

Contents

<i>Contributor contact details</i>	xv
<i>Preface</i>	xxi
1 Introduction to food hydrocolloids	
<i>P. A. Williams and G. O. Phillips, Glyndwr University, UK</i>	
1.1 Introduction	5
1.2 Regulatory aspects	8
1.3 Thickening characteristics	14
1.4 Viscoelasticity and gelation	18
1.5 Synergistic combinations	19
1.6 Hydrocolloid fibres	21
1.7 Future trends	22
1.8 Bibliography	
2 Hydrocolloids and emulsion stability	23
<i>E. Dickinson, University of Leeds, UK</i>	
2.1 Introduction	23
2.2 Principles of emulsion stability	26
2.3 Effect of non-adsorbing hydrocolloids on emulsion stability	35
2.4 Effect of adsorbing hydrocolloids on emulsion stability	42
2.5 Summary	46
2.6 References	47

Contents

3 The health aspects of hydrocolloids	50
<i>C. A. Edwards and A. L. Garcia, University of Glasgow, UK</i>	
3.1 Introduction	50
3.2 Hydrocolloids and non-digestible carbohydrates in food	51
3.3 Effects on metabolism and health	55
3.4 Clinical nutrition	69
3.5 Future trends	70
3.6 References	71
4 Agar	82
<i>R. Armisen and F. Galatas, Hispanagar S. A., Spain</i>	
4.1 Introduction	83
4.2 Agar manufacture	86
4.3 Chemical structure of agar	89
4.4 Agar gelation	91
4.5 Agar applications	96
4.6 Future trends	104
4.7 References	105
5 Starch	108
<i>P. Taggart, National Starch Food Innovation, UK and J.R. Mitchell, Division of Food Sciences, University of Nottingham, UK</i>	
5.1 Introduction	108
5.2 Manufacture	109
5.3 Structure	110
5.4 Modifications	115
5.5 Technical data	121
5.6 Uses and applications	125
5.7 Regulatory status: European label declarations	137
5.8 References	140
6 Gelatin	142
<i>I. J. Haug and K. I. Draget, Norwegian University of Science and Technology (NTNU), Norway</i>	
6.1 Introduction	142
6.2 Manufacturing gelatin	143
6.3 Regulations, technical data and standard quality test methods	147
6.4 Chemical composition and physical properties of collagens and gelatins	149
6.5 Gelatin derivatives	157
6.6 Applications of gelatin	158
6.7 Acknowledgements	162
6.8 References and further reading	162

7 Carrageenan and furcellaran ..	164
<i>A. P. Imeson, FMC Biopolymer, UK</i>	
7.1 Introduction	164
7.2 Manufacture	165
7.3 Regulatory status	167
7.4 Structure	169
7.5 Physical properties	170
7.6 Food applications	177
7.7 Conclusion	183
7.8 Glossary	183
7.9 References	184
8 Xanthan gum	186
<i>G. Sworn, Danisco France SAS, France</i>	
8.1 Introduction	186
8.2 Manufacture	187
8.3 Structure	187
8.4 Technical data	188
8.5 Applications in food products	195
8.6 Regulatory status	201
8.7 Future trends	201
8.8 Sources of further information and advice	202
8.9 References	202
9 Gellan gum	
<i>G. Sworn, Danisco France SAS, France</i>	
9.1 Introduction	204
9.2 Manufacture	205
9.3 Structure	205
9.4 Technical data	206
9.5 Uses and applications	213
9.6 Regulatory status	225
9.7 Future trends	225
9.8 Sources of further information and advice	226
9.9 References	226
10 Galactomannans	
<i>W. C. Wielinga, retired in 2000 from Meyhall AG, Kreuzlingen, Switzerland, which was subsequently acquired by Danisco A/S</i>	
10.1 Introduction	229
10.2 Raw materials and structure	229
10.3 Manufacture	237
10.4 Technical data	243
10.5 Uses and applications	249
10.6 Regulatory status	249

10.7	Future trends ..	250
10.8	References	250
11	Gum arabic	252
	<i>P. A. Williams and G. O. Phillips, Glyndwr University, UK</i>	
11.1	Introduction	252
11.2	Supply and market trends	254
11.3	Manufacture	255
11.4	Regulatory aspects	256
11.5	Structure	260
11.6	Properties	265
11.7	Applications	270
11.8	References	273
12	Pectins	274
	<i>H.-U. Endreß, Herbstreith & Fox KG Pektin-Fabrik Neuenbürg, Germany and S. H. Christensen, CP Kelco ApS, Germany</i>	
12.1	Introduction	274
12.2	Manufacture	275
12.3	The chemical nature of pectin	277
12.4	Commercial pectin: properties and function	277
12.5	Nutritional and health aspects	281
12.6	Uses and applications	282
12.7	Legal status	296
12.8	References	297
13	Milk proteins	298
	<i>J. O. Regan, M. P. Ennis and D. M. Mulvihill, University College Cork, Ireland</i>	
13.1	Introduction	298
13.2	The milk protein system	299
13.3	Production of milk protein products	303
13.4	Functional properties of milk protein products	317
13.5	Biological activity of milk protein products	324
13.6	Food uses of milk protein products	329
13.7	Future trends	341
13.8	Sources of further information and advice	342
13.9	References	343
14	Egg proteins	359
	<i>M. Anton, INRA Nantes Unité 1268 Biopolymères Interactions Assemblages, France and F. Nau and V. Lechevalier, UMR INRA Science et Technologie du Lait et de l'Oeuf, France</i>	
14.1	Introduction: technofunctional uses of egg constituents ...	359
14.2	Physico-chemistry and structure of egg constituents	360

14.3	Egg yolk emulsions	365
14.4	Egg white foams ..	369
14.5	Gels	373
14.6	Conclusion	376
14.7	References	376
15	Vegetable protein isolates	383
	<i>S. González-Pérez and J. B. Arellano, IRNASA-CSIC, Spain</i>	
15.1	Introduction	383
15.2	Chemical composition of vegetable proteins	387
15.3	Protein composition and structure	389
15.4	Manufacture	394
15.5	Technical data: functional properties	399
15.6	Functional properties for industrial applications	401
15.7	Chemical and enzymatic modification of protein products ..	404
15.8	Vegetable proteins: choosing the best functionality for food application	406
15.9	Applications of vegetable proteins in food products	406
15.10	Nutritional and health effects	412
15.11	Regulatory status	415
15.12	References and sources of further reading	418
16	Protein-polysaccharide complexes and coacervates	420
	<i>C. Schmitt, Nestlé Research Center, Switzerland and L. Aberkane and C. Sanchez, INPL-ENSAIA, France</i>	
16.1	Introduction	420
16.2	Thermodynamic background, theoretical models and energetics of the formation of protein-polysaccharide complexes and coacervates	422
16.3	Parameters influencing the formation of protein-polysaccharide complexes and coacervates	425
16.4	Structure, morphology and coarsening of protein-polysaccharide complexes and coacervates	440
16.5	Functional properties of protein-polysaccharide complexes and coacervates	445
16.6	Food applications of protein-polysaccharide complexes and coacervates	452
16.7	Non-food applications of protein-polysaccharide complexes and coacervates	458
16.8	Conclusions	460
16.9	Acknowledgements	462
16.10	References	462

17 Gum ghatti	477
<i>S. Al-Assaf, G. O. Phillips and V. Amar, Glyndwr University, UK</i>	
17.1 Introduction	477
17.2 Manufacture	480
17.3 Structure	480
17.4 Technical data	483
17.5 Uses and applications	487
17.6 Regulatory status	491
17.7 References	493
18 Other exudates: tragacanth, karaya, mesquite gum and larchwood arabinogalactans	495
<i>Y. López-Franco and I. Higuera-Ciapara, Centro de Investigación en Alimentación y Desarrollo, Mexico, F. M. Goycoolea, Universidad de Santiago de Compostela, Spain and Centro de Investigación en Alimentación y Desarrollo, Mexico and W. Wang, Andi-Johnson Konjac Co. Ltd., China</i>	
18.1 Introduction	495
18.2 Manufacture	496
18.3 Structure	501
18.4 Technical data	508
18.5 Uses and applications	519
18.6 Regulatory status	525
18.7 References	527
19 Xyloglucan	535
<i>K. Nishinari and M. Takemasa, Osaka City University, Japan and K. Yamatoya and M. Shirakawa, Dainippon-Sumitomo Pharma Co. Ltd, Japan</i>	
19.1 Introduction	535
19.2 Origin, distribution and preparation	535
19.3 Structure and fundamental properties	538
19.4 Interactions with tamarind seed xyloglucan	546
19.5 Applications in the food industry	553
19.6 Regulatory status in the food industry	557
19.7 Physiological effects of xyloglucan	558
19.8 Other aspects and applications	561
19.9 References and further reading	563
20 Curdlan	567
<i>K. Nishinari, Osaka City University, Japan, and Glyndwr University, UK, and Shanghai Jiao Tong University, China, H. Zhang, Shanghai Jiao Tong University, China and T. Funami, San-Ei Gen F.F.I. Inc, Japan</i>	
20.1 Introduction	567

20.2	Production	568
20.3	Chemical structure	568
20.4	Native curdlan	568
20.5	Functional properties	570
20.6	Applications	585
20.7	Regulatory status	588
20.8	References	588
21	Other microbial polysaccharides: pullulan, scleroglucan, elsinan, levan, alternan, dextran	592
	<i>J. K. Park, Kyungpook National University, Korea and T. Khan, COMSATS Institute of Information Technology, Pakistan</i>	
21.1	Introduction	592
21.2	Pullulan	593
21.3	Scleroglucan	596
21.4	Elsinan	600
21.5	Levan	603
21.6	Alternan	606
21.7	Dextran	609
21.8	References and sources of further reading	612
22	Cereal β-glucans	615
	<i>D. G. Stevenson, National Starch, USA and G. E. Inglett, USDA, USA</i>	
22.1	Introduction	615
22.2	Botanical distribution	617
22.3	Structure and analysis	617
22.4	Biosynthesis	621
22.5	Extraction and purification	622
22.6	Health benefits	624
22.7	Commercial products	628
22.8	Food applications	632
22.9	Processing	635
22.10	Regulatory status	637
22.11	Future trends	638
22.12	References	639
23	Arabinoxylans	653
	<i>M. S. Izydorczyk, Canadian Grain Commission, Canada</i>	
23.1	Introduction	653
23.2	Occurrence and content of arabinoxylans	655
23.3	Extraction, isolation and purification of arabinoxylans	658
23.4	Molecular structure	664
23.5	Analysis and detection	669
23.6	Physico-chemical properties	671

23.7	Technological functionality and potential applications of arabinoxylans	677
23.8	Physiological effects of arabinoxylans	681
23.9	References	683
24	Soluble soybean polysaccharide	693
	<i>H. Maeda, Soy Protein Processed Foods Company, Japan and A. Nakamura, Fuji Oil Co., Ltd., Japan</i>	
24.1	Introduction	693
24.2	Manufacture	694
24.3	Structure	694
24.4	Basic material properties and characteristics	696
24.5	Functional properties and reported use of soluble soybean polysaccharide in foods and pharmaceutical applications	700
24.6	Regulatory status	706
24.7	References	706
25	Cellulosics	710
	<i>J. C. F. Murray, UK</i>	
25.1	Introduction	710
25.2	Manufacture ...	711
25.3	Structure	711
25.4	Properties	712
25.5	Applications ...	714
25.6	Regulatory status	722
26	Bacterial cellulose	724
	<i>J. K. Park, Kyungpook National University, Korea, J. Y. Jung, Korea Institute of Patent Information (KIPI), Korea and T. Khan, COMSATS Institute of Information Technology, Pakistan</i>	
26.1	Introduction	725
26.2	Historical overview	725
26.3	Biosynthesis	726
26.4	Manufacture	728
26.5	Structure	729
26.6	Functional properties	730
26.7	Uses and applications	733
26.8	Regulatory status	736
26.9	References and further reading	736
27	Microcrystalline cellulose	740
	<i>G. Krawczyk, A. Venables and D. Tuason, FMC BioPolymer, USA</i>	
27.1	Introduction	740
27.2	Raw materials and manufacturing process	741

27.3	Nutritional and regulatory information	743
27.4	Physical properties	744
27.5	Food applications and functionality	745
27.6	Future trends	757
27.7	References	758
28	Hydrocolloids for coatings and adhesives	760
	<i>A. Nussinovitch, The Hebrew University of Jerusalem, Israel</i>	
28.1	Introduction	760
28.2	Today's edible protective films	761
28.3	Novel products	769
28.4	Inclusion of food additives in edible films	771
28.5	Parameters to be considered before, during and after food coating	775
28.6	Hydrocolloid non-food coatings	776
28.7	Film-application techniques and stages	777
28.8	Methods for testing coatings	778
28.9	Market estimates for edible films	779
28.10	The next generation of edible films and possible research directions	779
28.11	Non-food uses and applications of adhesives	781
28.12	Adhesive hydrocolloid preparations: pastes and hydrogels	782
28.13	Adhesion mechanisms of hydrogels	783
28.14	Food uses and applications of adhesives	784
28.15	Uses and applications of bioadhesives	785
28.16	Structure-function and hydrogel-adherend relationships	786
28.17	Hydrocolloid adhesion tests	788
28.18	Hydrocolloids as wet glues	790
28.19	Future trends	792
28.20	References	792
29	Alginates	807
	<i>K. I. Draget, Norwegian University of Science and Technology, Norway</i>	
29.1	Introduction	807
29.2	Manufacture	808
29.3	Structure and physical properties	809
29.4	Technical data	813
29.5	Gels and gelling technologies	817
29.6	Foods, nutrition and health	823
29.7	Regulatory status	824
29.8	Future trends	824
29.9	References and sources of further reading	825

30 Inulin	829
<i>D. Meyer, Sensus, The Netherlands and J.-P. Blaauwloed, Cosun Food Technology Centre, The Netherlands</i>	
30.1 Introduction	829
30.2 Production process of inulin	831
30.3 Technical properties	831
30.4 Nutritional and health benefits	838
30.5 Applications	839
30.6 Regulatory status	843
30.7 Future trends	845
30.8 Acknowledgements	845
30.9 References	845
31 Chitin and chitosan hydrogels	849
<i>R. A. A. Muzzarelli, Muzzarelli Consulting, Italy and University of Ancona, Italy and C. Muzzarelli, University of Ancona, Italy</i>	
31.1 Introduction	850
31.2 Chitosan chemistry	851
31.3 Properties of chitosans and derivatives	853
31.4 Chitin as a food component	860
31.5 Nutritional and health effects	861
31.6 Food industry applications	867
31.7 Applications in drug delivery	869
31.8 Conclusion	876
31.9 References	876
32 Konjac mannan	889
<i>S. Takigami, Gunma University, Japan</i>	
32.1 Introduction	889
32.2 Manufacture	892
32.3 Structure	894
32.4 Technical data	896
32.5 Uses and applications	899
32.6 Regulatory status	900
32.7 References	901
Index	902