

LIST OF CONTENTS

<i>Introduction, Objectives and Thesis Structure</i>	24
1. INTRODUCTION.....	25
2. OBJECTIVES.....	27
2.1. General Objective.....	27
2.2. Specific Objectives.....	27
3. THESIS STRUCTURE.....	28
CHAPTER 1	31
<i>Near-infrared spectral techniques for wheat flour and wheat-based products evaluation: A review</i>	31
1.1. Introduction.....	35
1.2. Spectral Techniques.....	36
1.3. Chemometrics.....	40
1.3.1. Data pre-processing.....	41
1.3.2. Exploratory analysis.....	41
1.3.3. Quantitative analyses.....	42
1.3.4. Discriminant and classification analysis.....	43
1.3.5. Curve resolution/spectral unmixing methods.....	44
1.4. Application in wheat flour and wheat-based products.....	47
1.4.1. Authentication.....	47
1.4.2. Determination of quality parameters.....	57
1.4.3. Other applications.....	63
1.4.4. Data fusion.....	70
1.5. Conclusions and future trends.....	73
Acknowledgments.....	74
Declaration of competing interest.....	74
Author contributions.....	74
References.....	74
CHAPTER 2	83
<i>Identification of fibre added to semolina by Near Infrared (NIR) spectral techniques</i>	83
2.1. Introduction.....	84
2.2. Material and Methods.....	85
2.2.1. Sample Preparation.....	85

2.2.2.	NIR spectra and hyperspectral image acquisition.....	85
2.2.3.	Pre-processing.....	85
2.2.4.	Spectral pre-processing.....	85
2.2.5.	Data analysis.....	86
2.2.6.	Discriminant analysis.....	87
2.2.7.	Development of the prediction model and distribution map.....	87
2.3.	Results and discussion.....	87
2.3.1.	Raw spectra of samples.....	87
2.3.2.	Principal components analysis (PCA)	89
2.3.3.	Sample classification.....	90
2.3.4.	Prediction models.....	90
2.3.5.	Distribution maps.....	91
2.4.	Conclusion.....	91
	Acknowledgments.....	91
	Conflict of interest disclosure.....	92
	References.....	92
	CHAPTER 3.....	93
	<i>Near infrared hyperspectral imaging and spectral unmixing methods for evaluation of fibre distribution in enriched pasta.....</i>	93
3.1.	Introduction.....	94
3.2.	Material and Methods.....	97
3.2.1.	Sample Preparation.....	97
3.2.2.	Image acquisition.....	97
3.2.3.	Data analysis: MCR-ALS.....	97
3.3.	Results and discussion.....	99
3.3.1.	Control sample and pure flour spectra as initial estimates.....	99
3.3.2.	MCR-ALS in pasta samples.....	99
3.3.2.1.	Fibre distribution.....	99
3.3.2.2.	MCR-ALS models.....	99
3.3.2.3.	Distribution of fibre content in the surface of samples	101
3.4.	Conclusion.....	101
	CRedit authorship contribution statement.....	101
	Declaration of Competing Interest.....	101

Acknowledgments.....	101
Appendix A. Supplementary data.....	101
References.....	101
CHAPTER 4.....	103
<i>Study of changes in pasta during cooking by hyperspectral imaging.....</i>	103
4.1. Introduction.....	106
4.2. Materials and methods.....	107
4.2.1. Sample preparation.....	107
4.2.2. Cooking process.....	108
4.2.3. Acquisition hardware.....	108
4.2.4. Data processing.....	109
4.2.5. Multivariate data analysis.....	110
4.3. Results and discussion.....	111
4.3.1. Raw spectra of samples.....	111
4.3.2. Principal Component Analysis (PCA)	115
4.3.3. Classification of pasta samples - Linear Discriminant Analysis (LDA)	118
4.3.4. Classification of pasta samples - Partial Least Squares Discriminant Analysis (PLSDA)	119
4.4. Conclusion.....	120
Acknowledgment.....	121
Conflict of interest disclosure.....	121
References.....	121
CHAPTER 5.....	124
<i>Determination of pectin content in orange peels by near infrared hyperspectral imaging.....</i>	124
5.1. Introduction.....	125
5.2. Material and Methods.....	127
5.2.1. Pectin extraction from raw material.....	127
5.2.2. Sample preparation and image acquisition.....	128
5.2.3. Spectra extraction and multivariate analysis.....	129
5.2.4. Principal components analysis (PCA)	129
5.2.5. Linear discriminant analysis (LDA)	130
5.2.6. Partial least Square regression (PLSR)	130

5.3.	Results and discussion.....	131
5.3.1.	Spectral analysis.....	131
5.3.2.	Principal components analysis (PCA)	131
5.3.3.	Linear discriminant analysis (LDA)	131
5.3.4.	Partial least Square regression (PLSR)	131
5.4.	Conclusion	132
	CRedit authorship contribution statement	132
	Declaration of Competing Interest.....	132
	Acknowledgments.....	132
	References.....	132
	GENERAL DISCUSSION.....	134
	GENERAL CONCLUSION.....	138
	STUDENT STORY.....	141
	REFERENCES.....	145
	FINAL CONSIDERATIONS.....	148
	APPENDIX I.....	151
	<i>Food Quality and NIR Spectroscopy in the Omics Era.....</i>	<i>151</i>
	APPENDIX II.....	168
	<i>Automated method for determination of cheese meltability by computer vision</i>	<i>168</i>
	APPENDIX III.....	187
	<i>Identification of turkey meat and processed products using near infrared spectroscopy...187</i>	
	APPENDIX IV.....	198
	<i>Supplementary material of Chapter 2.....</i>	<i>198</i>
	APPENDIX V.....	200
	<i>Supplementary material of Chapter 3.....</i>	<i>200</i>
	APPENDIX VI.....	202
	<i>Supplementary material of Chapter 5.....</i>	<i>202</i>