

# **11 Chemistry of Plant Protection**

---

## **Analysis of Pesticides in Ground and Surface Water I**

**Progress in Basic Multi-Residue Methods**

**Volume Editor: H.-J. Stan**

With contributions by  
M. Åkerblom, H. Egli, P. Günther, T. Heberer,  
P. T. Holland, R. L. Jones, W. Pestemer,  
K. Rubach, H.-J. Stan,

With 71 Figures and 23 Tables



**Springer**

*Volume Editor:*

Prof. Dr. H.-J. Stan  
Technische Universität Berlin  
Gustav-Meyer-Allee 25  
D-13355 Berlin, Germany

---

This series continues the handbook  
"Chemie der Pflanzenschutz- und Schädlingsbekämpfungsmittel"  
edited by R. Wegler

---

ISBN 3-540-58794-2 Springer-Verlag Berlin Heidelberg New York  
ISBN 0-387-58794-2 Springer-Verlag New York Berlin Heidelberg

CIP-Code applied for

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in other ways, and storage in data banks. Duplication of this publication or parts thereof is only permitted under the provisions of the German Copyright Law of September 9, 1965, in its current version, and a copyright fee must always be paid.

© Springer-Verlag Berlin Heidelberg 1995  
Printed in Germany

The use of registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Typesetting: Macmillan India Ltd., Bangalore-25  
SPIN: 10077334 52/3020 - 5 4 3 2 1 0 - Printed on acid-free paper

## **Table of Contents**

<b>Introduction . . . . .</b>	<b>1</b>
<b>Sampling, Sample Preparation and Preservation</b>	
R. L. Jones . . . . .	3
<b>Extraction and Cleanup</b>	
M. Åkerblom . . . . .	19
<b>Capillary GC with Selective Detectors (ECD, NPD, FPD)</b>	
P. T. Holland . . . . .	67
<b>GC Analysis Based on Mass Spectrometry</b>	
H.-J. Stan . . . . .	113
<b>Identification and Confirmatory Analysis Based on Capillary GC - Mass Spectrometry</b>	
H.-J. Stan, T. Heberer . . . . .	141
<b>Biochemical Methods</b>	
K. Rubach . . . . .	185
<b>Growth Inhibition of Plants as a Bioassay for Herbicide Analysis</b>	
W. Pestemer, P. Günther . . . . .	219
<b>Assurance of Data Quality</b>	
H. Egli . . . . .	233
<b>Subject Index . . . . .</b>	<b>257</b>

# **12 Chemistry of Plant Protection**

---

## **Analysis of Pesticides in Ground and Surface Water II**

**Latest Developments and State-of-the-Art  
of Multiple Residue Methods**

**Volume Editor: H.-J. Stan**

With contributions by

A. Brandt, U. A. T. Brinkman, S. Butz, K. Burger,  
J. Keever, K. Levsen, M. Linkerh  gner,  
A. J. H. Louter, T. H. M. Noij, B. F. Scott, H.-J. Stan,  
D. Volmer, R. D. Voyksner, J. J. Vreuls, P. L. Wylie

With 95 Figures and 21 Tables



**Springer**

## **Table of Contents**

<b>Introduction .....</b>	1
<b>Capillary GC with Selective Detection Using On-Line Solid Phase Extraction and Liquid Chromatography Techniques</b>	
J. J. Vreuls, A. J. H. Louter U.A.T. Brinkman .....	3
<b>Capillary GC with Atomic Emission Detection (AED)</b>	
B. Scott, P. L. Wylie .....	33
<b>Multimethod Applying GC-AED to Water Samples</b>	
H.-J. Stan, M. Linkerh��gner .....	59
<b>HPLC with On-Line Solid Phase Extraction for the Trace Analysis of Polar Pesticides</b>	
T. H. M. Noij, A. Brandt .....	91
<b>HPLC-Mass Spectrometry</b>	
R. D. Voyksner, J. Keever .....	109
<b>HPLC with Thermospray Mass Spectrometry</b>	
D. Volmer, K. Levsen .....	133
<b>Thin Layer Chromatography with Automated Multiple Development (AMD-TLC)</b>	
K. Burger .....	181
<b>Multimethod Applying AMD-TLC Analysis to Drinking Water</b>	
H.-J. Stan, S. Butz .....	197
<b>Subject Index .....</b>	217