

Methods of Enzymatic Analysis

Third Edition

Editor-in-Chief: Hans Ulrich Bergmeyer

Editors: Jürgen Bergmeyer and Marianne Graßl

Volume XII
Drugs and Pesticides

Editorial Consultant: Michael Oellerich



Contents

Preface to the Series	V
Preface to Volume XII	VII
Contents of Volumes I – XII (Chapter Headings only)	XV
Contributors	XIX
1 Drugs Monitored during Therapy	1
1.1 Introduction	2
<i>William E. Evans and Michael Oellerich</i>	
1.2 Theophylline	5
<i>Michael Oellerich</i>	
1.2.1 Determination with Enzyme-multiplied Immunoassay Technique	7
1.2.2 Determination with Substrate-labelled Fluorescent Immunoassay	15
1.3 Caffeine	23
<i>Thomas Zysset and Prithipal Singh</i>	
1.4 Phenytoin	33
<i>Leonello Leone and Emilio Perucca</i>	
1.4.1 Total Phenytoin	37
1.4.1.1 Determination with Enzyme-multiplied Immunoassay Technique	37
1.4.1.2 Determination with Substrate-labelled Fluorescent Immunoassay	43
1.4.2 Free Phenytoin, Determination by Ultrafiltration and Enzyme-multiplied Immunoassay	50
1.5 Primidone	56
<i>Leonello Leone and Emilio Perucca</i>	
1.5.1 Determination with Enzyme-multiplied Immunoassay Technique	58
1.5.2 Determination with Substrate-labelled Fluorescent Immunoassay	63
1.6 Phenobarbital	69
<i>Leonello Leone and Emilio Perucca</i>	
1.6.1 Determination with Enzyme-multiplied Immunoassay Technique	70
1.6.2 Determination with Substrate-labelled Fluorescent Immunoassay	76

1.7	Ethosuximide	82
	<i>Leonello Leone and Emilio Perucca</i>	
1.7.1	Determination with Enzyme-multiplied Immunoassay Technique	84
1.7.2	Determination with Substrate-labelled Fluorescent Immunoassay	89
1.8	Carbamazepine	95
	<i>Thomas M. Li</i>	
1.9	Valproic Acid	103
	<i>Hans Reinauer</i>	
1.10	Digoxin, Digitoxin	112
	<i>Gerd Kleinhammer and Hans Mattersberger</i>	
1.10.1	Determination with Enzyme-linked Immunosorbent Assay	115
1.10.2	Determination with Enzyme-multiplied Immunoassay Technique	124
1.11	Methotrexate	134
	<i>William E. Evans and Michael L. Christensen</i>	
1.11.1	Determination with Enzyme-multiplied Immunoassay Technique	137
1.11.2	Determination with Enzyme-linked Immunosorbent Assay	144
1.11.3	Determination with Enzyme-inhibition Assay	152
1.12	Amikacin, Gentamicin, Netilmicin, Tobramycin Determination with Enzyme-multiplied Immunoassay Technique	159
	<i>Markus Wenk</i>	
1.13	Gentamicin Determination with Competitive Enzyme-linked Immunosorbent Assay	172
	<i>Jim Standefer</i>	
1.14	Kanamycin A	187
	<i>Tsunehiro Kitagawa and Kunio Fujiwara</i>	
1.15	Viomycin and Ampicillin	200
	<i>Tsunehiro Kitagawa</i>	
1.16	Disopyramide, Lidocaine, Procainamide, N-Acetylprocainamide, Quinidine	216
	<i>Clarence T. Ueda and Mary C. Haven</i>	

1.16.1	Determination with Enzyme-multiplied Immunoassay Technique	220
1.16.2	Determination with Substrate-labelled Fluorescent Immunoassay	226
1.17	Nortriptyline <i>Vincent Marks and Graham P. Mould</i>	232
1.18	Aprotinin	246
1.18.1	Enzyme-linked Immunosorbent Assay <i>Werner Müller-Esterl</i>	246
1.18.2	Inhibition Assay <i>Marianne Jochum</i>	257
2	Drugs of Abuse and of Toxicological Relevance	265
2.1	Introduction <i>Christopher P. Price, Peter M. Hammond, R. Stewart Campbell and Tony Atkinson</i>	266
2.2	Amphetamine (and Methamphetamine) <i>Christopher P. Price and R. Stewart Campbell</i>	269
2.3	Barbiturates <i>Christopher P. Price and R. Stewart Campbell</i>	278
2.3.1	Determination in Serum with Enzyme-multiplied Immunoassay Technique	280
2.3.2	Determination in Urine with Enzyme-multiplied Immunoassay Technique	284
2.4	Benzodiazepines <i>Christopher P. Price and R. Stewart Campbell</i>	291
2.4.1	Determination of Diazepam in Serum with Enzyme-multiplied Immunoassay Technique	292
2.4.2	Determination of Oxazepam in Urine with Enzyme-multiplied Immunoassay Technique	297
2.5	Methadone <i>Christopher P. Price and R. Stewart Campbell</i>	303
2.6	Methaqualone <i>Christopher P. Price and R. Stewart Campbell</i>	310

2.7	Morphine and Codeine	317
	<i>Christopher P. Price and R. Stewart Campbell</i>	
2.8	Benzoylecgonine	325
	<i>Christopher P. Price and R. Stewart Campbell</i>	
2.9	Phencyclidine	332
	<i>Christopher P. Price and R. Stewart Campbell</i>	
2.10	Propoxyphene	339
	<i>Christopher P. Price and R. Stewart Campbell</i>	
2.11	Δ^9-Tetrahydrocannabinol	347
	<i>Christopher P. Price and R. Stewart Campbell</i>	
2.12	Nortryptiline (and Amitryptiline)	355
	<i>Christopher P. Price and R. Stewart Campbell</i>	
2.13	Paracetamol (Acetaminophen)	362
	<i>Christopher P. Price, R. Stewart Campbell, Peter M. Hammond and Tony Atkinson</i>	
2.13.1	Determination with Enzyme-multiplied Immunoassay Technique	364
2.13.2	Determination with Aryl Acylamidase	369
2.14	Salicylic Acid	374
	<i>Christopher P. Price, Peter M. Hammond, S. A. Paul Chubb, R. Stewart Campbell and Tony Atkinson</i>	
2.15	Nicotine	381
	<i>Alberto Castro and Nobuo Monji</i>	
2.16	Drug Residues in Animal Blood	391
	<i>James Fleeker</i>	
3	Pesticides	403
3.1	Introduction	404
	<i>Hans Ulrich Bergmeyer</i>	
3.2	Organophosphorus and Carbamate Residues in Water	406
3.2.1	Radiometric Method	406
	<i>László Horváth</i>	

3.2.2	Colorimetric Method	412
	<i>Gyöngyi Kovács Huber</i>	
3.3	Pesticides in Plants	418
	<i>Anna Wędzisz</i>	
3.4	Paraoxon in Body Fluids	426
	<i>Kenneth W. Hunter, Jr., David E. Lenz and Alan A. Brimfield</i>	
3.5	Atrazine in Water	438
	<i>Sigmund J. Huber and Bertold Hock</i>	
3.6	Paraquat in Soil	451
	<i>Jill P. Benner and Zbigniew Niewola</i>	
	Appendix	465
1	Symbols, Quantities, Units and Constants	466
2	Abbreviations for Chemical and Biochemical Compounds	469
3	Formulae	478
4	Absorption Coefficients of NAD(P)H	489
	Index	491