

CONTENTS

	Page
Contents	(8)
List of tables	(11)
List of figures	(12)
Chapter	
1. Introduction	1
Literature review	2
1. Lipid oxidation	2
1.1 Initiation	2
1.2 Propagation	3
1.3 Termination	3
1.4 Factors influencing lipid oxidation	4
2. Antioxidants	6
2.1 Classification of food antioxidants	7
2.2 Mode of action of antioxidants in food	8
3. Fish protein hydrolysates	10
3.1 The production of protein hydrolysates	11
3.2 Enzymatic hydrolysis process of fish muscle proteins	12
3.3 Compositions and functional properties of fish protein hydrolysates	19
4. Antioxidative activity of fish protein hydrolysates	27
4.1 Mode of action of fish protein hydrolysates	27
4.2 Amino acids and peptides with antioxidative activity	28
Objectives	31
2. Materials and Methods	32
1. Materials/Chemicals	32
2. Instruments	32
3. Methods	33
3.1 Use of Alcalase and Flavourzyme for the hydrolysis of round scad mince	33
	(8)

CONTENTS (Continued)

	Page
3.2 Antioxidative activities of round scad protein hydrolysates as affected by proteinase types	34
3.3 Effect of defatting on antioxidative activities of round scad protein hydrolysates	35
3.4 Fractionation of antioxidative peptides from round scad protein hydrolysate	35
3.5 Compositions and some properties of round scad protein hydrolysate	37
3.6 Study on the stability of round scad protein hydrolysate during storage	38
4. Statistical analysis	38
3. Results and Discussion	39
1. Enzymatic hydrolysis and antioxidative activities of round scad protein hydrolysates prepared using Alcalase (HA) and Flavourzyme (HF)	39
1.1 Effect of heating time on DH of round scad protein hydrolysates	39
1.2 Effect of enzyme concentration on DH of round scad protein hydrolysates	40
1.3 Effect of DH on antioxidative activities of round scad protein hydrolysates	41
2. Effect of defatting on enzymatic hydrolysis and antioxidative activities of round scad protein hydrolysates	45
2.1 Fat and moisture contents of round scad mince and defatted mince	45
2.2 Enzymatic hydrolysis of round scad mince and defatted mince using Flavourzyme	45
2.3 Yield of round scad protein hydrolysates from mince and defatted mince using Flavourzyme	46
2.4 DPPH radical scavenging activity	47
2.5 Reducing power	49
2.6 Metal chelating activity	50

CONTENTS (Continued)

	Page
3. Fractionation of antioxidative peptides from round scad protein hydrolysate	51
3.1 Fractionation of round scad protein hydrolysate by gel filtration chromatography and solvent extraction	51
3.2 DPPH radical scavenging activity	53
3.3 Reducing power	55
3.4 Metal chelating activity	55
3.5 Characterization of antioxidative peptide fraction	56
3.6 Antioxidative activity of HFIP 60 and peptide fractions in different systems	58
4. Compositions and some properties of round scad protein hydrolysate	63
4.1 Proximate analysis	63
4.2 Amino acid compositions	64
4.3 Mineral contents	66
4.4 Color	67
4.5 Functional properties	67
5. Study on the stability of round scad protein hydrolysate during storage	71
4.6 Antioxidative activities	71
4.7 Solubility	73
4.8 Color	73
4. Conclusion	75
References	76
Appendix	93
Vitae	101

LIST OF TABLES

Table	Page
1. Type of enzymes and substrates used to prepare fish protein hydrolysates	15
2. Proximate composition, nitrogen solubility index and yields of protein hydrolysates from raw herring, herring presscake and ethanol-extracted herring	20
3. Amino acid composition of capelin proteins and capelin protein hydrolysate	21
4. The molecular weight of peptides with the antioxidative activity from fish protein hydrolysates	30
5. Yields of round scad protein hydrolysate derived from mince and defatted mince using Flavourzyme with different DHs	47
6. Yields of different fractions from round scad protein hydrolysate derived from isopropanol-defatted mince with 60% DH separated by Sephadex G-75 gel filtration and solvent extraction	53
7. Chemical compositions of round scad protein hydrolysate	64
8. Amino acid compositions of round scad protein hydrolysate	65
9. Mineral contents of round scad protein hydrolysate	66
10. Emulsifying properties of round scad protein hydrolysate at various concentrations	69
11. Changes in L* (lightness), a* (redness/greenness) and b* (yellowness/blueness)-values of the solution prepared from round scad protein hydrolysate stored at 25°C and 4°C for different times	74

LIST OF FIGURES

Figure	Page
1. Delocalization of the unpaired electron in the aromatic ring of phenoxy radicals	9
2. Flowchart for the production of capelin protein hydrolysate	13
3. Enzymatic hydrolysis of salmon muscle mince with different alkaline proteases (pH 7.5, 40°C, 180 min and 7.5% substrate concentration)	17
4. Changes in DH of round scad protein hydrolysate prepared using Alcalase and Flavourzyme during hydrolysis with different times. The reaction was performed at 50°C, pH 8 for Alcalase and 50°C, pH 7 for Flavourzyme	40
5. The relationship between \log_{10} (enzyme concentration) and DH (%) in enzymatic hydrolysis of round scad by Alcalase and Flavourzyme. The reaction was performed for 1 h at 50°C, pH 8 for Alcalase and 50°C, pH 7 for Flavourzyme	41
6. Antioxidative activities of round scad protein hydrolysates prepared using Alcalase (HA) and Flavourzyme (HF) with various DH. a: DPPH radical scavenging activity, b: reducing power and c: Fe^{2+} chelating activity	42
7. The relationship between \log_{10} (enzyme concentration) and DH (%) in enzymatic hydrolysis of round scad mince and defatted mince using Flavourzyme. The reaction was performed for 1 h at 50°C and pH 7	46
8. Antioxidative activities of HF prepared from round scad mince, ethanol-defatted mince and isopropanol-defatted mince with various DH. a: DPPH radical scavenging activity, b: reducing power and c: Fe^{2+} chelating activity	48
9. Separation of peptides from round scad protein hydrolysate derived from isopropanol-defatted mince with 60% DH by Sephadex G-75	52
10. Antioxidative activities of fractions from round scad protein hydrolysate separated by Sephadex G-75 gel filtration and solvent extraction. a: DPPH radical scavenging activity, b: reducing power and c: Fe^{2+} chelating activity	54
11. Thin layer chromatography of E2 (dichloromethane fraction) of round scad protein hydrolysate after separation; plates were sprayed with ninhydrin solution (a) and DPPH solution (b)	57

LIST OF FIGURES (Continued)

Figure	Page
12. Changes in A_{500} of linoleic acid system in the presence of HFIP 60, E2: dichloromethane fraction and E3: ethyl acetate fraction at different levels in comparison with the control and the systems containing BHT at 25 ppm and 100 ppm	59
13. Changes in conjugated diene (A_{234}) of lecithin liposome system in the presence of HFIP 60, E2: dichloromethane fraction and E3: ethyl acetate fraction at different levels in comparison with the control and the systems containing BHT at 25 ppm and 100 ppm	61
14. Changes in TBARS (mg MDA/ml liposome) of lecithin liposome system in the presence of HFIP 60, E2: dichloromethane fraction and E3: ethyl acetate fraction at different levels in comparison with the control and the systems containing BHT at 25 ppm and 100 ppm	62
15. Foaming properties of round scad protein hydrolysates at various concentrations	70
16. Changes in DPPH radical scavenging activity, reducing power and chelating activity of round scad protein hydrolysate during storage at 25°C and 4°C for 6 weeks	72
17. Changes in solubility (nitrogen solubility index: NSI) of round scad protein hydrolysate during storage at 25°C and 4°C for 6 weeks	73