

Contents

<i>Contributor contact details</i>	xi
<i>Introduction</i>	xv
Part I Product safety	1
1 On-line detection of contaminants	3
<i>R. Righelato, Ashbourne Biosciences, UK</i>	
1.1 Introduction	3
1.2 Process issues	5
1.3 Detection of chemical contaminants	6
1.4 Detection of foreign bodies	7
1.5 Conclusions	10
1.6 Sources of further information and advice	12
1.7 References	12
2 On-line immunochemical assays for contaminant analysis	14
<i>I.E. Tothill, Cranfield University, UK</i>	
2.1 Introduction	14
2.2 Principles and applications of immunochemical assays	15
2.3 Immunoassays for food contaminant analysis	20
2.4 Immunochemical sensors (immunosensors)	21
2.5 On-line immunosensors in food processing	25
2.6 Future trends	30

2.7	Conclusions	34
2.8	Sources of further information and advice	34
2.9	References	35
3	Using bioassays in contaminant analysis	40
	<i>L.A.P. Hoogenboom, State Institute for Quality Control of Agricultural Products (RIKILT), The Netherlands</i>	
3.1	Introduction	40
3.2	The use of bioassays: the case of dioxins	41
3.3	The use of bioassays for other contaminants	49
3.4	Future trends	51
3.5	Acknowledgements	51
3.6	References	51
4	The rapid detection of pesticides in food	55
	<i>R. Luxton and J. Hart, University of the West of England, UK</i>	
4.1	Introduction	55
4.2	Detecting pesticides: physicochemical methods	58
4.3	Detecting pesticides: biological methods	59
4.4	The principles of biosensors	62
4.5	Developing low-cost biosensors	69
4.6	Using biosensors: pesticide residues in grain, fruit and vegetables	70
4.7	Future trends	72
4.8	Sources of further information and advice	73
4.9	Further reading	73
5	Detecting antimicrobial drug residues	75
	<i>Å. Sternesjö, Swedish University of Agricultural Sciences</i>	
5.1	Introduction	75
5.2	Current screening methods for residue detection	76
5.3	Developing biosensors: the use of surface plasmon resonance	79
5.4	Using biosensors to detect veterinary drug residues	81
5.5	Biosensor applications in the food industry	83
5.6	Future trends	86
5.7	Sources of further information and advice	88
5.8	References	88
6	Detecting veterinary drug residues	91
	<i>N. van Hoof, K. de Wasch, H. Noppe, S. Poelmans and H.F. de Brabender, University of Ghent, Belgium</i>	
6.1	Introduction	91
6.2	Veterinary medicinal products	92
6.3	Methods for detecting residues	93
6.4	Validating detection methods	96

6.5	Rapid on-line confirmation of different veterinary residues	98
6.6	Future trends	112
6.7	Acknowledgements	113
6.8	References	113
7	The rapid detection of toxins in food: a case study	116
	<i>G. Palleschi, D. Moscone and L. Micheli, University of Rome 'Tor Vergata', Italy</i>	
7.1	Introduction	116
7.2	Immunosensors	117
7.3	Detecting toxins: domoic acid	118
7.4	Detecting toxins: okadaic acid	122
7.5	Detecting toxins: saxitoxin	125
7.6	Developing on-line applications	129
7.7	Conclusions	132
7.8	Acknowledgements	132
7.9	References	132
8	Rapid detection methods for microbial contamination	136
	<i>I. E. Tothill and N. Magan, Cranfield University, UK</i>	
8.1	Introduction	136
8.2	Conventional methods	136
8.3	Specialised techniques: epifluorescence (DEFT), bioluminescence and particle counting	139
8.4	Specialised techniques: flow cytometry, electron microscopy and immunoassay techniques	141
8.5	Cellular components detection: API, metabolising enzymes and nucleic acids	143
8.6	Electrochemical methods: impedimetry, conductivity and other methods	145
8.7	Immunosensors: amperometric, potentiometric, acoustic wave-based and optical sensors	147
8.8	Detection of moulds using biochemical methods	150
8.9	Electronic noses	153
8.10	Conclusions: commercial products	154
8.11	Sources of further information and advice	155
8.12	References	155
9	Rapid analysis of microbial contamination of water	161
	<i>L. Bonadonna, Istituto Superiore di Sanità – Rome, Italy</i>	
9.1	Introduction	161
9.2	Current techniques and their limitations	162
9.3	Identifying indicator organisms	163
9.4	The development of more rapid detection methods	167

9.5	Developing online monitors	173
9.6	Future trends	176
9.7	Sources of further information and advice	178
9.8	References	179
Part II Product quality		183
10	Rapid techniques for analysing food additives and micronutrients	185
	<i>C.J. Blake, Nestlé Research Centre, Switzerland</i>	
10.1	Introduction	185
10.2	The range of rapid methods	186
10.3	Chromatographic techniques	186
10.4	X-ray fluorescence and other indirect methods	189
10.5	PCR, immunoassays and biosensors	191
10.6	Other rapid methods	193
10.7	Future trends	196
10.8	Sources of further information and advice	197
10.9	References	198
11	Detecting genetically-modified ingredients	205
	<i>M. Pla, T. Esteve and P. Puigdomènech, Institut de Biologia Molecular de Barcelona – CSIC, Spain</i>	
11.1	Introduction	205
11.2	Principles of analysis	206
11.3	Polymerase chain reaction (PCR) techniques	208
11.4	Identifying genetically-modified ingredients in practice	211
11.5	Future trends	212
11.6	References	213
12	In-line sensors for food process monitoring and control	215
	<i>P.D. Patel and C. Beveridge, Leatherhead Food International Ltd, UK</i>	
12.1	Introduction	215
12.2	Principles of in-line sensors	216
12.3	Current commercial sensor systems	219
12.4	Dealing with complex food matrices	227
12.5	Future trends	236
12.6	Sources of further information and advice	237
12.7	References	238
13	Measurement of added water in foodstuffs	240
	<i>M. Kent, Consultant, UK</i>	
13.1	Introduction	240
13.2	Problems in measuring added water	241

13.3	Measuring the dielectric properties of water	245
13.4	Instrumentation for measuring dielectric properties	251
13.5	Applications	258
13.6	Future trends	264
13.7	Sources of further information and advice	267
13.8	References	267
14	Spectroscopic techniques for analysing raw material quality ..	270
	<i>R. Cubeddu, A. Pifferi, P. Taroni and A. Torricelli, INFM – Dipartimento di Fisica and Politecnico di Milano, Italy</i>	
14.1	Introduction	270
14.2	Advantages of time-resolved optical methods	271
14.3	Principles of time-resolved reflectance	272
14.4	Instrumentation	274
14.5	Data analysis	277
14.6	Effect of skin and penetration depth	278
14.7	Optical properties of fruits and vegetables	280
14.8	Applications: analysing fruit maturity and quality defects ...	285
14.9	Future trends	287
14.10	Sources of further information and advice	288
14.11	References	289
15	Using spectroscopic techniques to monitor food composition ..	291
	<i>P. Grenier and V. Bellon-Maurel, Cemagref, France, R. Wilson, Institute of Food Research, UK and P. Niemelä, VTT Biotechnology, Finland</i>	
15.1	Introduction	291
15.2	Spectroscopic techniques	292
15.3	Instrument design for on-line applications	296
15.4	Design or adaptation of MIR, optothermal and Raman spectrometers	298
15.5	Applications: analysing the composition of cereal and dairy products	300
15.6	Future trends	302
15.7	Sources of further information and advice	303
15.8	References	304
15.9	Acknowledgements	305
16	Confocal scanning laser microscopy (CSLM) for monitoring food composition	306
	<i>R.H. Tromp, Y. Nicolas, F. van de Velde and M. Paques, Wageningen Centre for Food Sciences, The Netherlands</i>	
16.1	Introduction	306
16.2	The principles of CSLM	308
16.3	Sample preparation	310

16.4	Applications: food composition	313
16.5	Future trends	319
16.6	References	321
17	Using electronic noses to assess food quality	324
	<i>H. Zhang, University of Florida, USA</i>	
17.1	Introduction	324
17.2	The theory of electronic noses	325
17.3	Comparing sensor types of electronic nose	325
17.4	Current commercial instruments and selection criteria	327
17.5	Data analysis methods	329
17.6	Applications	331
17.7	Future trends	334
17.8	Sources of further information and advice	335
17.9	References	335
18	Rapid olfaction arrays for determining fish quality	339
	<i>G. Ólafsdóttir, Icelandic Fisheries Laboratories</i>	
18.1	Introduction	339
18.2	Spoilage odours and product quality: the case of fish	340
18.3	Electronic noses: principles and applications	341
18.4	Validation of the performance of the electronic nose	348
18.5	Developing rapid and on-line applications	352
18.6	Future trends	354
18.7	Sources of further information and advice	355
18.8	References	356
19	On-line analysis and control of product quality	361
	<i>G. Montague, E. Martin and J. Morris, University of Newcastle, UK</i>	
19.1	Introduction	361
19.2	Process models	362
19.3	Case study 1: quality assessment in breakfast cereal production	363
19.4	Building models of breakfast cereal production	367
19.5	On-line implementation and performance	373
19.6	Case Study 2: improving process control in french-fry manufacture	376
19.7	On-line application and performance	384
19.8	Future trends	391
19.9	Sources of further information and advice	392
19.10	Acknowledgements	392
19.11	References	393
	<i>Index</i>	395