

TABLE OF CONTENTS

	Page
TABLE OF CONTENTS	i
LIST OF TABLES	ii
LIST OF FIGURES	iv
LIST OF ABBREVIATIONS	viii
INTRODUCTION	1
OBJECTIVES	3
LITERATURE REVIEW	4
MATERIALS AND METHODS	39
Materials	39
Methods	40
RESULTS AND DISCUSSION	49
CONCLUSION AND RECOMMEDATION	128
Conclusion	128
Recommendation	132
LITERATURE CITED	133
APPENDIX	143
APPENDIX A	144
APPENDIX B	160
CURRICULUM VITAE	162

LIST OF TABLES

Table	Page
1 Structural properties of amylose from rice	6
2 Structural properties of amylopectin from rice	9
3 Chemical composition of dry-milled and wet-milled rice flour and rice starch from three rice varieties	50
4 Gelatinization properties dry-milled and wet-milled rice flour and rice starch from three rice varieties	64
5 Swelling power of rice flours and rice starch from three rice varieties	72
6 Solubility of rice flours and rice starch from three rice varieties	78
7 Pasting properties of dry- and wet- milled rice flour and rice starch from three rice varieties	83
8 Degree of relative crystallinity (%) of rice flour and rice starch from three rice varieties	91
9 Molecular size distribution and average molecular weight from total starch fraction (TSF) of rice flour and rice starch and hot-water-soluble fraction (HWSF) of rice flour from three rice varieties	97
10 Correlation between chemical properties, starch molecular properties and physicochemical properties of rice flour and starch	106
11 Cooking properties of rice noodle prepared from dry- and wet-milled rice flour from three rice varieties	109
12 Textural properties of rice noodle prepared from dry- and wet-milled rice flour from three rice varieties	111
13 Sensory evaluation of rice noodle prepared from dry- and wet-milled rice flour from three rice varieties	114
14 Correlation between rice noodle properties and some chemical properties and starch molecular properties of rice flour	118

LIST OF TABLES (Continued)

Table		Page
15	Correlation between rice noodle properties and some physical properties of rice flour	124

Appendix Table

1	Correction factors for blue values not measured at 20 °C	148
2	Correlation between chemical properties, starch molecular properties and physicochemical properties of rice flour and rice starch	161

LIST OF FIGURES

Figure		Page
1	Rice starch granules magnified x5,000 at 5 μm by a scanning electron microscope	4
2	Schematic representation of starch granule structure: (a) a single granule with alternating amorphous and semicrystalline layers, representing growth ring; (b) expanded view of the semicrystalline layer of a growth ring, consisting of alternating crystalline and amorphous lamellae; (c) the cluster structure of amylopectin within the semicrystalline layer of the growth ring	5
3	Cluster model of amylopectin. \emptyset = Reducing chain-end. Solid lines indicate (1 \rightarrow 4)- α -D-glucan chain; arrows indicated α -(1 \rightarrow 6) linkage	8
4	Temperature sweep data for gelatinization of 25% TCW70 (a), waxy rice and TCS10 (b), normal rice with amylose content of 17.1% rice starch suspension. Symbols: G' (- \blacktriangle -), G'' (- Δ -) and $\tan \delta$ (-*-)	16
5	Amylograms of rice flour at 10% solids in water with and without dithiothreitol (DTT) added, (b) incubated 2 hours before analysis in water or a solution containing chymotrypsin, pronase, or bovine serum albumin (BSA)	21
6	Manufacture of rice flour and their applications	23

LIST OF FIGURES (Continued)

Figure		Page
7	Model of part of an amylopectin molecule showing possible fracture point following mechanical damage: crystalline domains formed by double helices are shaded grey, and α -1, 6-glycosidic branch points are showed by small arrow heads. (a) A single break in a B ₂ , B ₃ , or B ₄ chain traversing the narrow amorphous zone between two consecutive clusters of helices, giving low molecular weight fragments of amylopectin (LMWAP) of DP 50-80 approximately; (b) breaks in one A-chain and B-chain immediately above the double helix; and (c) a single break in a B-chain that would release LMWAP of DP 20-30	27
8	The effect of ball-milling treatment on pasting characteristics of TNU519 and TCW70 rice starch	29
9	SEM of the outer endosperm of rice kernel. (a) Before soaking, (b) soaked at 25°C for 10 min, (c) soaked at 25°C for 60 min, (d) soaked at 5°C for 7 days	33
10	Isolation of rice starch from dry- and wet-milled rice flour	42
11	SEMs of dry-milled and wet-milled Pathum Thani 1 rice flour with and without α -amylase treatment at magnificent (1,000X) and (3,000X)	56
12	SEMs of dry-milled and wet-milled Pathum Thani 1 rice starch with and without α -amylase treatment at magnificent (1,000X) and (3,000X)	57
13	SEMs of dry-milled and wet-milled RD 7 rice flour with and without α -amylase treatment at magnificent (1,000X) and (3,000X)	58

LIST OF FIGURES (Continued)

Figure		Page
14	SEMs of dry-milled and wet-milled RD 7 rice starch with and without α -amylase treatment at magnificant (1,000X) and (3,000X)	59
15	SEMs of dry-milled and wet-milled Leuang 11 rice flour with and without α -amylase treatment at magnificant (1,000X) and (3,000X)	60
16	SEMs of dry-milled and wet-milled Leuang 11 rice starch with and without α -amylase treatment at magnificant (1,000X) and (3,000X)	61
17	Swelling power of rice flour (a) and rice starch (b) (PD= dry-milled Pathum Thani 1, PW=wet-milled Pathum Thani 1, RD = dry-milled RD 7, RW=wet-milled RD 7, LD=dry-milled Leuang 11, LW=wet-milled Leuang 11)	71
18	Solubility of rice flour (a) and rice starch (b) (PD= dry-milled Pathum Thani 1, PW=wet-milled Pathum Thani 1, RD = dry-milled RD 7, RW=wet-milled RD 7, LD=dry-milled Leuang 11, LW=wet-milled Leuang 11)	77
19	RVA viscographs of dry- and wet-milled rice flour and rice starch samples from three rice varieties (a) Pathum Thani 1 (b) RD 7 and (c) Leuang 11	82
20	X-ray diffraction patterns of rice flour and rice starch from three rice varieties (a) Pathum Thani 1 (b) RD 7 and (c) Leuang 11	90

LIST OF FIGURES (Continued)

Figure	Page
21 Starch molecular size distributions (dots are molar mass, solid line is RI profile) of total starch fraction of dry- and wet-milled rice flour from three rice varieties; (a) Pathum Thani 1 (b) RD 7 and (c) Leuang 11 (---) dry-milled and (---) wet-milled rice flour	94
22 Starch molecular size distributions (dots are molar mass, solid line is RI profile) of total starch fraction of dry- and wet-milled rice starch from three rice varieties; (a) Pathum Thani 1 (b) RD 7 and (c) Leuang 11 (---) dry-milled and (---) wet-milled rice flour	95
23 Starch molecular size distributions (dots are molar mass, solid line is RI profile) of hot-water-soluble fraction of dry- and wet-milled rice flour from three rice varieties; (a) Pathum Thani 1 (b) RD 7 and (c) Leuang 11 (---) dry-milled and (---) wet-milled rice flour	96
 Appendix Figure	
1 X-ray diffraction spectra for rice flour showing crystalline (above the smooth curve) and amorphous regions	154
2 Force vs. time plot from the measurement of rice noodle firmness	156
3 Force vs. time plot from the measurement of rice noodle tensile strength	158

LIST OF ABBREVIATIONS

DP	=	Degree of polymerization
DSC	=	Differential scanning calorimeter
g	=	Gram
MALLS	=	Multi-angle light scattering
mL	=	Milliliter
Mw	=	Molecular weight
QDA	=	Quantitative data analysis
RI	=	Reflective index
RVA	=	Rapid visco analyzer
RVU	=	Rapid visco unit
SEC	=	Size exclusion chromatography
SEM	=	Scanning electron microscopy
SP	=	Swelling power
TPA	=	Texture profile analysis
μm	=	Micrometer
WAI	=	Water absorption index