemical Methods For Environmental Analysis:**

*Immunochemical Methods for Environmental Analysis*, 1990      *Immunochemical Methods for Environmental Analysis*, 1990      **Immunochemical Methods for Environmental Analysis** Jeanette M. Van Emon, 1990 Presents 18 papers from a symposium at the American Chemical Society meeting in Miami September 1989 Researchers from academia and the chemical industry report recent advances in using immunochemical methods to detect a variety of environmental contaminants They introduce the non specialist to the principles procedures advantages and limitations of the methods and speculate on anticipated requirements of regulatory agencies Annotation copyrighted by Book News Inc Portland OR

**Environmental Analysis** W. Kleiböhmer, 2001-10-25 This volume reflects the importance of analytical separation methods in monitoring and identifying the many compounds of environmental importance It includes chapters on the main groups of analytes of interest from PAHs and PCBs to phenols sulphur compounds and pesticides These methods illustrate the wide range of analytical techniques that have been employed in the measurement of environmental constituents and different matrices that have been examined      *Fifteenth Annual EPA Conference on Analysis of Pollutants in the Environment, May 6 & 7, 1992*, 1992      *Analysis of Pesticides in Food and Environmental Samples, Second Edition* Jose L. Tadeo, 2019-03-04 This book provides a critical overview of analytical methods used for the determination of pesticide residues and other contaminants in food and environmental samples by modern instrumental analysis It contains up to date material including recent trends in sample preparation general methods used for pesticide analysis and quality assurance aspects and chromatographic and immunoassay methods The rest of the book describes particular analytical methods used for the determination of pesticides in food and soil water and air In addition the levels of these chemicals found in food their regulatory aspects and the monitoring of pesticides in the environment are described      **Manual for Soil Analysis -**

**Monitoring and Assessing Soil Bioremediation** Rosa Margesin, Franz Schinner, 2005-12-15 Reliable methods for monitoring and assessing soil quality are a prerequisite for successful soil bioremediation projects The fifth volume of Soil Biology presents detailed descriptions of selected methods for evaluating monitoring and assessing bioremediation treatments of soils contaminated with organic pollutants or heavy metals Traditional soil investigation techniques including chemical physical and microbiological methods are complemented by the most suitable modern methods such as the use of bioreporter technology immunological ecotoxicological or molecular assays Feasibility studies for bioremediation treatments complete the manual Easy to follow protocols with step by step procedures lists of the required equipment and reagents as well as notes on the evaluation and quality control allow immediate application Short introductions to the principles and objectives help to assess the field of application of each procedure      *Immunoassay and Other Bioanalytical Techniques* Jeanette M. van Emon, 2016-04-19 Taking an interdisciplinary approach that emphasizes the adaptability of immunochemical and related bioanalytical methods to a variety of matrices Immunoassay and Other Bioanalytical Techniques describes the

strength and the versatility of these methods in a wide range of environmental and biological measurement applications With contribut *Emerging Strategies for Pesticide Analysis* Thomas Cairns, Joseph Sherma, 1992-08-05 *Emerging Strategies for Pesticide Analysis* presents a selection of reports on analytical technologies in the field of pesticide residue analysis These reports have been written by international experts in their respective fields Applications oriented chapters focus on methods development for extraction and cleanup in addition to multiresidue analysis of important pesticides Other chapters describe alternative analytical approaches to conventional detection methods stressing advantages and disadvantages of techniques such as fiber optic spectroscopy ion trap mass spectrometry LC MS and others The final chapter summarizes the future of technological advancement in pesticide analysis

**Rapid Methods for Analysis of Biological Materials in the Environment** Peter J. Stopa, Michael A. Bartoszcze, 2013-04-17 Contrary to common belief infectious diseases are not as well under control as we would like We are now at a crossroads regarding the impact of the environment on infectious diseases Renewed interest in biological weapons and the emergence of new pathogens coupled with a better understanding of the impact of infectious agents on other conventional diseases has led us to realise that we can no longer remain complacent about the impact of infectious agents on human animal and crop health The present book first discusses current and emerging military and civilian policies on the environment In addition the impact of environmental biology on the future of space exploration is discussed especially in reference to the Mars mission There follows a discussion of the state of bacteria in the environment with a presentation of current and emerging techniques of microbial investigation Finally two case studies are presented on the impact of these techniques on both political and environmental problems

**Trace Determination of Pesticides and their Degradation Products in Water (BOOK REPRINT)** Damia Barcelo, 1997-12-15 *Trace Determination of Pesticides and their Degradation Products in Water* is a critical compilation of analytical methods for the monitoring of pesticides and their degradation products in water It contains up to date material and is the result of the authors experience in the pesticide analysis field The book is structured in six chapters starting from general aspects of pesticides like usage physicochemical parameters and occurrence in the environment A second chapter is devoted to sampling from water matrices stability methods of pesticides in water and quality assurance issues The general chromatographic methods for pesticides are reported including the newly developed electrophoresis methods and GC MS and LC MS confirmatory analytical methods Sample preparation methodologies including off line and on line techniques are described in the next two chapters with a comprehensive list of examples of pesticides and many metabolites including the use of different GC methods and LC methods The final chapter is devoted to the development of biological techniques immunoassays and biosensors for the trace determination of pesticides in water samples

Trace Analysis Peter Bedson, 2007-10-31 *Trace Analysis* is a highly practical book which deals with the science rather than the paperwork of quality assurance systems Produced as part of the UK Valid Analytical Measurement VAM initiative it provides the analyst

with a systematic approach across the broad spectrum of trace analysis offering practical advice and guidance on methodology and techniques The book is structured to take the analyst step by step through the stages of any trace analysis The approach is general being broken down only into types of analyte Additional chapters explain the application of groups of techniques to each analyte type Each section contains references to published material which will allow the analyst to obtain further information on specific topics Throughout the book the analyst is reminded of pitfalls which lead to unreliable results This new book therefore offers invaluable advice to analysts in all areas and at all levels providing practical expert advice on methodology It will prove indispensable as a single comprehensive bench guide for analysts in university college and industrial laboratories

**Waste Testing and Quality Assurance** David Friedman, 1990 Annotation Thirty three papers address waste and environmental media sampling property and hazard assessment chemical and biological analysis estimating migration of hazardous constituents from wastes analytical methods development and evaluation laboratory data management and quality assurance Annotation copyrighted by Book News Inc Portland OR *Methods of Pesticide Exposure Assessment* Patricia B. Curry, Sesh Iyengar, Pamela A. Maloney, M. Maroni, 2013-11-21 This book is a summary of the presentations and discussions at the Workshop on Methods of Pesticide Exposure Assessment held in Ottawa Canada on October 5 8 1993 The event was a joint effort of Health Canada and the North Atlantic Treaty Organisation and was officially supported by the United States Environmental Agency and the Organisation for Economic Co operation and Development OECD The goal of the workshop was to examine current issues in the field of pesticide exposure assessment with the aim of reaching an internationally harmonized approach to methods of exposure assessment With regulatory agencies of OECD Member countries moving towards the harmonization of data requirements it was timely and beneficial to bring together international experts in the field of pesticide exposure assessment to discuss current issues Approximately 60 delegates and 20 observers participated including individuals from 15 different countries representing academia government industry and international organizations A guidance document on methods of pesticide exposure assessment was presented as a means to achieving the goal of international for critique and discussion harmonization After extensive discussion the workshop delegates agreed in principle to procedures for revising the guidance document Following revision and further review by a designated peer review group the revised document will be submitted to the OECD for consideration as a draft OECD Guidance Document on pesticide exposure assessment methods Both the revised and original documents are included in these proceedings

**Current Catalog** National Library of Medicine (U.S.), 1993-04 **Microscale Testing in Aquatic Toxicology** Peter G. Wells, Kenneth Lee, Christian Blaise, 2018-05-04 Bioassays are among the ecotoxicologist s most effective weapons in the evaluation of water quality and the assessment of ecological impacts of effluents chemicals discharges and emissions on the aquatic environment Information on these assessment aids is needed throughout the international scientific and environmental management community This comprehensive reference provides an excellent overview of the small scale

aquatic bioassay techniques and applications currently in use around the world This special volume is the result of several years of collaboration between Environment Canada and Fisheries and Oceans Canada Internationally recognized research scientists at many institutions have contributed to this state of the art examination of the exciting environmentally important field of microscale testing in aquatic toxicology Microscale Testing in Aquatic Toxicology contains over forty chapters covering relevant principles new techniques and recent advancements and applications in scientific research environmental management academia and the private sector     Endocrine Disrupters in Wastewater and Sludge Treatment Processes Jason W. Birkett, John N. Lester, 2002-11-25 Endocrine Disrupting Chemicals EDCs have been shown to produce changes in the endocrine system of organisms leading to increases in cancers and abnormalities in reproductive structure and function This book presents research on the endocrine disrupting effects of sewage and industrial effluents covering the sources fate and transport of EDCs     *Analytical Chemistry of PCBs* Mitchell D. Erickson, 2018-05-11 This updated and expanded Second Edition of Dr Erickson's Analytical Chemistry of PCBs appears a decade after the first and is completely revised and updated The changes from the First Edition reflect the significant growth in the area and a growing appreciation of the importance of PCB analysis to our culture This book is a comprehensive review of the analytical chemistry of PCBs It is part history part annotated bibliography part comparison and part guidance Featuring a new chapter on analyst customer interactions and several new appendices the Second Edition is an invaluable resource for both chemists with no experience in PCB analysis and seasoned PCB researchers All topics have been more thoroughly treated and updated in this new edition to reflect advances made in the last decade especially     *Immunoassays in Agricultural Biotechnology* Guomin Shan, 2011-04-27 A very broad range of professionals are using immunoassay technology daily to analyze genetically engineered GE crops and related areas and many of these professionals are completely new to this technology There is a great need for users to have a book containing technical and practical guidance and describing limitations and pitfalls of applying immunoassay in agricultural biotechnology This book focuses on the application of immunoassays to GE plants and related areas A group of international experts from government agencies academics and industries who have many years of related experience contribute high quality chapters in their areas of expertise This book covers topics including principles of immunoassay antibody engineering in AgBiotech current technologies formats kit development manufacturing and quality control method validation applications in trait discovery and product development applications in grain products and food processing applications in environmental monitoring automation and high throughput reference materials data interpretation and source of error and future perspectives and challenges In addition to meet the practical needs for a variety of readers from different backgrounds methods and protocols are included as well     **Weeds** Bruce Archibald Auld, Richard William Medd, 1987 Reprint of a reference book first published in 1987 Lavishly illustrated it contains detailed descriptions of all the important weeds of Australia Suitable for primary producers students agricultural advisers and research workers

This book delves into Immunochemical Methods For Environmental Analysis. Immunochemical Methods For Environmental Analysis is a crucial topic that must be grasped by everyone, from students and scholars to the general public. The book will furnish comprehensive and in-depth insights into Immunochemical Methods For Environmental Analysis, encompassing both the fundamentals and more intricate discussions.

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