

REFERENCES

- Department of fisheries. 2002. Office of Agricultural Economics. Retrieved January 3, 2006, from Office of Agricultural Economics Web site: <http://www.oae.go.th/statistic/yearbook/2002/>
- AOAC. 2000. Official Methods of Analysis, 17th ed. Association of Official Chemists. Gaithersberg, Maryland.
- Adler-Nissen, J. 1976. Determination of the degree of hydrolysis of food protein hydrolysates by trinitrobenzenesulfonic acid. *J. Agric. Food Chem.* 27: 1256-1262.
- Adler-Nissen, J and Olsen, H.S. 1979. The influence of peptide chain length on taste and functional properties of enzymatically modified soy protein. In *Functionality and protein structure*. (Pour-El, A., ed.). American Chemical Society Symposium Series 92. Washington, DC.
- Adler-Nissen, J. 1986. Enzymic hydrolysis of food proteins. Elsevier Applied Science Publishers. Barking. UK.
- Akoh, C.C. and Min, D.B. 1998. *Food lipids: Chemistry, Nutrition and Biotechnology*. Marcel Dekker. USA.
- Amarowicz, R. and Shahidi, F. 1997. Antioxidant activity of peptide fractions of capelin protein hydrolysates. *Food Chem.* 58: 355-359.
- Aruoma, M.J., Laughton, J. and Halliwell, B. 1989. Carnosine, homocarnosine and anserine: could they act as antioxidants in vivo. *Biochem. J.* 268: 863-869.
- Aspmo, S.I., Horn, S.J. and Eijsink, V.G.H. 2005. Enzymatic hydrolysis of Atlantic cod (*Gadus morhua* L.) viscera. *Process Biochem.* 40: 1957-1966.
- Attwood, D. and Florence, A.T. 1983. *Surfactant system: their chemistry, pharmacy and biology*. Chapman & Hall. London, UK.
- Baek, H.H. and Cadwallader, K.R. 1995. Enzymatic hydrolysis of crayfish processing by-products. *J. Food Sci.* 60: 929-935.
- Benjakul, S. and Morrissey, M. 1997. Protein hydrolysates from Pacific whiting solid wastes. *J. Agric. Food Chem.* 45: 3423-3430.

- Baek, H.H. and Cadwallader, K.R. 1995. Enzymatic hydrolysis of crayfish processing by-products. *J. Food Sci.* 60: 929-935.
- Benjakul, S. and Morrissey, M. 1997. Protein hydrolysates from Pacific whiting solid wastes. *J. Agric. Food Chem.* 45: 3423-3430.
- Bishov, S.J. and Henick, A.S. 1975. Antioxidant effect of protein hydrolyzates in freeze-dried model systems. Synergistic action with a series of phenolic antioxidants. *J. Food Sci.* 40: 345-348.
- Blendford, D.E. 1994. Protein hydrolysate: functionalities and uses in nutritional products. *Int. Food Ingr.* 3: 45-49.
- Bligh, E.G. and Dyer, W.J. 1959. A rapid method of total lipid extraction and purification. *Can. J. Biochem. Physiol.* 37: 911-931.
- Bombara, N., Pilosof, A.M.R., and Añón, M.C. 1994. Mathematical model to describe the rate of formation and collapse of foams from enzyme modified wheat flours. *J. Food Sci.* 59: 626-628, 681.
- Bordenave, S., Fruitier, I., Ballandier, I., Sannier, F., Gildberg, A., Batista I. and Piot, J.M. 2002. HPLC preparation of fish waste hydrolysate fractions. Effect on guinea pig ileum and ACE activity. *Prep. Biochem. Biotechnol.* 32: 65-77.
- Boyer, R.F. and McCleary, C.J. 1987. Superoxide ion as a primary reductant in ascorbate-mediated ferritin iron release. *Free Rad. Biol. Med.* 3: 389-395.
- Brand-Williams, W., Cuvelier, M.E. and Barset, C. 1995. Use of a free radical method to evaluate antioxidant activity. *Lebensm-Wissu-Technol.* 28: 25-30.
- Buinov, A.A., Ginzburg, A.S. and Syroedov, V.I. 1977. Hygroscopic properties of fish protein hydrolysates, dried as a foam. *Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Technologiya.* 3: 110-113.
- Burton, G.W. and Ingold, K.U. 1986. Vitamin E: Application of the principles of physical organic chemistry to the exploration of its structure and function. *Acc. Chem. Res.* 19: 194-201.
- Caessens, P.W.J.R., Gruppen, H., Slangen, C.J., Visser, S. and Voragen, A.G.J. 1999. Functionality of beta-casein peptides: importance of amphipathicity for emulsion-stabilizing properties. *J. Agric. Food Chem.* 47: 1856-1862.

- Calligaris, S. and Nicoli, M.C. 2005. Effect of selected ions from lyotropic series on lipid oxidation rate. *Food Chem.* 94: 130-134.
- Castell, C.H., Maclean, J. and Moore, B. 1965. Rancidity in lean fish muscle. IV. Effect of sodium chloride and other salts. *J. Fish. Res. Bd. Can.* 22: 929-944.
- Cervato, G., Cazzola, R., & Cestaro, B. (1999). Studies on the antioxidant activity of milk caseins. *Int. J. Food Sci. Nutr.* 50: 291–296.
- Chan, W.K.M. and Decker, E.A. (1994) Endogenous skeletal muscle antioxidants. *Crit. Rev. Food Sci. Nutr.* 34: 403-426.
- Cheftel, J.C., Cuq, J.L. and Lorient, D. 1985. Amino acids; peptides, and proteins. In *Food chemistry*. (Fennema, O.R., ed.). p. 245–370. Marcel Dekker. New York.
- Chen, H.M., Muramoto, K. and Yamauchi, F. 1995. Structural analysis of antioxidative peptides from soybean β -conglycinin. *J. Agric. Food Chem.* 43: 574-578.
- Chen, H.M., Muramoto, K., Yamauchi, F. and Nokihara, K. 1996. Antioxidant activity of designed peptides based on the antioxidative peptide isolated from digests of a soybean protein. *J. Agric. Food Chem.* 44: 2619–2623.
- Chen, H.M., Muramoto, K., Yamauchi, F., Fujimoto, K. and Nokihara, K. 1998. Antioxidative properties of histidine-containing peptides designed from peptide fragments found in the digests of a soybean protein. *J. Agric. Food Chem.* 46: 49–53.
- Chiang, W.D., Shih, C.J. and Chu, Y.H. 1999. Functional properties of soy protein hydrolysate produced from a continuous membrane reactor system. *Food Chem.* 65: 189-194.
- Chobert, J. M., Bertrand-Harb, C. and Nicolas, M.G. 1988. Solubility and emulsifying properties of caseins and whey proteins modified enzymatically by trypsin. *J. Agric. Food Chem.* 36: 883-886.
- Chobert, J.M., Briand, L., Guéguen, J., Popineau, Y., Larré, C., and Haertlé, T. 1996. Recent advances in enzymatic modifications of food proteins for improving their functional properties. *Nahrung.* 40: 177-182.
- Choi, C.W., Kim, S.C., Hwang, S.S., Choi, B.K., Ahn, H.J., Lee, M.Y., Park, S.H. and Kim, S.K. 2002. Antioxidant activity and free radical scavenging capacity between Korean medicinal plants and flavonoids by assay guided comparison. *Plant Sci.* 163: 1161-1168.

- Conforti, F., Statti, G.A., Tundis, R., Menichini, F. and Houghton, P. 2002. Antioxidant activity of methanolic extract of *Hypericum triquertifolium* Turra aerial part. *Fitoterapia*. 73: 479-483.
- Cohen, S.A. and Michaud, D.P. 1993. Synthesis of a fluorescent derivatizing reagent, 6-aminoquinolyl-N-hydroxysuccinimidyl carbamate, and its application for the analysis of hydrolysate amino acids via high-performance liquid chromatography. *Anal. Biochem.* 211: 279-287.
- Damodaran, S. 1996. Amino acids, peptides and proteins. In *Food chemistry*. (Fennema, O.R., ed.). Marcel Dekker. New York.
- Daukšas, E., Šližyte, R., Rustard, T. and Storrøl, I. 2004. Bitterness in fish protein hydrolysates and methods for removal. *J. Aquat. Food Prod. Technol.* 13: 101-114.
- Decker, A.E. 1998. Antioxidant mechanism. In *Food lipid: chemistry, nutrition, and biotechnology*. (Akoh, C.C and Min, D.B., eds.). p. 397-448. Marcel Decker. New York.
- Decker, E.A. and Crum, A.D. 1993. Antioxidant activity of carnosine in cooked ground pork. *Meat Sci.* 34: 245-253.
- Demetriades, K. Coupland, J.N. and McClements, D.J. 1997. Physical properties of whey protein stabilized emulsions as related to pH and NaCl. *J. Food Sci.* 62: 342-347.
- Dickinson, E. and Lorient, D. 1994. Emulsions. In *Food Macromolecules and Colloids*. (Dickinson, E. and Lorient, D., eds.). p. 201-274. The Royal Society of Chemistry. Cambridge, UK.
- Diniz, F.M. and Martin, A.M. 1996. Use of response surface methodology to describe the combined effects of pH, temperature and E:S ratio on the hydrolysis of dogfish (*Squalus acanthias*) muscle. *Int. J. Food Sci. Technol.* 31: 419-426.
- Duh, P. D. 1998. Antioxidant activity of burdock (*Arctium lappa linne'*): its scavenging effect on free radical and active oxygen. *J. Am. Oil Chem. Soc.* 75: 455-461.
- Dziezak, J.D. 1986. Antioxidants: The ultimate answer to oxidation. *Food Technol.* 40: 94-102.
- Egorov, S.Y., Kurella, E.G., Boldrynev, A.A. and Kasnovski, A.A. 1992. The quenching of singlet molecular oxygen by carnosine and anserine in aqueous solution. *Bioorg. Khim.* 18: 142-144.
- FAO. 1971. Protein Advisory Group. 12. Bulletin.

- Fennema, O.R. 1996. Water and ice. In Food chemistry. (Fennema, R., ed.). p. 17–94. Marcel Dekker. New York
- Fomuso, L.B., Corredig, M. and Akoh, C.C. 2002. Effect of emulsifier on oxidation properties of fish oil-based structured lipid emulsions. *J. Agric. Food Chem.* 50: 2957-2961.
- Frankel, E.N. 1991. Recent advances in lipid oxidation. *J. Sci. Food Agric.* 54: 495–511.
- Frankel, E.N., Huang, S.W. and Aeschbach, R. 1997. Antioxidant activity of green tea in different lipid systems. *J. Am. Oil Chem. Soc.* 74: 1309-1315.
- Frankel, E.N. 1998. Lipid oxidation. Dundee. The Oily Press. UK.
- Fukumoto, L.R. and Mazza, G. 2000. Assessing antioxidant and prooxidant activities of phenolic compounds. *J. Agric. Food Chem.* 48: 3597-3604.
- Gauthier, S.F., Paquin, P., Pouliot, Y. and Turgeon, S. 1993. Surface activity and related functional properties of peptides obtained from whey proteins. *J. Dairy Sci.* 76: 321-328.
- Gauthier, S. F. and Pouliot, Y. 2003. Functional and biological properties of peptides obtained by enzymatic hydrolysis of whey proteins. *J. Dairy Sci.* 86: E78-E87.
- Gbogouri, G.A., Linder, M., Fanni, J. and Parmentier, M. 2004. Influence of hydrolysis degree on the functional properties of salmon byproducts hydrolysates. *J. Food Sci.* 69: 615-619.
- Giese, J. 1996. Antioxidants : Tools for preventing lipid oxidation. *Food Technol.* 50 (11): 73-81.
- Gildberg, A., Batista, I. and Strøm, E. 1989. Preparation and characterization of peptones obtained by a two-step enzymatic hydrolysis of whole fish. *Biotechnol. Appl. Biochem.* 11: 413–423.
- Gocan, S. and Cimpan, G. 2004. Review of the analysis of medicinal plants by TLC: modern approaches. *J. Liq. Chromatogr. Relat. Technol.* 27: 1377-1411.
- Gonzalez-Tello, P., Camacho, F., Jurado, E., Paez, M.P. and Guadix, E.M. 1994. Enzymatic hydrolysis of whey proteins. II. Molecular-weight range. *Biotechnol. Bioeng.* 44: 529-532.
- Gordon, M.H. 2001. The development of oxidative rancidity in foods. In Antioxidants in food: practical applications. (Pokorny, J. *et al.*, eds.). p.7-21. Woodhead Publishing. USA.
- Guerard, F., Dufosse, L., De La Broise, D. and Binet, A. 2001. Enzymatic hydrolysis of proteins from yellowfin tuna (*Thunnus albacares*) wastes using alcalase. *J. Mol. Cat.* 11: 1051-1059.

- Hale, M.B. 1972. Making fish protein concentrate by enzymatic hydrolysis. NOAA technical report NMFS SSRF-675. p.1-31. Department of commerce. Seattle, USA.
- Halliwell, B. and Gutteridge, J.M.C. 1984. Oxygen toxicity, oxygen radicals, transition metals and disease. *Biochem. J.* 219: 1-14.
- Haque, Z.U. 1993. Influence of milk peptides in determining the functionality of milk proteins: a review. *J. Dairy Sci.* 76: 311-320.
- Hatake, H., Nagata, Y., and Kochi, M. 1990. Antioxidative effect of bovine serum albumin hydrolysates and their synergistic effect with antioxidants. *Yukagaku.* 39: 42–46.
- Hrčková, M., Rusňáková, M. and Zemanovič, J. 2002. Enzymatic hydrolysis of defatted soy flour by three different proteases and their effect on the functional properties of resulting protein hydrolysates. *Czech J. Food Sci.* 20: 7–14.
- Heo, S.J., Park, E.J., Lee, K.W. and Jeon, Y.J. 2005. Antioxidant activities of enzymatic extracts from brown seaweeds. *Biores. Technol.* 96: 1613-1623.
- Hoyle, N.T. and Merritt, J.H. 1994. Quality of fish protein hydrolysate from herring (*Clupea harengus*). *J. Food Sci.* 59: 76-80.
- Hsieh, R.J. and Kinsella, J.E. 1989. Lipoxygenase generates specific volatile carbonyl compounds in fish tissues. *J. Agric. Food Chem.* 37: 279-286.
- Hu, M., McClements, D.J. and Decker, E.A. 2004. Impact of chelators on the oxidative stability of whey protein isolate-stabilized oil-in-water emulsions containing ω-3 fatty acids. *Food Chem.* 88: 57-62.
- Imm, J.Y. and Lee, C.M. 1999. Production of seafood flavor from red hake (*Urophycis chuss*) by enzymatic hydrolysis. *J. Agric. Food Chem.* 47: 2360–2366.
- Jadhav, S.J., Nimbalker, S.S., Kulkami, A.D. and Madhavi, D.L. 1996. Lipid oxidation in biological and food systems. In *Food antioxidants.* (Madhavi, D.L. et al., eds.). p. 5-64. Marcel Dekker. New York.
- Jakobsen, M. and Bertelsen, G. 2000. Colour stability and lipid oxidation of fresh beef. Development of a response surface model for predicting the effects of temperature, storage time and modified atmosphere composition. *Meat Sci.* 54: 49-57.
- Jao, C.L. and Ko, W.C. 2002. 1,1-Diphenyl-2-picrylhydrazyl (DPPH) radical scavenging by protein hydrolysates from tuna cooking juice. *Fish. Sci.* 68: 430-435.

- Je, J.Y., Park, P.J. and Kim, S.K. 2005. Antioxidant activity of a peptide isolated from Alaska pollack (*Theragra chalcogramma*) frame protein hydrolysate. *Food Res. Intern.* 38: 45-50.
- Jeon, Y.J., Byun, H.G. and Kim, S.K. 1999. Improvement of functional properties of cod frame protein hydrolysates using ultrafiltration membranes. *Process Biochem.* 35: 471-478.
- Josephson, D.B., Lindsay, R.C. and Stuiber, D.A. 1987. Enzymic hydroperoxide initiated effects in fresh fish. *J. Food Sci.* 52: 569-600.
- Jun, S.Y., Park, P.J., Jung, W.K. and Kim, S.K. 2004. Purification and characterization of an antioxidative peptide from enzymatic hydrolysate of yellowfin sole (*Limanda aspera*) frame protein. *Eur. Food Res. Technol.* 219: 20-26.
- Juntachote, T. and Berghofer, E. 2005. Antioxidative properties and stability of ethanolic extracts of Holy basil and Galangal. *Food Chem.* 92: 193–202.
- Kansci, G., Genot, C., Meynier, A., Gaucheron, F. and Chobert, J.M. 2004. β -Caseinophosphopeptide f1-25 confers on β -casein tryptic hydrolysate an antioxidant activity during iron/ascorbate-induced oxidation of liposomes. *Le Lait.* 84: 449-462.
- Kim, S.K., Kim, Y.T., Byun, H.G., Nam, K.S., Joo, D.S. and Shahidi, F. 2001. Isolation and characterization of antioxidative peptides from gelatin hydrolysate of Alaska pollack skin. *J. Agric. Food Chem.* 49: 1984–1989.
- Kim, S.Y., Je, J.Y. and Kim, S.K. 2006. Purification and characterization of antioxidant peptide from hoki (*Johnius belengerii*) frame protein by gastrointestinal digestion. *J. Nutr. Biochem.* In press.
- Kinsella, J.E. 1976. Functional properties of proteins in food: a survey. *Crit. Rev. Food Sci. Nutr.* 8: 219–280.
- Kinsella, J.E. 1981. Functional properties of proteins: possible relationships between structure and function in foams. *Food Chem.* 7: 273-288.
- Kohen, R., Yamamoto, Y., Cundy, K.C. and Ames, B.N. 1988. Antioxidant activity of carnosine, homocarnosine, and anserine present in mussel and brain. *Proc. Natl. Acad. Sci. USA.* 85: 3175–3179.
- Kristinsson, H.G. and Rasco, B.A. 2000a. Fish protein hydrolysates: production, biochemical and functional properties. *Crit. Rev. Food Sci. Nutr.* 40: 43-81.

- Kristinsson, H.G. and Rasco, B.A. 2000b. Biochemical and functional properties of Atlantic salmon (*Salmo salar*) muscle proteins hydrolyzed with various alkaline proteases. *J. Agric. Food Chem.* 48: 657–666.
- Kristinsson, H.G. and Rasco, B.A. 2000c. Kinetics of the hydrolysis of Atlantic salmon (*Salmo salar*) muscle proteins by alkaline proteases and a visceral serine protease mixture. *Process Biochem.* 36: 131-139.
- Lahl, W.J. and Braun, S.D. 1994. Enzymatic production of protein hydrolysates for food use. *Food Technol.* 48(10): 68-71.
- Lalasidis, G., Bostrom, S. and Sjoberg, L.B. 1978. Low molecular weight enzymatic fish protein hydrolysates: chemical composition and nutritive value. *J. Agric. Food Chem.* 26: 751–756.
- Lawal, O.S. 2004. Functionality of African locust bean (*Parkia biglobossa*) protein isolate: effects of pH, ionic strength and various protein concentrations. *Food Chem.* 86: 345–355.
- Lee, S.W., Shimizu, M., Kaminogawa, S. and Yamauchi, K. 1987. Emulsifying properties of peptides obtained from the hydrolysates of β -casein. *Agric. Bio. Chem.* 51:1661–1666.
- Lee, B.J. and Hendricks, D.G. 1997. Antioxidant effects of L-carnosine on liposomes and beef homogenates. *J. Food Sci.* 62: 931-935.
- Leffler, A. 1986. Proteolytic enzymes: sources and applications. *Food Technol.* 40(1): 63-69.
- Liaset, B., Lied, E. and Espe, M. 2000. Enzymatic hydrolysis of by-products from the fish-filleting industry; chemical characterisation and nutritional evaluation. *J. Sci. Food Agric.* 80: 581-589.
- Liaset, B., Nortvedt, R., Lied, E. and Espe, M. 2002. Studies on the nitrogen recovery in enzymic hydrolysis of Atlantic salmon (*Salmo salar* L.) frames by Protamex (TM) protease. *Process Biochem.* 37: 1263–1269.
- Liceaga-Gesualdo, A.M. and Li-Chan, E.C.Y. 1999. Functional properties of fish protein hydrolysates from herring (*Clupea harengus*). *J. Food Sci.* 64: 1000–1004.
- Linder, M., Fanni, J., Parmentier, M., Sergent, M. and Phan-Than-Luu, R. 1995. Protein recovery from veal bones by enzymatic hydrolysis. *J. Food Sci.* 60: 949-952.

- Lu, C.L. and Baker, R.C. 1986. Characteristic of egg yolk phosvitin as an antioxidant for inhibiting metal-catalyzed phospholipids oxidations. *Poultry Sci.* 65: 2065–2070.
- Mackie, J.M. 1982. Fish protein hydrolysates. *Process Biochem.* 17: 26-31.
- Mahmoud, M.I., Malone, W.T. and Cordle, C.T. 1992. Enzymatic hydrolysis of casein: effect of degree of hydrolysis on antigenicity and physical properties. *J. Food Sci.* 57: 1223-1229.
- Mahmoud, M.I. 1994. Physicochemical and functional properties of protein hydrolysates in nutritional products. *Food Technol.* 48(10): 89– 95.
- Marcuse, R. 1962. The effect of some amino acids on oxidation of linoleic acid and its methyl esters. *J. Am. Oil Chem. Soc.* 39: 97–103.
- Martinez, T.S., Morales, A.C., Torres, E.F., Ochoa1, S.H. and Barragan, L.A.P. 2005. Fish protein hydrolysates from gold carp (*Carassius auratus*): I. A study of hydrolysis parameters using response surface methodology. *J. Sci. Food Agric.* 85: 98-104.
- Matthaus, B. 2002. Antioxidant activity of extracts obtained from residues of different oilseeds. *J. Agric. Food Chem.* 50: 3444-3452.
- McCarthy, T.L., Kerry, J.P., Kerry, J.F., Lynch, P.B. and Buckley, D.J. 2001. Evaluation of the antioxidant potential of natural food/plant extracts as compared with synthetic antioxidants and vitamin E in raw and cooked pork patties. *Meat Sci.* 58: 45-52.
- Mei, L., McClements, D.J., Wu, J. and Decker, E.A. 1998. Iron-catalyzed lipid oxidation in emulsion as affected by surfactant, pH and NaCl. *Food Chem.* 61: 307-312.
- Meir, S., Kanner, J., Akiri, B. and Hadas, S.P. 1995. Determination and involvement of aqueous reducing compounds in oxidative defense systems of various senescing leaves. *J. Agric. Food Chem.* 43:1813–1819.
- Mendis, E., Rajapakse, N., Byun, H.G. and Kim, S.K. 2005. Investigation of jumbo squid (*Dosidicus gigas*) skin gelatin peptides for their *in vitro* antioxidant effects. *Life Sci.* 77: 2166–2178.
- Mitsuda, H., Yasumoto, K. and Iwami, K. 1966. Antioxidative action of indole compounds during the autoxidation of linoleic acid. *Eiyo Shokuryou.* 19: 210-214.
- Mohr, V. 1980. Enzyme technology in the meat and fish industries. *Process Biochem.* 15: 18-21, 32.

- Morr, C.V. 1985. Composition, physicochemical and functional properties of reference whey protein concentrates. *J. Food Sci.* 50: 1406-1411.
- Moure, A., Domínguez, H. and Parajó, J.C. 2006. Antioxidant properties of ultrafiltration-recovered soy protein fractions from industrial effluents and their hydrolysates. *Process Biochem.* 41: 447-456.
- Mullally, M.M., O'Callaghan, D.M., FitzGerald, R.J., Donnelly, W.J. and Dalton, J.P. 1995. Zymogen activation in pancreatic endoproteolytic preparations and influence on some whey protein characteristics. *J. Food Sci.* 60: 227-233.
- Murase, H., Nagao, A. and Terao, J. 1993. Antioxidant and emulsifying action of N-long-chain-acylhistidine and N-long-chain-acyl carnosine. *J. Agric. Food Chem.* 41: 1601-1604.
- Mutilangi, W.A.M., Panyam, D. and Kilara, A. 1996. Functional properties of hydrolysates from proteolysis of heat-denatured whey protein isolate. *J. Food Sci.* 61: 270-274, 303.
- Nakayama, T., Osawa, T., Mendosa, E.N.T., Laurena, A.C. and Kawakishi, S. 1994. Comparative study of antioxidative assays of plant materials. In *Postharvest biochemistry of plant food-materials in the tropics*. (Uritani, I. et al., eds.). p. 241-251. Japan Scientific Societies Press. Japan.
- Namiki, M. 1990. Antioxidant/antimutagens in food. *Crit. Rev. Food Sci. Nutr.* 29: 273-300.
- Nawar, W.W. 1996. Lipids. In *Food Chemistry*. (Fennema, O.R., ed). p. 225-319. Marcel Dekker. New York.
- Nawar, W.W. 1998. Biochemical process: lipid instability. In *Food Storage Stability*. (Taub, I.A. and Singh, R.P., eds.). p. 89-103. CRC Press. New York.
- Nielsen, P.M. 1997. Functionality of protein hydrolysates. In *Food proteins and their applications*. (Damodaran S. and Paraf A., eds.). Marcel Dekker. New York.
- Niki, E. 1987. Antioxidants in relation to lipid peroxidation. *Chem. Phys. Lipids.* 44: 227-253.
- Nilsang, S., Lertsiri, S., Suphantharika, M. and Assavanig, A. 2004. Optimization of enzymatic hydrolysis of fish soluble concentrate by commercial proteases. *J. Food Eng.* 70: 571-578.
- Normah, I., Jamilah, B., Saari, N. and Man, Y.B.C. 2004. Chemical and taste characteristics of threadfin bream (*Nemipterus japonicus*) hydrolysate. *J. Sci. Food Agric.* 84: 1290-1298.

- O'Brien, P.J. 1969. Intracellular mechanisms for the decomposition of a lipid peroxide. I. Decomposition of a lipid peroxide by metal ions, heme compounds, and nucleophiles. *Can. J. Biochem.* 47: 485-492.
- Onodenalore, A.C. and Shahidi, F. 1996. Protein dispersions and hydrolysates from shark (*Isurus oxyrinchus*). *J. Aquat. Food Prod. Technol.* 5(4): 43-59.
- Osawa, T. 1994. Novel natural antioxidants for utilization in food and biological system. In Postharvest biochemical of plant food-material in the tropics. (Uritani, I. et al., eds.). p. 241-251. Japan Scientific Societies Press. Japan.
- Osborn, H.T. and Akoh, C.C. 2004. Effect of emulsifier type, droplet size and oil concentration on lipid oxidation in structured lipid-based oil-in-water emulsion. *Food Chem.* 84: 451-456.
- Pearce, K.N. and Kinsella, J.E. 1978. Emulsifying properties of proteins: evaluation of a turbidimetric technique. *J. Agric. Food Chem.* 26: 716-723.
- Peña-Ramos and Xiong, Y.L. 2002. Antioxidant activity of soy protein hydrolysates in a liposomal system. *J. Food Sci.* 67: 2952-2956.
- Peterson, J. 1978. Encyclopedia of Food Science. The Avi publishing company, Inc. Westport. Connecticut.
- Peterson, B.R. 1981. The impact of the enzymatic hydrolysis process on recovery and use of proteins. In Enzymes and food processing. (Birch, G.G. et al., eds). p. 269-299. Elsevier Applied Science Publishers. London, UK.
- Phillips, L.G., Whitehead, D.M. and Kinsella, J. 1994. Structure-function properties of food proteins. Academic Press. San Diego, Calif., USA.
- Picot, L., Bordenave, S., Didelot, S., Fruitier-Arnaudin, I., Sannier, F., Thorkelsson, G., Bergé, J.P., Guérard, F., Chabeaud, A., Piot, J.M. 2006. Antiproliferative activity of fish protein hydrolysates on human breast cancer cell lines. *Process Biochem.* 41: 1217-1222.
- Poirier, B., Michel, O., Bazin, R., Bariety, J., Chevalier, J., Myara, I. and Gaston, A.T. 2001. Conjugated dienes: a critical trait of lipoprotein oxidizability in renal fibrosis. *Nephrol. Dial. Transpl.* 16: 1598-1606.
- Pour-El, A. 1981. Protein functionality: classification, definition, and methodology. *Protein Funct. Foods.* 147: 1-19.

- Pratt, D.E. and Hudson, B.J.F. 1990. Natural antioxidants not exploited commercially. In *Food Antioxidants*. (Hudson, B.J.F., ed.). Elsevier Applied Science. London and New York.
- Qi, M., Hettiarachchy, N.S., and Kalapathy, U. 1997. Solubility and emulsifying properties of soy protein isolates modified by pancreatin. *J. Food Sci.* 62: 1110-1115.
- Quaglia, G.B. and Orban, E. 1987. Enzymic solubilisation of proteins of sardine (*Sardina pilchardus*) by commercial proteases. *J. Sci. Food Agric.* 38: 263-269.
- Quaglia, G.B. and Orban, E. 1990. Influence of enzymatic hydrolysis on structure and emulsifying properties of sardine (*Sardina pilchardus*) protein hydrolysates. *J. Food Sci.* 55: 1571-1619.
- Rahali, V. and Guéguen, J. 2000. Foaming characteristics of chemical and enzymatic hydrolysates of bovine β -lactoglobulin. *Nahrung*. 44: 309-317.
- Rahali, V., Chobert, J.M., Haertle, T., and Gueguen, J. 2000. Emulsification of chemical and enzymatic hydrolysates of β -lactoglobulin: characterization of the peptides adsorbed at the interface. *Nahrung*. 44: 89-95.
- Rajapakse, N., Mendis, E., Jung, W.K., Je, J.Y. and Kim, S.K. 2005. Purification of a radical scavenging peptide from fermented mussel sauce and its antioxidant properties. *Food Res. Intern.* 38: 175–182.
- Rajalakshmi, D. and Narasimhan, S. 1996. Food antioxidants: sources and method of evaluation. In *Food antioxidants*. (Madhavi, D.L. et al., eds.). p. 65-158. Marcel Dekker. New York.
- Ravallec-Plé, R., Charlot, C., Pires, C., Braga, V., Batista, I., Wormhoudt, A.V., Gal, Y.L. and Fouchereau-Péron, M. 2001. The presence of bioactive peptides in hydrolysates prepared from processing waste of sardine (*Sardina pilchardus*). *J. Sci. Food Agric.* 81: 1120–1125.
- Rebeca, B.D., Penavera, M.T. and Diazcastaneda, M. 1991. Production of fish protein hydrolysates with bacterial proteases yield and nutritional value. *J. Food Sci.* 56: 309–314.
- Riisom, T., Sims, R.J. and Fiorti, J.A. 1980. Effect of amino acids on the autoxidation of safflower oil in emulsions. *J. Am. Oil Chem. Soc.* 57: 351–359.
- Ritchie, A.H. and Mackie, I.M. 1982. Preparation of fish protein hydrolysates. *Anim. Feed Sci. Technol.* 7: 125-133.

- Saiga, A.I., Tanabe, S. and Nishimura, T. 2003. Antioxidant activity of peptides obtained from porcine myofibrillar proteins by protease treatment. *J. Agric. Food Chem.* 51: 3661-3667.
- Saito, K., Jin, D.H., Ogawa, T., Muramoto, K., Hatakeyama, E., Yasuhara, T. and Nokihara, K. 2003. Antioxidative properties of tripeptide libraries prepared by the combinatorial chemistry. *J. Agric. Food Chem.* 51: 3668-3674.
- Sakanaka, S., Tachibana, Y., Ishihara, N. and Juneja, L.R. 2004. Antioxidant activity of egg-yolk protein hydrolysates in a linoleic acid oxidation system. *Food Chem.* 86: 99–103.
- Salas, J.J., Williams, M., Harwood, J.L. and Sánchez. 1999. Lipoxygenase activity in olive (*Olea europaea*) fruit. *J. Am. Oil Chem. Soc.* 76: 1163-1168.
- Sánchez-Vioque, R., Bagger, C.L., Rabiller, C., and Guéguen, J. 2001. Foaming properties of acylated rapeseed (*Brassica napus* L.) hydrolysates. *J. Colloid Interface Sci.* 244: 386–393.
- Sánchez, C.C., Patino J.M.R. 2005. Interfacial, foaming and emulsifying characteristics of sodium caseinate as influenced by protein concentration in solution. *Food Hydrocoll.* 19: 407-416.
- Sathivel, S., Bechtel, P., Babbitt, J., Smiley, S., Crapro, C., Repond, K. and Prinyawiwatkul, W. 2003. Biochemical and functional properties of herring (*Clupea harengus*) byproduct hydrolysates. *J. Food Sci.* 68: 2196-2200.
- Shahidi, F. and Wanasundara, P.K.J.P.D. 1992. Phenolic antioxidants. *Crit. Rev. Food Sci. Nutr.* 32: 67-103.
- Shahidi, F. 1994a. Assesment of lipid oxidation and off-flavour development in meat and meat products. In *Flavor of Meat and Meat Products*. (Shahidi, F. ed.). p. 247-266. Blackie Academic and Professional. London.
- Shahidi F. 1994b. Proteins from seafood processing discards, Chapter 12. In *Seafood proteins*. (Sikoreski, Z.E. et al., ed.). Chapman & Hall. New York, London.
- Shahidi, F., Xiao-Qing, H. and Synowiecki, J. 1995. Production and characteristics of protein hydrolysates from capelin (*Mallotus villosus*). *Food Chem.* 53: 285-293.
- Shimada, K., Fujikawa, K., Yahara, K., and Nakamura, T. 1992. Antioxidative properties of xanthan on the antioxidation of soy bean oil in cyclodextrin emulsion. *J. Agric. Food Chem.* 40: 945-948.

- Sikorski, Z.E., and Naczk, M. 1981. Modification of technological properties of fish protein concentrate. Crit. Rev. Food Sci. Nutr. 14: 201-230.
- Silva, A.S., Hernandez, J.L. and Losada, P.P. 2004. Modified atmosphere packaging and temperature effect on potato crisps oxidation during storage. Anal. Chem Acta. 524: 185-189.
- Slabyi, B.M. and Hultin, H.O. 1982. Lipid peroxidation by microsomal fractions isolated from light and dark muscles of herring (*Clupea harengus*). J. Food Sci. 47: 1395-1425.
- Šližyte, R., Daukšas, E., Falch, E., Storrøl, I. and Rustad, T. 2005a. Yield and composition of different fractions obtained after enzymatic hydrolysis of cod (*Gadus morhua*) by-products. Process Biochem. 40: 1415-1424.
- Šližyte, R., Daukšas, E., Falch, E., Storrøl, I. and Rustad, T. 2005b. Characteristics of protein fractions generated from hydrolysed cod (*Gadus morhua*) by-products. Process Biochem. 40: 2021-2033.
- Spinelli, J., Koury, B. and Miller, R. 1972. Approaches to the utilization of fish for the preparation of protein isolates; Isolation and properties of myofibrillar and sarcoplasmic fish proteins. J. Food Sci. 37: 599-603.
- St. Angelo, A.J. 1996. Lipid oxidation in foods. CRC Crit. Rev. Food Sci. Nutr. 36: 175-224.
- Stahnke, L.H. 1994. Aroma components from dry fermented sausages fermented with *Staphylococcus xylosus*. Meat Sci. 38: 39-53.
- Stahnke, L.H. 1995. Dried sausages fermented with *Staphylococcus xylosus* at different temperatures and different ingredient levels-part II volatile components. Meat Sci. 41: 193-209.
- Stohs, S.J. and Bagchi, D. 1995. Oxidative mechanisms in the toxicity of metal ions. Free Rad. Biol. Med. 18: 321-336.
- Suetsuna, K., Ukeda, H., and Ochi, H. 2000. Isolation and characterization of free radical scavenging activities peptides derived from casein. J. Nutr. Biochem. 11: 128-131.
- Tanaka, M., Chiu, W.K., Nagashima, Y. and Taguchi, T. 1992. Inhibitory effect of the Maillard reaction products towards lipid oxidation. J. Tokyo Univ. Fish. 79: 135-141.
- Taylor, M.J. and Richardson, T. 1980. Antioxidant activity of cysteine and protein sulphhydryls in a linoleate emulsion oxidized by hemoglobin. J. Food Sci. 45:1223-1227, 1230.

- Thanonkaew, A., Benjakul, S., and Visessanguan, W. 2006. Chemical composition and thermal property of cuttlefish (*Sepia pharaonis*) muscle. *J. Food Comp. Anal.* 19: 127-133.
- Tichivangana, J.Z. and Morrissey, P.A. 1985. Metmyoglobin and inorganic metals as prooxidants in raw and cooked muscle systems. *Meat Sci.* 15: 107-116.
- Turgeon, S.L., Gauthier, S.F. and Paquin, P. 1991. Interfacial and emulsifying properties of whey peptides fraction obtained with a two step ultrafiltration process. *J. Agric. Food Chem.* 39: 637-676.
- Turgeon, S.L., Gauthier, S.F., Molle, D. and Leonil, J. 1992. Interfacial properties of tryptic peptides of β -lactoglobulin. *J. Agric. Food Chem.* 40: 669-675.
- Uchida, K. and Kawakishi, S. 1992. Sequence-dependant reactivity of histidine-containing peptides with copper (II)/ascorbate. *J. Agric. Food Chem.* 40: 13-16.
- Venugopal, V. and Shahidi, F. 1994 Thermostable water dispersions of myofibrillar proteins from Atlantic mackerel (*Scomber scombrus*). *J. Food Sci.* 59: 265-268.
- Viera, G.H.F., Martin, A.M., Saker-Sampaiao, S., Omar, S. and Goncalves, R.C.F. 1995. Studies on the enzymatic hydrolysis of Brazilian lobster (*Panulirus* spp.) processing wastes. *J. Sci. Food Agric.* 69: 61-65.
- Wang, L.L. and Xiong, Y.L. 2005. Inhibition of lipid oxidation in cooked beef patties by hydrolyzed potato protein is related to its reducing and radical scavenging ability. *J. Agric. Food Chem.* 53: 9186-9192.
- Webster, J.D., Ledward, D.A. and Lawrie, R.A. 1982. Protein hydrolysates from meat industry by-products. *Meat Sci.* 7: 147-157.
- Wergedahl, H., Liaset, B., Gudbrandsen, O.A., Lied, E., Espe, M., Muna, Z., Mork, S. and Berge, R.K., 2004. Fish protein hydrolyzate reduces plasma total cholesterol, increases the proportion of HDL cholesterol and lowers acyl-CoA: cholesterol acyltransferase activity in liver of Zucker rats. *J. Nutr.* 134: 1320-1327.
- Wijewickreme, A.N., Kitts, D.D. and Durance, T.D. 1997. Reaction conditions influence the elementary composition and metal chelating affinity of nondialyzable model Maillard reaction products. *J. Agric. Food Chem.* 45: 4577-4583.

- Wilde, P.J. and Clark, D.C. 1996. Foam formation and stability. In methods for testing protein functionality. (Hall, G.M., ed.). p. 110-148. Blackie Academic and Professional. London, UK.
- Wilding, P., Lilliford, P.J. and Regenstein, J.M. 1984. Functional properties of proteins in foods. *J. Chem. Technol. Biotechnol.* 34B: 182–189.
- Wu, H.C., Chen, H.M. and Shiao, C.Y. 2003. Free amino acids and peptides as related to antioxidant properties in protein hydrolysates of mackerel (*Scomber austriasicus*). *Food Res. Int.* 36: 949–957.
- Yamauchi, R., Tatsumi, Y., Asano, M., Kato, K. and Ueno, Y. 1988. Effect of metal salts and fructose on the autoxidation of methyl linoleate in emulsions. *Agric. Biol. Chem.* 52: 849-850.
- Yamaguchi, N., Yokoo, Y. and Fujimaki, M. 1975. Studies on antioxidative activities of amino compounds on fats and oils. Part II. Antioxidative activities of dipeptides and their synergistic effects of tocopherol. *Nippon Shokuhin Kogyo Gakkaishi*. 22: 425-430.
- Yamaguchi, T., Takamura, H., Matoba, T., Terao, J. 1998. HPLC method for evaluation of the free radical-scavenging activity of foods by using 1,1-diphenyl-2-picrylhydrazyl. *Biosci. Biotechnol. Biochem.* 62: 1201-1204.
- Yáñez, E., Ballester, D. and Monckeberg, F. 1976. Enzymatic fish protein hydrolyzate: chemical composition, nutritive value and use as a supplement to cereal protein. *J. Food Sci.* 41: 1289-1292.
- Yanishlieva-Maslarova, N.V. 2001. Inhibiting oxidation. In *Antioxidants in food: practical applications*. (Pokorny, J. *et al.*, eds.). p. 22-84. Woodhead Publishing. USA.
- Yen, G.C. and Chen, H.Y. 1995. Antioxidative activity of various tea extracts in relation to their antimutagenicity. *J. Agric. Food Chem.* 43: 27-32.
- Yen, G. and Hsieh, P. 1995. Antioxidative activity and scavenging effects on active oxygen of xylose-lysine Maillard reaction products. *J. Sci. Food Agric.* 67: 415-420.
- Yen, G.C., Chang, Y.C., and Chen, J.P. (2002). Antioxidant activity of mycelia from *Aspergillus candidus*. *J. Food Sci.* 67: 567–572.
- Yi, O.S., Meyer, A.S. and Frankel, E.N. 1997. Antioxidant activity of grape extracts in a lecithin liposome system. *J. Am Oil. Chem. Soc.* 74: 1301-1307.

- Yoshimura, Y., Iijima, T., Watanabe, T. and Nakazawa, H. 1997. Antioxidative effect of Maillard reaction products using glucose-glycine model system. *J. Agric. Food Chem.* 45: 4106-4109.
- Zayas, J.F. 1997. Solubility of proteins. In *Functionality of proteins in food*. p. 6–22. Springer-Verlag. Berlin.
- Zhu, K., Zhou, H., and Qian, H. 2006. Antioxidant and free radical-scavenging activities of wheat germ protein hydrolysates (WGPH) prepared with Alcalase. *Process Biochem.* 41: 1296-1302.