

Woodhead Publishing in Food Science and Technology

Detecting allergens in food

Edited by Stef J. Koppelman and Sue L. Hefle



WP

Contents

<i>Contributor contact details</i>	xi
<i>Preface</i>	xv
Part I The basics of food allergy	1
1 The nature of food allergy	3
<i>S. Taylor, University of Nebraska, USA</i>	
1.1 Introduction: defining food allergy	3
1.2 Mechanisms of food allergy	7
1.3 Avoidance diets and treatment for IgE-mediated food allergies	10
1.4 Future trends	15
1.5 Sources of further information and advice	16
1.6 References	17
2 Classifying food allergens	21
<i>H. Breiteneder, Medical University of Vienna, Austria</i>	
2.1 Introduction	21
2.2 Plant food allergens	23
2.3 Animal derived food allergens	37
2.4 Future trends	43
2.5 Sources of further information and advice	44
2.6 Acknowledgement	45
2.7 References	45
Part II Types of detection method	63
3 Antibodies	65
<i>S. Hefle, University of Nebraska, USA, J. Yeung, Food Products Association, USA and R. Helm, University of Arkansas, USA</i>	
3.1 Nature of antibodies	65
3.2 Immunogens and antigens	68
3.3 Antibody production.....	68

3.4	Choice of producing monoclonal or polyclonal antibodies	75
3.5	References	77
4	Allergen-specific human IgE antibody-based analysis of food	79
	<i>R. Hamilton, Johns Hopkins University School of Medicine, USA</i>	
4.1	Introduction	79
4.2	IgE antibody-based <i>in vivo</i> assay	80
4.3	IgE antibody-based <i>in vitro</i> assay for food allergen detection	85
4.4	Applications	91
4.5	RAST inhibition assay strengths and weaknesses	94
4.6	Future trends	95
4.7	References	96
5	Immunoblotting in allergen detection	98
	<i>R. van Ree, J. Akkerdaas and L. Zuidmeer, Sanguin Research, The Netherlands</i>	
5.1	Introduction	98
5.2	Mono-specific antibody reagents	100
5.3	Critical assessment of (mono-)specificity	102
5.4	Food processing and antibody specificity	104
5.5	Future trends	104
5.6	References	105
6	Enzyme-linked immunosorbent assays (ELISAs) for detecting allergens in foods	109
	<i>J. Yeung, Food Products Association, USA</i>	
6.1	Introduction	109
6.2	Principles of ELISAs	110
6.3	Applications	115
6.4	Future trends	120
6.5	Conclusions	121
6.6	Acknowledgements	121
6.7	References	121
7	Polymerase chain reaction (PCR) methods for the detection of allergenic foods	125
	<i>T. Holzhauser, O. Stephan and S. Viehs, Paul-Ehrlich-Institut, Germany</i>	
7.1	Introduction	125
7.2	PCR principles	125
7.3	Application of PCR for the detection of allergenic foods	133
7.4	Advantages and disadvantages of PCR compared to ELISA	138

7.5	Future trends	140
7.6	References	141
8	Proteomic assessment of allergens in food	144
	<i>M. Zeece, J. Markwell, G. Sarath and X. Gu, University of Nebraska, USA</i>	
8.1	Introduction	144
8.2	Key issues in proteomic assessment of allergens	145
8.3	Applications of proteomics for detection of allergens	149
8.4	Future trends	155
8.5	Conclusions	155
8.6	References	156
9	Detecting food allergens with a surface plasmon resonance immunoassay	158
	<i>H. Jonsson, A. Eriksson and I. Malmheden Yman, National Food Administration, Sweden</i>	
9.1	Introduction	158
9.2	Biosensors and SPR technology	159
9.3	Developing a food allergen SPR immunoassay	160
9.4	Published methods	164
9.5	Experimental data	165
9.6	Conclusions	172
9.7	Sources of further information and advice	173
9.8	References	173
10	The use of lateral flow devices to detect food allergens	175
	<i>R. Van Herwijnen, European Veterinary Laboratory, The Netherlands and S. Baumgartner, Department for Agrobiotechnology, IFA – Tulln, Austria</i>	
10.1	Introduction	175
10.2	Antibodies	176
10.3	Constructing a lateral flow device (LFD)	177
10.4	Running a sample	178
10.5	Methods available	180
10.6	Future trends	180
10.7	References	181
	Part III Detection methods for particular allergens	183
11	Methods for detecting peanuts in food	185
	<i>S. Hefle, University of Nebraska, USA</i>	
11.1	Introduction: peanut allergy	185
11.2	Allergenic peanut proteins	186
11.3	Peanut detection methods	186
11.4	Appropriate detection limits for peanut methods	195
11.5	Future trends	195
11.6	References	197

12 Detecting tree nuts and seeds in food	201
<i>S. Koppelman, AllerTeQ and University Medical Centre Utrecht, The Netherlands</i>	
12.1 Introduction.....	201
12.2 Prevalence of nut and seed allergies	202
12.3 Thresholds	203
12.4 Allergenic proteins in nuts and seeds	204
12.5 Effect of food processing on allergenicity	204
12.6 Detecting nut and seed residues in food: selecting a method.....	205
12.7 Conclusions.....	212
12.8 References.....	214
13 Detecting dairy and egg residues in food	219
<i>C. Demeulemester and I. Giovannacci, Centre Technique de la Salaison, de la Charcuterie et des Conserves de Viandes (CTSCCV), France, and V. Leduc, Allerbio, France</i>	
13.1 Introduction.....	219
13.2 Milk	220
13.3 Egg	225
13.4 Types of detection methods	228
13.5 Future trends	235
13.6 Acknowledgements	236
13.7 References	236
14 Detecting wheat gluten in food	244
<i>F. Janssen, Fascola FAS Food Consultancy, The Netherlands</i>	
14.1 Introduction.....	244
14.2 Key requirements for detection and quantization	249
14.3 Types of detection methods	249
14.4 Non-antibody-based techniques	262
14.5 Selecting a method	264
14.6 Future trends	265
14.7 Sources of further information and advice.....	267
14.8 References	268
15 Detecting soy, fish and crustaceans in food	273
<i>S. Koppelman, AllerTeQ and University Medical Centre Utrecht, The Netherlands, and S. Hefle, University of Nebraska, USA</i>	
15.1 Introduction.....	273
15.2 Soy	273
15.3 Crustaceans	281
15.4 Fish	283
15.5 Future trends	285
15.6 References	286

Part IV Issues in allergen detection methods	291
16 Allergen quality assurance for hypoallergenic formula	293
<i>C. Cordle, Abbott Laboratories, USA</i>	
16.1 Introduction	293
16.2 Key terms and clinical and analytical performance targets	294
16.3 Analytical methods	297
16.4 Applications	306
16.5 Summary and future trends	311
16.6 References	313
17 Common issues in detecting allergenic residues on equipment and in processed foods	315
<i>R. Crevel, Unilever Research and Development, Colworth, UK</i>	
17.1 Introduction	315
17.2 Food allergy and product safety	316
17.3 Management of food allergy risks	318
17.4 Role of allergen detection and other considerations	321
17.5 Future trends	326
17.6 References	328
18 Factors affecting the effectiveness of allergen detection	330
<i>U. Immer, R-Biopharm AG, Germany</i>	
18.1 Introduction	330
18.2 Factors affecting the determination of allergenic residues	331
18.3 Troubleshooting	340
18.4 Future trends	344
18.5 Summary	346
18.6 References	346
19 Reference materials and method validation in allergen detection	348
<i>R. Poms, International Association for Cereal Science and Technology, Austria, H. Emons and E. Anklam, Institute for Reference Materials and Measurements, Belgium</i>	
19.1 Introduction	348
19.2 Quality assurance for the analysis of allergens	349
19.3 Towards validated methods for allergen determination	350
19.4 Characteristics and use of reference materials	351
19.5 Towards reference materials for allergens	353
19.6 Future trends	354
19.7 Sources of further information and advice	355
19.8 References	355

20 US regulation of undeclared allergens in food products	357
<i>M. Hahn, Hogan & Hartson LLP, USA</i>	
20.1 Introduction.....	357
20.2 Regulatory liability	358
20.3 Legal grounds for product liability actions	364
20.4 Future trends	372
20.5 Conclusion	373
20.6 Sources of further information and advice.....	373
20.7 References	373
Appendix I: Summary of cases involving known allergens	375
Appendix II: Summary of cases involving ingredients that are not allergens	377
21 EU regulation of undeclared allergens in food products	378
<i>H. Heeres, TNO Quality of Life, The Netherlands</i>	
21.1 Introduction.....	378
21.2 Food legislation concerning the labelling of ingredients	379
21.3 Food legislation concerning the labelling of allergens	382
21.4 Legislation concerning general product safety (Directive 2001/95/EC)	386
21.5 Legislation concerning food safety (Regulation (EC) No. 2002/178/EC)	388
21.6 Legislation concerning product liability	390
21.7 Key issues in labelling of allergens, undeclared allergens, food safety and product liability	395
21.8 Future trends	401
21.9 Sources of further information and advice.....	401
21.10 References	403
22 Conclusions	405
<i>S. Hefle, University of Nebraska, USA and S. Koppelman, AllerTeQ and University Medical Centre Utrecht, The Netherlands</i>	
22.1 Recent literature and trends	405
22.2 Relating detection limits to clinically relevant doses	407
22.3 Reference materials, extraction and recovery	409
22.4 Developing realistic and practical detection methods	409
22.5 Summary	410
22.6 References	412
Index	413