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**A VISCOMETRIC STUDY OF RHEOLOGICAL INTERACTION
BETWEEN SELECTED COMMERCIAL DAIRY PROTEINS
AND SELECTED GUMS IN AQUEOUS SOLUTION**

A THESIS PRESENTED FOR THE DEGREE OF
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To my wife, Suwaranya, and
my daughter, Veeya,

ABSTRACT

Rheological interaction between solutions of four selected gum (locust bean gum (LB), sodium carboxymethylcellulose (CMC), lambda-carrageenan (CR), xanthan gum (XN)) and solutions of four dairy proteins (sodium caseinate (SC), whey protein concentrate (WPC), coprecipitate (TMP), whey protein isolate (WPI)) were studied by steady shear viscometry using a Bohlin VOR Rheometer at 25 °C, natural pH and natural ionic strength. The rheological properties of mixed solutions were greatly influenced by presence of gum, gum concentration and gum type. Rheological synergism, with no obvious shear rate dependence, occurred between LB and SC, LB and WPC, LB and TMP, CMC and all dairy proteins, CR and WPC, CR and TMP, and XN and WPC. The degree of synergism, which was determined in a new way, was relatively much greater with TMP. The results are discussed in terms of Ca^{2+} bridging for TMP synergism and in terms of electrostatic and molecular space occupancy effects for SC, WPC and WPI synergism. No significant interaction occurred between LB and WPI or between CR and SC or between CR and WPI or between XN and SC or between XN and TMP or between XN and WPI. Quantitative measures of synergism in mixed solutions prepared from 0.5% gum solution and 6.0% dairy protein solution were in close agreement with similar measures of synergism in mixed solutions prepared from 1.2% gum, 10.0% dairy protein and distilled water. Rheological synergism was found to be unrelated to phase separation in the mixed solutions provided the phases remained intimately mixed. The relevance of this work to the use of the gum-dairy protein mixtures as rheologically-functional food ingredients is discussed.

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TABLE OF CONTENTS

	PAGE
ABSTRACT	i
ACKNOWLEDGEMENTS	ii
LIST OF TABLES	xiii
LIST OF FIGURES	xv
ABBREVIATIONS	xxxi
 CHAPTER 1 INTRODUCTION	 1
1.1 THE USE OF DAIRY PROTEINS AS RHEOLOGICALLY- FUNCTIONAL FOOD INGREDIENTS	 1
1.1.1 Caseinates	2
1.1.2 Whey protein concentrate	2
1.1.3 Coprecipitate	3
1.2 THE USE OF GUMS AS RHEOLOGICALLY-FUNCTIONAL FOOD INGREDIENTS	 4
1.2.1 Locust bean gum	4
1.2.2 Sodium carboxymethyl cellulose (CMC)	5
1.2.3 Carrageenans	5
1.2.4 Xanthan gum	5
1.3 THE USE OF GUM/DAIRY PROTEIN COMBINATIONS IN FOOD SYSTEMS	 6
1.4 DISCUSSION AND PROJECT IDENTIFICATION	7

CHAPTER 2 LITERATURE REVIEW	8
2.1 INTRODUCTION	8
2.2 FUNDAMENTAL RHEOLOGY OF GUM SOLUTIONS	8
2.2.1 Intrinsic viscosity	8
2.2.2 Dilute solutions	11
2.2.3 Concentrated solutions	11
2.3 RHEOLOGICAL PROPERTIES OF CONCENTRATED GUM SOLUTIONS	11
2.3.1 Effect of concentration	12
2.3.2 Effect of pH	13
2.3.3 Effect of ionic strength	13
2.3.4 Effect of added sugar	13
2.4 GUM-GUM INTERACTIONS	13
2.5 FUNDAMENTAL RHEOLOGY OF PROTEIN SOLUTIONS	15
2.5.1 Intrinsic viscosity	15
2.5.2 Dilute solutions	17
2.5.3 Concentrated solutions	17
2.6 RHEOLOGICAL PROPERTIES OF CASEINATE SOLUTIONS	18
2.6.1 Effect of shear	18
2.6.2 Effect of concentration	18
2.6.3 Effect of pH	18
2.6.4 Effect of ionic strength	19
2.6.5 Effect of temperature and heat treatment	19

2.6.6	Effect of chemical agents	20
2.7	RHEOLOGICAL PROPERTIES OF WHEY PROTEIN CONCENTRATE (WPC) SOLUTIONS	21
2.7.1	Effect of shear	21
2.7.2	Effect of concentration	21
2.7.3	Effect of pH and ionic strength	21
2.7.4	Effect of temperature	22
2.8	RHEOLOGICAL PROPERTIES OF COPRECIPITATE SOLUTIONS	22
2.8.1	Effect of shear and calcium content	22
2.8.2	Effect of pH	23
2.8.3	Effect of temperature	23
2.9	GUM-PROTEIN INTERACTIONS	23
2.9.1	Homogeneous mixtures	23
2.9.2	Simple coacervation	24
2.9.3	Complex coacervation	26
2.10	GUM-MILK PROTEIN INTERACTIONS	27
2.10.1	Neutral gums	27
2.10.2	Anionic gums	28
2.10.2.1	Caseins	28
2.10.2.2	Whey proteins	29
2.11	GUM-DAIRY PROTEIN INTERACTIONS	30
2.12	VISCOMETRIC INVESTIGATIONS OF GUM-PROTEIN (INCLUDING GUM-DAIRY PROTEIN) MIXTURES	30
2.12.1	Milk proteins	31

	vii
2.12.2 Dairy proteins	32
2.12.3 Other proteins	34
2.13 DISCUSSION AND RECOMMENDATION	35
2.13.1 pH	36
2.13.2 Gum:protein ratios and concentrations	36
2.13.3 Salts	37
2.13.4 Heat	37
 CHAPTER 3 PROJECT AIMS AND OVERALL PROJECT PLAN	 39
3.1 PROJECT AIMS	39
3.2 OVERALL PROJECT PLAN	39
 CHAPTER 4 MATERIALS AND METHODS	 41
4.1 MATERIALS	41
4.1.1 Gums	41
4.1.2 Dairy Proteins	41
4.1.3 Other materials	41
4.2 PREPARATION OF SOLUTIONS	42
4.2.1 Preparation of gum solutions	42
4.2.2 Preparation of dairy protein solutions	42
4.2.3 Storage of pure protein and gum solutions (Aging trials)	42
4.2.4 Preparation of mixtures of gum solutions and dairy protein solutions	43
4.3 CENTRIFUGATION OF MIXED SOLUTIONS	43

4.4	MEASUREMENT OF SEDIMENT	43
4.5	RHEOLOGICAL MEASUREMENT	44
4.5.1	Experimental procedure for viscosity measurements	45
4.5.2	Recording of viscometric flow data	45
4.5.3	Model fitting for viscometric flow data	45
4.6	ANALYTICAL TESTS	47
4.6.1	Moisture determination of gum and dairy protein powders	47
4.6.2	Total solids in the supernatant	48
4.6.3	Protein determination	48
4.6.4	pH measurement	48

CHAPTER 5 RHEOLOGICAL CHARACTERISATION OF GUM AND DAIRY PROTEIN SOLUTIONS

		50
5.1	INTRODUCTION	50
5.2	EXPERIMENTAL PLAN	50
5.3	PROCESSING AND PRESENTATION OF EXPERIMENTAL DATA	50
5.4	RESULTS	52
5.4.1	The flow properties of pure dairy protein and pure gum solutions	52
5.4.2	Effect of concentration on apparent viscosity of pure gum solutions	57
5.5	DISCUSSION	57
5.6	CONCLUSION	60

CHAPTER 6 RHEOLOGICAL SYNERGISM AND ANTAGONISM IN

	GUM-DAIRY PROTEIN MIXED SOLUTIONS	61
6.1	INTRODUCTION	61
6.2	EXPERIMENTAL PLAN	61
6.3	PROCESSING AND PRESENTATION OF EXPERIMENTAL DATA	62
6.4	RESULTS	89
6.4.1	The flow properties of mixed gum-protein solutions	89
6.4.2	Synergism and antagonism in mixed solutions	89
6.4.3	Sedimentation study	101
6.5	DISCUSSION	101
6.5.1	LB/dairy protein mixed solutions	101
6.5.2	CMC/dairy protein mixed solutions	103
6.5.3	CR/dairy protein mixed solutions	104
6.5.4	XN/dairy protein mixed solutions	104
6.6	CONCLUSION	105

CHAPTER 7 THE EFFECTS OF GUM : PROTEIN RATIO AND TOTAL POLYMER CONCENTRATION ON THE VISCOSITY OF GUM-DAIRY PROTEIN MIXED SOLUTIONS

		107
7.1	INTRODUCTION	107
7.2	EXPERIMENTAL PLAN	107
7.3	PROCESSING AND PRESENTATION OF EXPERIMENTAL DATA	109

	x
7.3.1 Viscosity	109
7.3.2 Power law constants	110
7.3.3 Z-ratios	110
7.3.4 Sedimentation results	114
7.4 RESULTS AND DISCUSSION	114
7.4.1 The effect of gum : protein ratio and total polymer concentration on the apparent viscosity of gum-dairy protein mixed solutions	114
7.4.2 The effect of gum : protein ratio and total polymer concentration on the rheological character of gum-dairy protein mixed solutions	123
7.4.3 Z-ratios	124
7.4.4 Sedimentation results	145
7.5 CONCLUSIONS	151
CHAPTER 8 FURTHER SEDIMENTATION EXPERIMENTS	152
8.1 INTRODUCTION	152
8.2 EXPERIMENTAL PLAN	152
8.3 PROCESSING AND PRESENTATION OF EXPERIMENTAL DATA	153
8.4 RESULTS AND DISCUSSION	156
8.4.1 Sedimentation results	156
8.4.2 Supernatant and sediment compositions	165
8.4.3 Rheology	165
8.5 CONCLUSION	168

CHAPTER 9 FINAL DISCUSSION AND CONCLUSIONS

AND RECOMMENDATIONS FOR FURTHER WORK	170
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REFERENCES	174
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APPENDICES	190
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APPENDIX 1: THE CONCENTRATIONS AND RATIOS OF DAIRY PROTEINS AND GUMS THAT HAVE BEEN USED IN FOODS.	190
APPENDIX 2: SPECIFICATIONS OF GUMS	191
APPENDIX 3: SPECIFICATION OF DAIRY PROTEINS	193
APPENDIX 4: PREPARATION OF GUM SOLUTIONS	195
APPENDIX 5: PREPARATION OF DAIRY PROTEIN SOLUTIONS	200
APPENDIX 6: STORAGE TIME STUDY	204
APPENDIX 7: MEASURED MOISTURE AND SOLIDS CONTENTS OF ALL GUM POWERS AND DAIRY PROTEIN POWDERS	205
APPENDIX 8: NATURAL pH VALUES OF 0.5% GUM SOLUTIONS AND 6.0% DAIRY PROTEIN SOLUTIONS	206
APPENDIX 9: X-RATIOS FOR MIXTURES OF 0.5% GUM AND 6.0% DAIRY PROTEIN SOLUTIONS	207
APPENDIX 10: X-RATIOS FOR MIXTURES OF 0.5% GUM SOLUTION AND WATER	211

APPENDIX 11: X'-RATIOS FOR MIXTURES OF 0.5% GUM AND 6.0% DAIRY PROTEIN SOLUTIONS	212
APPENDIX 12: Z-RATIOS FOR MIXTURES OF GUM-DAIRY PROTEIN SOLUTIONS	216
APPENDIX 13: MASS BALANCE AND COMPOSITION DATA FORMING THE BASIS OF TABLES 8.10 AND 8.11	217

LIST OF TABLES

	PAGE
Table 5.1: The n and k values of 6.0% dairy protein and 0.5% gum solutions at 25 °C.	52
Table 6.1: Compositions of mixtures of 0.5% gum solution and 6.0% dairy protein solution.	62
Table 6.2: Sedimentation results (%) for gum-dairy protein mixed solutions.	102
Table 7.1: Compositions of the gum-dairy protein mixtures studied.	109
Table 7.2: n values for locust bean gum (LB) and dairy protein mixed solutions.	125
Table 7.3: n values for CMC and dairy protein mixed solutions.	126
Table 7.4: n values for lambda-carrageenan (CR) and dairy protein mixed solutions.	127
Table 7.5: n values for xanthan gum (XN) and dairy protein mixed solutions.	128
Table 7.6: k values for locust bean gum (LB) and dairy protein mixed solutions.	129
Table 7.7: k values for CMC and dairy protein mixed solutions.	130
Table 7.8: k values for lambda-carrageenan (CR) and dairy protein mixed solutions.	131
Table 7.9: k value for xanthan gum (XN) and dairy protein mixed solutions.	132
Table 7.10: Sedimentation results (%) for LB/dairy protein mixed solutions.	146

Table 7.11:	Sedimentation results (%) CMC/dairy protein mixed solutions	147
Table 7.12:	Sedimentation results (%) for CR/dairy protein mixed solutions.	148
Table 7.13:	Sedimentation results (%) of XN/dairy protein mixed solutions.	149
Table 8.1:	Compositions of mixtures designated Mixture 1.	152
Table 8.2:	Compositions of mixtures designated Mixture 2.	153
Table 8.3:	Sedimentation results (%) for batch 1.	157
Table 8.4:	Sedimentation results (%) for batch 2.1.	158
Table 8.5:	Sedimentation result (% w/w) for batch 2.2.	159
Table 8.6:	Sedimentation results (%) for Mixture 2.	160
Table 8.7:	Sedimentation results (%) and analytical results for batch 5	161
Table 8.8:	Sedimentation results (%) for Mixture 1 (Data from Tables 8.3-8.5)	163
Table 8.9:	Sedimentation results (%) for Mixture 2 (Data from Table 8.6)	164
Table 8.10:	Sedimentation results, compositions, supernatant viscosities and X'-ratios for batch 5 mixed solutions. (Data ranked in descending order of the figure for the percentage of total gum in the mixed solution remaining in the supernatant after centrifugation)	166
Table 8.11:	Sedimentation results, compositions, supernatant viscosities and X'-ratios for batch 5 mixed solutions. (Data ranked in ascending order of sediment %).	167

LIST OF FIGURES

		PAGE
Fig. 2.1	Concentration dependence of 'zero shear' specific viscosity for random coil gum solutions (based on Morris (1983)).	10
Fig. 2.2	Generalised shear-thinning behaviour of concentrated gum solutions (based on Morris (1983)).	10
Fig. 2.3.	Schematic illustration of the phase-volume ratio method (based on Tolstoguzov (1990)). A % protein solution mixed with B % gum solution. C % and D % are protein % and gum % in mixture. E % and G % are the protein and gum concentrations in the protein rich phase. H % and F % are the protein and gum concentrations in the gum rich phase.	25
Fig. 4.1	Schematic diagram of Bohlin VOR Rheometer.	46
Fig. 4.2.	Schematic diagram of concentric cylinders, C25 system.	46
Fig. 5.1	Example (for 0.5% locust bean gum solution) of Bohlin plots of shear stress and apparent viscosity versus shear rate.	51
Fig. 5.2	Example of Bohlin printout of flow curve data (the data plotted in Fig 5.1).	51
Fig. 5.3a.	Flow properties of 0.5 % locust bean gum in distilled water at 25 °C	53
Fig. 5.3b.	Flow properties of 0.5 % CMC in distilled water at 25 °C	53
Fig. 5.3c.	Flow properties of 0.5 % lambda-carrageenan in distilled water at 25 °C	54
Fig. 5.3d.	Flow properties of 0.5 % xanthan gum in distilled water at 25	

	°C	54
Fig. 5.4a.	Flow properties of 6.0 % sodium caseinate in distilled water at 25 °C	55
Fig. 5.4b.	Flow properties of 6.0 % WPC in distilled water at 25 °C	55
Fig. 5.4c.	Flow properties of 6.0 % TMP in distilled water at 25 °C	56
Fig. 5.4d.	Flow properties of 6.0 % WPI in distilled water at 25 °C	56
Fig. 5.5a.	Apparent viscosity (mPa.s) versus concentration (%) for locust bean gum solutions. Power law constants (n and k values) for each concentration are also shown.	58
Fig. 5.5b.	Apparent viscosity (mPa.s) versus concentration (%) for CMC solutions. Power law constants (n and k values) for each concentration are also shown.	58
Fig. 5.5c.	Apparent viscosity (mPa.s) versus concentration (%) for lambda-carrageenan solutions. Power law constants (n and k values) for each concentration are also shown.	59
Fig. 5.5d.	Apparent viscosity (mPa.s) versus concentration (%) for xanthan gum solutions. Power law constants (n and k values) for each concentration are also shown.	59
Fig. 6.1a.	Apparent viscosity versus mixture composition for mixtures of 0.5 % LB and 6.0 % SC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown.	63
Fig. 6.1b.	Apparent viscosity versus mixture composition for mixtures of 0.5 % LB and 6.0 % SC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k	

- are also shown. 63
- Fig. 6.1c. Apparent viscosity versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 64
- Fig. 6.1d. Apparent viscosity versus mixture composition for mixtures of 0.5 % LB and 6.0 % TMP solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 64
- Fig. 6.1e. Apparent viscosity versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPI solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 65
- Fig. 6.2a. Apparent viscosity versus mixture composition for mixtures of 0.5 % CMC and 6.0 % SC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 65
- Fig. 6.2b. Apparent viscosity versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 66
- Fig. 6.2c. Apparent viscosity versus mixture composition for mixtures of 0.5 % CMC and 6.0 % TMP solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 66

- Fig. 6.2d. Apparent viscosity versus mixture composition for mixtures of 0.5 % CMC and 6.0 % TMP solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 67
- Fig. 6.2e. Apparent viscosity versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPI solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 67
- Fig. 6.3a. Apparent viscosity versus mixture composition for mixtures of 0.5 % CR and 6.0 % SC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 68
- Fig. 6.3b. Apparent viscosity versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 68
- Fig. 6.3c. Apparent viscosity versus mixture composition for mixtures of 0.5 % CR and 6.0 % TMP solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 69
- Fig. 6.3d. Apparent viscosity versus mixture composition for mixtures of 0.5 % CR and 6.0 % TMP solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 69

- Fig. 6.3e. Apparent viscosity versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPI solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 70
- Fig. 6.4a. Apparent viscosity versus mixture composition for mixtures of 0.5 % XN and 6.0 % SC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 70
- Fig. 6.4b. Apparent viscosity versus mixture composition for mixtures of 0.5 % XN and 6.0 % SC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 71
- Fig. 6.4c. Apparent viscosity versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPC solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k also shown. 71
- Fig. 6.4d. Apparent viscosity versus mixture composition for mixtures of 0.5 % XN and 6.0 % TMP solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 72
- Fig. 6.4e. Apparent viscosity versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPI solutions. Gum : protein ratios, total concentrations, and values of the power law constants n and k are also shown. 72
- Fig. 6.5. Schematic presentation of the possible rheological behaviour

	patterns of gum-dairy protein mixed solutions.	74
Fig. 6.6.	Schematic presentation of the possible rheological behaviour patterns of gum-dairy protein mixed solutions in terms of X-ratios.	74
Fig. 6.7a.	X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown.	75
Fig. 6.7b.	X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown.	75
Fig. 6.7c.	X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown.	76
Fig. 6.7d.	X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown.	76
Fig. 6.7e.	X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown.	77
Fig. 6.8a.	X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown.	77
Fig. 6.8b.	X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown.	78

- Fig. 6.8c. X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown. 78
- Fig. 6.8d. X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown. 79
- Fig. 6.8e. X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown. 79
- Fig. 6.9a. X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown. 80
- Fig. 6.9b. X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown. 80
- Fig. 6.9c. X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown. 81
- Fig. 6.9d. X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown. 81
- Fig. 6.9e. X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown. 82
- Fig. 6.10a. X-ratio versus mixture composition for mixtures of 0.5 % XN

	and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown.	82
Fig. 6.10b.	X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown.	83
Fig. 6.10c.	X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown.	83
Fig. 6.10d.	X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown.	84
Fig. 6.10e.	X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown.	84
Fig. 6.11	Viscosity versus concentration for aqueous sucrose solutions at 25 °C, showing effect of non-linearity on predicted (expected) viscosity (Data from Norrish (1967)).	86
Fig. 6.12a.	X-ratio versus mixture composition for mixtures of 0.5 % LB and water.	86
Fig. 6.12b.	X-ratio versus composition for mixtures of 0.5 % CMC and water.	87
Fig. 6.12c.	X-ratio versus mixture composition for mixtures of 0.5 % CR and water.	87
Fig. 6.12d.	X-ratio versus mixture composition for mixtures of 0.5 % XN and water.	88

- Fig. 6.13a. X'-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown. 91
- Fig. 6.13b. X'-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown. 91
- Fig. 6.13c. X'-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown. 92
- Fig. 6.13d. X'-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown. 92
- Fig. 6.13e. X'-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown. 93
- Fig. 6.14a. X'-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown. 93
- Fig. 6.14b. X'-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown. 94
- Fig. 6.14c. X'-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown. 94
- Fig. 6.14d. X'-ratio versus mixture composition for mixtures of 0.5 %

	CMC and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown.	95
Fig. 6.14e.	X'-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown.	95
Fig. 6.15a.	X'-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown.	96
Fig. 6.15b.	X'-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown.	96
Fig. 6.15c.	X'-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown.	97
Fig. 6.15d.	X'-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown.	97
Fig. 6.15e.	X'-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown.	98
Fig. 6.16a.	X'-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % SC solutions. Gum : protein ratios and total concentrations are also shown.	98
Fig. 6.16b.	X'-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % SC solutions. Gum : protein ratios and total	

- concentrations are also shown. 99
- Fig. 6.16c. X'-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPC solutions. Gum : protein ratios and total concentrations are also shown 99
- Fig. 6.16d. X'-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % TMP solutions. Gum : protein ratios and total concentrations are also shown. 100
- Fig. 6.16e. X'-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPI solutions. Gum : protein ratios and total concentrations are also shown. 100
- Fig. 7.1. Compositions of the mixed gum-dairy protein solutions studied in Chapter 6. 108
- Fig. 7.2a. Apparent viscosity versus gum : protein ratio and total polymer concentration for LB/SC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 115
- Fig. 7.2b. Apparent viscosity versus gum : protein ratio and total polymer concentration for LB/WPC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 115
- Fig. 7.2c. Apparent viscosity versus gum : protein ratio and total polymer concentration for LB/TMP mixtures. The x-axis is total polymer concentration (%), the y-axis is protein figure of the gum : protein ratio and the z-axis is apparent viscosity

(mPa.s).

116

Fig. 7.2d. Apparent viscosity versus gum : protein ratio and total polymer concentration for LB/WPI mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 116

Fig. 7.3a. Apparent viscosity versus gum : protein ratio and total polymer concentration for CMC/SC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 117

Fig. 7.3b. Apparent viscosity versus gum : protein ratio and total polymer concentration for CMC/WPC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 117

Fig. 7.3c. Apparent viscosity versus gum : protein ratio and total polymer concentration for CMC/TMP mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 118

Fig. 7.3d. Apparent viscosity versus gum : protein ratio and total polymer concentration for CMC/WPI mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 118

- Fig. 7.4a. Apparent viscosity versus gum : protein ratio and total polymer concentration for CR/SC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 119
- Fig. 7.4b. Apparent viscosity versus gum : protein ratio and total polymer concentration for CR/WPC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 119
- Fig. 7.4c. Apparent viscosity versus gum : protein ratio and total polymer concentration for CR/TMP mixtures. The x-axis is the total polymer concentration (%), the y-axis is protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 120
- Fig. 7.4d. Apparent viscosity versus gum : protein ratio and total polymer concentration for CR/WPI mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 120
- Fig. 7.5a. Apparent viscosity versus gum : protein ratio and total polymer concentration for XN/SC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s). 121
- Fig. 7.5b. Apparent viscosity versus gum : protein ratio and total polymer concentration for XN/WPC mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of

	the gum : protein ratio and z-axis is the apparent viscosity (mPa.s).	121
Fig. 7.5c.	Apparent viscosity versus gum : protein ratio and total polymer concentration for XN/TMP mixtures. The x-axis is total polymer concentration (%), the y-axis is protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s).	122
Fig. 7.5d.	Apparent viscosity versus gum : protein ratio and total polymer concentration for XN/WPI mixtures. The x-axis is total polymer concentration (%), the y-axis is the protein figure of the gum : protein ratio and the z-axis is apparent viscosity (mPa.s).	122
Fig. 7.6a.	n value versus gum concentration for LB/dairy protein mixed solutions.	133
Fig. 7.6b.	n value versus gum concentration for CMC/dairy protein mixed solutions.	133
Fig. 7.6c.	n value versus gum concentration for CR/dairy protein mixed solutions.	134
Fig. 7.6d.	n value versus gum concentration for XN/dairy protein mixed solutions.	134
Fig. 7.7a.	k value versus gum concentration for LB/dairy protein mixed solutions.	135
Fig. 7.7b.	k value versus gum concentration for CMC/dairy protein mixed solutions.	135
Fig. 7.7c.	k value versus gum concentration for CR/dairy protein mixed	

	solutions.	136
Fig. 7.7d.	k value versus gum concentration for XN/dairy protein mixed solutions.	136
Fig. 7.8a.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % SC solutions.	137
Fig. 7.8b.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPC solutions.	137
Fig. 7.8c.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % TMP solutions.	138
Fig. 7.8d.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % LB and 6.0 % WPI solutions.	138
Fig. 7.9a.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % SC solutions.	139
Fig. 7.9b.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPC solutions.	139
Fig. 7.9c.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % TMP solutions.	140
Fig. 7.9d.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CMC and 6.0 % WPI solutions.	140
Fig. 7.10a.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % SC solutions.	141
Fig. 7.10b.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPC solutions.	141
Fig. 7.10c.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % TMP solutions.	142

Fig. 7.10d.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % CR and 6.0 % WPI solutions.	142
Fig. 7.11a.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % SC solutions.	143
Fig. 7.11b.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPC solutions.	143
Fig. 7.11c.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % TMP solutions.	144
Fig. 7.11d.	Z-ratio and X-ratio versus mixture composition for mixtures of 0.5 % XN and 6.0 % WPI solutions.	144
Fig. 8.1.	Sedimentation experiments carried out on Mixtures 1 and 2.	154
Fig. 8.2.	Sedimentation measurement and analyses carried out on batch 5 (Mixture 1).	154

ABBREVIATIONS

LB	=	Locust bean gum
CMC	=	Sodium Carboxymethylcellulose
CR	=	Lambda-carrageenan
XN	=	Xanthan gum
SC	=	Sodium caseinate
WPC	=	Whey protein concentrate
TMP	=	Total milk protein
WPI	=	Whey protein isolate
LB/SC	=	LB and SC mixed solutions
LB/WPC	=	LB and WPC mixed solutions
LB/TMP	=	LB and TMP mixed solutions
LB/WPI	=	LB and WPI mixed solutions
CMC/SC	=	CMC and SC mixed solutions
CMC/WPC	=	CMC and WPC mixed solutions
CMC/TMP	=	CMC and TMP mixed solutions
CMC/WPI	=	CMC and SC mixed solutions
CR/SC	=	CR and SC mixed solutions
CR/WPC	=	CR and WPC mixed solutions
CR/TMP	=	CR and TMP mixed solutions
CR/WPI	=	CR and WPI mixed solutions
XN/SC	=	XN and SC mixed solutions

XN/WPC	=	XN and WPC mixed solutions
XN/TMP	=	XN and TMP mixed solutions
XN/WPI	=	XN and WPI mixed solutions
N	=	No sediment was observed.
NG	=	Sediment was found but the solution appeared to be a gel-like mass.