

CONTENTS

Chapter	Description	Page
	Abstract	i
	Declaration by the candidate	iii
	Certificate of the supervisor	iv
	Acknowledgement	v
	Contents	vii
	List of tables	xi
	List of figures	xii
	List of abbreviations	xiv
	List of symbols	xvi
Chapter 1	Introduction	1-6
Chapter 2	Review of Literature	7-34
	2.1 Orange fruit	7
	2.1.1 Varieties of oranges	7-8
	2.1.2 Standardization of fruit juice	8-11
	2.1.3 Current status of orange juice processing	11-12
	2.1.4 Changes in physicochemical properties	12-13
	2.2 Non-thermal approach in juice processing	14-15
	2.3 Cold plasma technology	16-17
	2.3.1 Plasma generation sources	17
	2.3.2 Types of cold plasma system	18
	2.3.2.1 Batch type cold plasma technology	18
	2.3.2.2 Continuous type cold plasma technology	18
	2.3.3 Cold plasma-assisted processing of juice	18-19
	2.3.4 Effect of cold plasma on food quality	19-20
	2.3.5 Current status of plasma-assisted processing of fruit juices	20-21
	2.3.6 Influence of cold plasma processing parameters	21
	2.3.6.1 Voltage	21
	2.3.6.2 Juice depth	21
	2.3.6.3 Treatment time	21-22
	2.4 Response surface methodology	22
	2.5 Enzyme and microbial inactivation	22-23
	2.6 Kinetics modeling	23
	2.7 Shelf-life and storage studies	23-24
	Bibliography	25-34
Chapter 3	To standardize the process parameters for atmospheric cold plasma (ACP)-assisted processing of orange juice from different cultivars	35-66
	3.1 Introduction	35
	3.2 Materials and Methods	35
	3.2.1 Raw materials and chemicals	35
	3.2.2 Juice preparation	36
	3.2.3 Cold plasma treatment	36
	3.2.4 Experimental design	38-39

3.2.5	Ascorbic acid	39-40
3.2.6	Residual activity of PME	40
3.2.7	Bioaccessibility index of ascorbic acid	40
3.2.8	DPPH radical scavenging activity	40-41
3.2.9	Total phenolic content	41
3.2.10	Statistical analysis	41
3.3	Results and Discussion	42
3.3.1	Response surface modeling	42
3.3.2	Effect of ACP treatment on orange (cv. Wakro) juice	46
3.3.2.1	Ascorbic acid	46-47
3.3.2.2	Residual activity of PME	47-48
3.3.2.3	Bioaccessibility index of ascorbic acid	48-49
3.3.2.4	DPPH radical scavenging activity	49-50
3.3.2.5	Total phenolic content	50-51
3.3.3	Optimization for ACP processing of orange (cv. Wakro) juice and validation	54-55
3.3.4	Effect of ACP treatment on orange (cv. Malta) juice	55
3.3.4.1	Ascorbic acid	55-56
3.3.4.2	Residual activity of PME	56-57
3.3.4.3	Bioaccessibility index of ascorbic acid	57
3.3.5	Optimization for ACP processing of orange (cv. Malta) juice and validation	57
3.4	Conclusion	60-61
	Bibliography	62-66
Chapter 4	To model the inactivation kinetics of enzyme (pectin methylesterase) and microbe (<i>Escherichia coli</i>) in orange juice during atmospheric cold plasma processing	67-93
4.1	Introduction	67
4.2	Materials and Methods	67
4.2.1	Raw materials and chemicals	67
4.2.2	Juice preparation	67-68
4.2.3	Experimental design	68
4.2.4	Atmospheric cold plasma treatment	68
4.2.5	Enzyme (pectin methylesterase) activity	68
4.2.6	Microbial (<i>Escherichia coli</i>) analysis	70
4.2.7	Enzyme inactivation kinetics models	70-71
4.2.8	Microbe (<i>Escherichia coli</i>) inactivation kinetics models	71
4.2.9	Goodness-of-fit parameters	71-72
4.2.10	Model assessment and validation	72
4.2.11	Model selection criteria	72
4.2.11.1	Akaike information criterion	72-73
4.2.11.2	Akaike increment	73
4.2.12	Statistical analysis	73
4.3	Results and Discussion	74

4.3.1	Effect of ACP treatment on PME inactivation	74
4.3.2	Inactivation kinetics modelling of PME enzyme	75
4.3.2.1	First-order model	75-76
4.3.2.2	Weibull model	76
4.3.2.3	n^{th} order model	76-77
4.3.3.4	Fractional conversion model	77
4.3.3	Model validation and selection for PME inactivation	79
4.3.3.1	Performance of the models and its validation	79-80
4.3.3.2	Model selection by the Akaike information criterion and Akaike increment	80-81
4.3.4	Effect of ACP treatment on <i>E. coli</i> inactivation	81
4.3.5	Inactivation kinetics modelling of <i>E. coli</i>	82
4.3.5.1	log-linear model	82-83
4.3.5.2	Weibull model	83
4.3.5.3	Membre model	83
4.3.6	Model validation and selection for <i>E. coli</i> inactivation	85
4.3.6.1	Performance of the models and their validation	85
4.3.6.2	Model selection by the Akaike information criterion and Akaike increment	86
4.4	Conclusion	86-87
	Bibliography	88-93
Chapter 5	To study the shelf life of atmospheric cold plasma (ACP) treated orange juice during storage.	94-115
5.1	Introduction	94
5.2	Materials and Methods	94
5.2.1	Raw materials and chemicals	94-95
5.2.2	Juice preparation and plasma treatment	95
5.2.3	Total soluble solids and pH	96
5.2.4	Titrateable acidity	96-97
5.2.5	Colour	97
5.2.6	Ascorbic acid	97
5.2.7	DPPH radical scavenging activity	97
5.2.8	Total phenolic content	97
5.2.9	Microbial (total viable counts and yeast and mold counts) analysis	97-98
5.2.10	Statistical analysis	98
5.3	Results and Discussion	98
5.3.1	Total soluble solids	98-99
5.3.2	pH	100-101
5.3.3	Titrateable acidity	101-102
5.3.4	Total colour change	102-103

	5.3.5	Ascorbic acid	103-104
	5.3.6	DPPH radical scavenging activity	105
	5.3.7	Total phenolic content	106-107
	5.3.8	Total viable counts	107-108
	5.3.9	Yeast and mold counts	108-109
	5.4	Conclusion	109-110
		Bibliography	111-115
Chapter 6		To develop a lab-scale continuous system of atmospheric cold plasma (ACP) for juice processing and its performance evaluation with orange juice	116-135
	6.1	Introduction	116
	6.2	Materials and Methods	116
	6.2.1	Raw materials and chemicals	116
	6.2.2	Juice preparation	116-117
	6.2.3	Lab-scale continuous cold plasma setup and juice treatment	117
	6.2.4	pH, total soluble solids, titratable acidity	117
	6.2.5	Electrical conductivity	118
	6.2.6	Colour	119
	6.2.7	Residual activity of PME	119
	6.2.8	Ascorbic acid	119
	6.2.9	DPPH radical scavenging activity	119
	6.2.10	Ascorbic acid, DPPH radical scavenging activity degradation and RA of PME inactivation kinetics modeling	119
	6.2.11	Statistical analysis	120
	6.3	Results and Discussion	120
	6.3.1	Effect of continuous ACP treatment on the quality parameters	120
	6.3.1.1	pH, total soluble solids, and titratable acidity	120-121
	6.3.1.2	Electrical conductivity	121-122
	6.3.1.3	Colour	122-123
	6.3.1.4	PME inactivation	124
	6.3.1.5	Ascorbic acid	125
	6.3.1.6	DPPH radical scavenging activity	126
	6.3.2	Kinetics modeling	127
	6.3.2.1	Residual activity of PME	127
	6.3.2.2	Ascorbic acid degradation	127-128
	6.3.2.3	DPPH radical scavenging activity degradation	128
	6.4	Conclusion	130-131
		Bibliography	132-135
Chapter 7		Summary and Conclusion	136-139
	7.1	Summary	136-138
	7.2	Conclusion	138-139
	7.3	Future scope of the present study	139
		Appendix	140
		List of publications from the present work	140