



DAFTAR PUSTAKA

- Ackman, R.G. (1989). Nutritional composition of fats in seafoods. *Prog. Food Nutr. Sci.* 13: 161-289.
- Ahmed, Z., Donkor, O., Street, W.A., Vasiljevic, T. (2013). Proteolytic activities in fillets of selected underutilized Australian fish species. *Food Chem.* 140: 238–244.
- Alvarez, C., Couso, I., Tejada, I. (1999). Thermal gel degradation (“modori”) in sardine surimi gels. *J. Food Sci.* 64: 663-637.
- Ando, H., Adachi, M., Umeda, K., Matsuura, A., Nonaka, M., Uchio, R., Tanaka, H., Motoki, M. (1989). Purification and Characteristics of a Novel Transglutaminase Derived from Microorganisms. *Agric. Biol. Chem.* 53: 2613–2617.
- Ando, M., Tsukamasa, Y., Makinodan, Y. (1998). Identification of 170 k component which appears in the setting process of surimi gel. *Fish. Sci.* 64, 497–498.
- An, H., Weerasinghe, V., Seymour, T.A., Morrissey, M.T. (1994). Cathepsin degradation of Pacific whiting surimi proteins. *J. Food Sci.* 59:1013–1017.
- An, H., Peters, M.Y., Seymours, T.A. (1996). Roles of indigenous enzymes on surimi gelation. *Trends in Food Sci. Technol.* 7: 321-327.
- Anonim. (1993). Waters ACCQ Tag Chemistry Package, Manual Number WAT 052874. Waters Millipore Coorporation. USA: Maple street Milford, MA 01757.
- Anonim. (2015). Peraturan Menteri Kelautan dan Perikanan Indonesia No. 17/PERMEN-KP/2015. Kementerian Kelautan dan Perikanan. Available at: http://infohukum.kkp.go.id/index.php/hukum/c/20/?type_id=1&produk_id=7. (14 Januari 2016).
- Anonim. (2017a). Laporan kinerja Kementerian Kelautan dan Perikanan 2016. Kementerian Kelautan dan Perikanan. Jakarta.
- Anonim. (2017b). Analisis industri surimi Indonesia. Kementerian Kelautan dan Perikanan. Available at: <http://kkp.go.id/artikel/1103-analisis-industri-surimi-indonesia> (14 Agustus 2018).



Anonim. (2018a). Statistik Perikanan Budidaya. Ditjen Perikanan Budidaya. Kementerian Kelautan dan Perikanan. Jakarta.

Anonim. (2018b). Frozen minced fish paste (surimi) quality standard. Zhonggang (Fujian) Aquatic Food Co., Ltd. China. Available at: <http://zgseafood.foodmate.com/> (19 Agustus 2018).

Anonim. (2018c). Spesifikasi surimi. PT. Indo Seafood, Indonesia. Available at: <https://www.indosurimi.com/surimi.html> (19 Agustus 2018).

[AOAC] Analysis of the Association of Official Analytical Chemists. (1995). *Official Methods of Analysis of the Association of Official Analytical Chemists*. Edisi ke-16. Washington, D.C.

Apriyantono, A., Fardiaz, D., Puspitasari, N.L., Sedarnawati, Budiyanto, S. (1989). Analisis Pangan. Institut Pertanian Bogor: Pusat Antar Universitas Pangan dan Gizi. pp. 30-32.

Araki, H., Seki, N. (1993). Comparison of reactivity of transglutaminase to various fish actomyosins. *Nippon Suisan Gakkaishi* 59:711-716.

Ashie, I.N.A., Lanier, T.C. (2000). Transglutaminase in seafood processing. In N. F. Haard, & B. K. Simpson (Eds.), *Seafood enzymes: utilization and influence on postharvest seafood quality* (pp. 147–166). New York: Marcel Dekker.

Arfat, Y.A., Benjakul, S. (2012). Gelling characteristics of surimi from yellow stripe trevally (*Selaroides leptolepis*). *Int. Aquatic Res.* 4: 1-13.

Arunde, E., Sinjal , H.J., Monijung, R.D. (2016). Pengaruh penggunaan substrat yang berbeda terhadap daya tetas telur dan sintasan hidup larva ikan lele sangkuriang (*Clarias* sp.). *Budidaya Perairan* 4: 7-15.

Bachtiar, I., Agustini, T.W., Dwi Anggo, A. (2014). Efektifitas pencucian dan suhu setting (25, 40, 50°C) pada gel kamaboko ikan lele dumbo (*clarias gariepenus*). *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan* 3: 45-50.

Belitz, H. D., Grosch, W., Schieberle, P. (2004). Fish, wales, crustaceans, mollusks. In: *Food Chemistry*. Berlin, Heidelberg: Springer, pp. 619–642.

Benjakul, S., Seymour, T.A., Morrissey, M.T., Haejung, A.N. (1996). Proteinase in pacific whiting surimi wash water: identification and characterization. *J. Food Sci.* 61 (6): 1165-1170.

Benjakul, S., Visessanguan, W., Ishizaki, S., Tanaka, M. (2001). Differences in Gelation Characteristics of Natural Actomyosin from Two Species of Bigeye



Snapper, *Priacanthus tayenus* and *Priacanthus macracanthus*. *J. Food Sci.* 66: 1311-1318.

Benjakul, S., Visessanguan, W., Leelapongwattana, K. (2002). Characteristics of muscle from two species of Bigeye snapper, *Priacanthus tayenus* and *Priacanthus macracanthus*. *J. Food Biochem.* 26: 307-326.

Benjakul, S., Chantarasuwan, C., Visessanguan, W. (2003). Effect of medium temperature setting on gelling characteristics of surimi from some tropical fish. *Food Chem.* 82: 567-574.

Benjakul, S., Visessanguan, W. (2003). Transglutaminase-mediated setting in bigeye snapper Surimi. *Food Res. Int.* 36: 253-266.

Benjakul, S., Visessanguan, W., Chantarasuwan, C. (2004). Effect of high-temperature setting on gelling characteristic of surimi from some tropical fish. *Int. J. Food Sci. Technol.* 39(6): 671-680.

Benjakul, S., Visessanguan, W., Thongkaew, C., Tanaka, M. (2005). Effect of frozen storage on chemical and gel-forming properties of fish commonly used for surimi production in Thailand. *Food Hydrocol.* 19: 197-207.

Bertak, J.A., Kahardian, C. (1995). Surimi-based imitation crab characteristic affected by heating method and end point temperature. *J. Food Sci.* 60 (2): 292-296.

Binsi, P.K., Shamasundar, B.A. (2012). Purification and characterisation of transglutaminase from four fish species: Effect of added transglutaminase on the viscoelastic behaviour of fish mince. *Food Chem.* 132: 1922-1929.

Blanco, M., Sotelo, C.G., Chapela, M.J., Pérez-Martín, R.I. (2006). Towards sustainable and efficient use of fishery resources: present and future trends. *Trends Food Sci. Technol.* 18(1):29-36.

Botta, J.R., (1995). *Evaluation of seafood freshness quality*. New York: VCH Publishers. p. 93.

Boyer, C., Joandel, S., Roussilhes, V., Culoli, J., Ouali, A. (1996). Heat-induced gelation of myofibrillar proteins and myosin from fast- and slow-twitch rabbit muscles. *J. Food Sci.* 61:138-43.

Camou, J.P., Sebranek, J.G., Olson, D.G. (1989). Effect of heating rate and protein concentration on gel strength and water loss of muscle protein gels. *J. Food Sci.* 54: 850-4.



- Cao, M. J., Hara, K., Osatomi, K., Tachibana, K., Izumi, T., Ishihara, T. (1999). Myofibril-bound serine proteinase (MBP) and its degradation of myofibrillar proteins. *J. Food Sci.* 64: 644–647.
- Cao, M.J., Osatomi, K., Hara, K., Ishihara, T. (2000). Identification of myofibril-bound serine proteinase (MBSP) in the skeletal muscle of lizard fish *Saurida waniuso* which specifically cleaves the arginine site. *Comp. Biochem. Physiol. Part B* 125:255–264.
- Cao, M.J., Jiang, X.J., Zhong, H.C., Zhang, Z.J., Su, W.J. (2006). Degradation of myofibrillar proteins by a myofibril-bound serine proteinase in the skeletal muscle of crucian carp (*Carassius auratus*). *Food Chem.* 94:7–13.
- Carvajal, P.A., Lanier, T.C., MacDonald, G.A. (2005). Stabilization of proteins in surimi. In: Park, J.W., editor. Surimi and surimi seafood. 2nd ed. Boca Raton: Taylor & Francis Group. p 163–225.
- Chang-Lee, M.V., Lampila, L.E., Crawford, D.L. (1990). Yield and Composition of Surimi from Pacific Whiting (*Merluccius productus*) and the Effect of Various Protein Additives on Gel Strength. *J. Food Sci.* 55: 83-86.
- Chaijan, M., Benjakul, S., Visessanguan, W., Faustman, C. (2004). Characteristics and gel properties of muscles from sardine (*Sardinella gibbosa*) and mackerel (*Rastrelliger kanagurta*) caught in Thailand. *Food Res. Int.* 37: 1021–1030.
- Chaijan, M., Benjakul, S., Visessanguan, W., Lee, S., Faustman, C. (2007) The effect of freezing and aldehydes on the interaction between fish myoglobin and myofibrillar proteins. *J Agric. Food Chem.* 55:4562–4568
- Chaijan, M., W. Panpipat and S. Benjakul. (2010). Physicochemical properties and gel-forming ability of surimi from three species of mackerel caught in Southern Thailand. *Food Chem.* 121: 85–92.
- Chaijan, M., Klomklao, S., Benjakul, S. (2013). Characterisation of muscles from Frigate mackerel (*Auxis thazard*) and catfish (*Clarias macrocephalus*). *Food Chem.* 139: 414–419.
- Chan, J.K., Gill, T.A., Paulson, A.T. (1992). Cross-linking of myosin heavy chains from cod, herring and silver hake during thermal setting. *J. Food Sci.* 57: 906–912.
- Chan, J.K., Gill, T.A., Paulson, A.T. (1993). Thermal aggregation of myosin subfragments from cod and herring. *J. Food Sci.* 58:1057-1061.
- Chen, J.S., Mehta, K. (1999). Tissue transglutaminase: an enzyme with a split personality. *Int. J. Biochem. Cell Biol.* 31: 817-836.



- Chen, H. H. (2002). Decoloration and gel-forming ability of horse mackerel mince by air-flotation washing. *J. Food Sci.* 67: 2970–2975.
- Chanarat, S., Benjakul, S., H-Kittikun, A. (2012). Comparative study on protein cross-linking and gel enhancing effect of microbial transglutaminase on surimi from different fish. *J. Sci. Food Agric.* 92(4): 844-852.
- Choi, Y.J., Lanier, T.C., Lee, H.G., Cho, Y.J. (1999). Purification and characterization of alkaline proteinase from Atlantic menhaden muscle. *J. Food Sci.* 64:768–771.
- Chomnawang, C., Nantachai, K., Yongsawatdigul, J., Thawornchinsombut, S., Tungkawachara, S. (2007). Chemical and biochemical changes of hybrid catfish fillet stored at 4 °C and its gel properties. *Food Chem.* 103: 420–427.
- CODEX COMMITTEE ON FISH AND FISHERY PRODUCTS. (2015). Appendices for Optional Final Product Requirements for Commodities in the *Code of Practice for Fish and Fishery Products* (CAC/RCP 52-2003). Alesund, Norway.
- Cortez-Vega, W. R., Fonseca, G.G., Prentice, C. (2012). Comparisons of the properties of whitemouth croaker (*Micropogonias furnieri*) surimi and mechanically deboned chicken meat surimi-like material. *Food Nutr. Sci.* 3: 1480–1483.
- Das, N., Khuntia, B.K., Raychaudhuri, U., Dora, K.C., Ganguly, S. (2015). Effect of water washing on the functional properties of fish meat. *Int. J. Med. Microbiol. Med. Diseases* 1: 8-12.
- Debusca, A., Tahergorabi, R., Beamer, S.K., Partington, S., Jaczynski, J. (2013). Interactions of dietary fibre and omega-3 rich oil with protein in surimi gels developed with salt substitute. *Food Chem.* 141: 201-208.
- Dey, S.S., Dora, K.C. (2011). Suitability of Chitosan as Cryoprotectant on Croaker Fish (*Johnius gangeticus*) Surimi during Frozen Storage. *J. Food Sci. Technol.* 48(6): 699-705.
- Ding, Y., Liu, R., Rong, J., Xiong, S. (2014). Heat-induced denaturation and aggregation of actomyosin and myosin from yellowcheek carp during setting. *Food Chem.* 149: 237–243.
- ElShehawy, S.M., Gab-Alla, A.A., Mutwally, H.M.A. (2016). Amino Acids Pattern and Fatty Acids Composition of the Most Important Fish Species of Saudi Arabia. *Int. J. Food Sci. Nutr. Eng.* 6: 32-41.



Folin, O., Ciocalteu, V. (1929). On tyrosine and thryptophane determinations in proteins. *J. Biol. Chem.* 73: 627.

Folk, J.E., Cole, P.W. (1966). Mechanism of action of guinea pig liver transglutaminase. Purification and properties of the enzyme: Identification of a functional cysteine essential for activity. *J. Biol. Chem.* 241: 5518–5525.

Folk, J.E. (1980). Transglutaminases. *Ann. Rev. Biochem.* 49: 517–531.

Folk, J.E. (1983). Mechanism and basis for specificity of transglutaminase-catalyzed e-(c-glutamyl) lysine bond formation. *Adv. Enzymol.* 54: 1–56.

Foegeding, E.A., Lanier, T.C., Hultin, H.O. (1996). Characteristics of edible muscle tissues. In O.R. Fennema (Ed.), *Food Chemistry. Third edition* (pp. 879-942). New York, USA: Marcel Dekker, Inc.

Funatsu, Y., Kato, N., Arai, K. (1993). Gel Forming Ability and Cross-linking Ability of Myosin Heavy Chain of Salt-ground Meat from Sardine Surimi Acidified by Lactic Acid. *Nippon Suisan Gakkaishi* 59: 1093-1098.

Ganesh, A., Dileep, A.O., Shamasundar, B.A., Singh, U. (2006). Gel-forming ability of common carp fish (*Cyprinus Carpio*) meat: effect of freezing and frozen storage. *J. Food Biochem.* 30: 342–361.

Gill, T.A., Conway, J.T. (1989). Thermal aggregation of cod (*Gadus morhua*) muscle proteins using l-ethyl-3-3-dimethylaminopropyl carbodiimide as a zero length crosslinker. *Agric. Biol. Chem.* 53:2553–62.

Guenneugues, P., Morrissey, M.T. (2005). Surimi resources. In: Park JW, editor. *Surimi and surimi seafood*. 2nd ed. Boca Raton, Fla.: Taylor & Francis Group. p 3–32.

Guenneugues, P., Lanelli, J. (2014). Surimi Resources and Market. In: Park JW, editor. *Surimi and surimi seafood*. 3th ed. Boca Raton, Fla.: Taylor & Francis Group. p 46–48.

Haard, N. F., Simpson, B. K., Pan, B. S. (1994). Sarcoplasmic proteins and other nitrogenous compounds. In Z. E. Sikorski, B. S. Pan, and F. Shahidi (Eds.), *Seafood proteins*, New York, USA: Chapman and Hall. pp. 13–39.

Hall GM, Ahmad NH. (1992). Surimi and fish minced products. Dalam: Hall GM (eds). *Fish Processing Technology*. New York: Blackie Academic and Professional.



- Harn-Gam, L., Yee-Leow, C., Baie, S. (2005). Amino acid composition of snakehead fish (*channa striatus*) of various sizes obtained at different times of the year. *Malaysian J. Pharmac. Sci.* 3: 19-30.
- Hashimoto, K., Watabe, S., Kono, M., Shiro, K. (1979). Muscle protein composition of sardine and mackerel. *Bull. Japanese Society Sci. Fish.* 45: 1435-1441.
- Hanan, T., Shaklai, N. (1995). Peroxidative interaction of myoglobin and myoglobin and myosin. *European J. Biochem.* 233: 930–936.
- Haejung An, Peters, M.Y., Seymour, T.A. 1996. Roles of indigenous enzymes in surimi gelation. *Trends Food Sci. Technol.* 7: 321-327.
- Hassan, M.A., Balange, A.K., Senapati, S.R., Martin Xavier, K.A. (2017). Effect of Different Washing Cycles on the Quality of Pangasius hypophthalmus Surimi. *Fish. Tech.* 54: 51-59.
- Hemung, B. O., Yongsawatdigul, J. (2005). Ca²⁺ Affects physicochemical and conformational changes of threadfin bream myosin and actin in a setting model. *J. Food Sci.* 70: 455–460.
- Hemung, B. O., Chin, K.B. (2013). Effects of fish sarcoplasmic proteins on the properties of myofibrillar protein gels mediated by microbial transglutaminase. *LWT-Food Sci. Technol.* 53: 184–190.
- Hermansson, A.M. (1979). Aggregation and denaturation involved in gel formation. In: Pour-El A. editor. Functionality and protein structure. Washington, D.C.: American Chemical Society. p 81–103.
- Hossain, M.I., Kamal, M.M., Shikha, F.H., Shahidul Haque, M.D. (2004). Effect of Washing and Salt Concentration on the Gel Forming Ability of Two Tropical Fish Species. *Int. J. Agri. Biol.* 6: 762-766.
- Hosseini-Shekarabi, S.P., Hosseini, S.E., Soltani, M., Kamali, A., Valinassab, T. (2014). A Comparative Study on Physicochemical and Sensory Characteristics of Minced Fish and Surimi from Black Mouth Croaker (*Atrobucca nibe*). *J. Agr. Sci. Tech.* 16: 1289-1300.
- Hosseini-Shekarabi, S.P., Hosseini, S.E., Soltani, M., Kamali, A., Valinassab, T. (2015). Effect of heat treatment on the properties of surimi gel from black mouth croaker (*Atrobucca nibe*). *Int. Food Res. J.* 22(1): 363-371.
- Hudson BJF. 1992. *Biochemistry of Food Proteins*. London: Elsevier Applied Sci.



Hultin, H.O., Kelleher, S.D. (2000) Surimi processing from dark muscle fish. In: Park JW (ed) *Surimi and surimi seafood*. Marcel Dekker, New York, pp 59–77

Hultin, H.O., Kristinsson, H.G., Lanier, T.C., Park, J.W. (2005). Process for recovery of functional proteins by pH shifts. In: Park JW, editor. *Surimi and surimi seafood*. 2nd ed. Boca Raton, Fla.: Taylor & Francis Group. p 107–39.

Hu, Y., Morioka, K., Itoh, Y. (2007). Hydrolysis of surimi paste from walleye pollock (*Theragra chalcogramma*) by cysteine proteinase cathepsin L and effect of the proteinase inhibitor (E-64) on gelation. *Food Chem.* 104:702–708.

Hu, Y., Morioka, K., Itoh, Y. (2008). Non-binding property of cathepsin L to myosin. *Food Chem.* 106:741–744.

Hu, Y., Ji, R., Jiang, H., Zhang, J., Chen, J., Ye, X. (2012). Participation of cathepsin L in “modori” phenomenon in carp (*Cyprinus carpio*) surimi gel. *Food Chem.* 134:2014–2020.

Ibhadon, S., Abdulsalami, M.S., Emere, M.C., Yilwa, V. (2015). Comparative Study of Proximate, Fatty and Amino Acids Composition of Wild and Farm-Raised African Catfish *Clarias gariepinus* in Kaduna, Nigeria. *Pakistan J. Nutr.* 14 (1): 56-61.

Jafarpour, A., Gorczyca, E.M. (2009). Characteristics of sarcoplasmic proteins and their interaction with surimi and kamaboko gel. *J. Food Sci.* 74: N16–N22.

James, C., Purnell, G., James, S.J. (2015). A Review of Novel and Innovative Food Freezing Technologies. *Food Bioprocess Technol.* 8:1616–1634.

Jiang, S.T., Lee, B.L., Tsao, C.Y., Lee, J.J. (1997). Mackerel cathepsin B and L effects on thermal degradation of surimi. *J. Food Sci.* 62:310–315.

Jiang, S.T. (2000). Enzymes and their effects on seafood texture. In: *Seafood Enzymes: Utilization and Influence on Postharvest Seafood Quality* (edited by N.F. Haard & B.K. Simpson). Pp. 411–450. New York: Marcel Dekker, Inc.

Jia, D., Huang, Q., Xiong, S. (2015). Chemical interactions and gel properties of black carp actomyosin affected by MTGase and their relationships. *Food Chem.* Accepted Manuscript.

Jianrong, W., Ikuo, K., Mikio, S., Nobuo, S. (1994). Effect of calcium ion concentration on the gelling properties and transglutaminase activity of walleye pollock surimi paste. *Nippon Suisan Gakkaishi* 60: 107-113.



Julavittayanakul, O., Benjakul, S., Visessanguan, W. (2005). Effects of phosphate compounds on gel-forming ability of surimi from bigeye snapper (*Priacanthus tayenus*). *J. Food Hydrocol.* 20: 1153-1163.

Kaba, N. (2006). The Determination of Technology and Storage Period of Surimi Production from Anchovy (*Engraulis encrasicholus* L., 1758). *Turk. J. Fisher. Aqua. Sci.* 6: 29-35.

Karthikeyan, M., Shamasundar, B.A., Mathew, S., Kumar, P.R., Prakash, V. (2004). Physicochemical and functional properties of protein from pelagic fatty fish (*Sardinella longiceps*) as function of water washing. *Int. J. Food Prop.* 7 (3): 353-365.

Karthikeyan, M., Dileep, A.O., Shamasundar, B.A. (2006). Effect of water washing on the functional and rheological properties of proteins from threadfin bream (*Nemipterus japonicus*) meat. *Int. J. Food Sci. Technol.* 41: 1002–1010.

Kamal, M., Hossain, M.I., Sakib, M.N., Shikha, F.H., Neazuddin, M., Bapary, M.A.J., Islam, M.N. (2005). Effect of salt concentration and cryoprotectants on gel-forming ability of surimi prepared from queen fish (*Chorinemus lysan*) during frozen storage. *Pakistan J. Biologic. Sci.* 8:793-797.

Kamath, G.G., Lanier, T.C., Foegeding, E.A., Hamann, D.D. (1992). Nondisulfide covalent cross-linking of myosin heavy chain in “setting” of alaska pollock and atlantic croaker surimi. *J. Food Biochem.* 16: 151-172.

Kang, I.S., Wang, J.J., Shih, J.C.H., Lanier, T.C. (2004). Extracellular production of a functional soy cystatin by *Bacillus subtilis*. *J. Agric. Food Chem.* 52:5052–5056.

Kang, E. J., Hunt, A.L., Park, J.W. (2008). Effects of salinity on physicochemical properties of alaska pollock surimi after repeated freeze-thaw cycles. *J. Food Sci.* 73: 347–355.

Keillor, J.W., Clouthier, C.M., Apperley, K.Y.P., Akbar, A., Mulani, A. (2014). Acyl transfer mechanisms of tissue transglutaminase. *Bioorg. Chem.* 57: 186–197.

Keillor, J.W., Apperley, K.Y.P., Akbar, A. (2015). Inhibitors of tissue transglutaminase. *Trends in Pharmacol. Sci.* 36: 32-40.

Kinoshita, M., Toyohara, H., Shimizu, Y. (1990). Purification and properties of a novel latent proteinase showing myosin heavy chain-degrading activity from threadfin-bream muscle. *J. Biochem.* 107:587–591.



- Kishi, H., Nozawa, H., Seki, N. (1991). Reactivity of muscle transglutaminase on carp myofibrils and myosin B. *Nippon Suisan Gakkaishi*, 57: 1203–1210.
- Kimura, I., Sugimoto, M., Toyoda, K., Seki, N., Arai, K., Fujita, T. (1991). A study on the cross-linking reaction of myosin in kamaboko “suwari” gels. *Nippon Suisan Gakkaishi*. 57: 1389-1396.
- Kim, S.K. (2013). Marine Proteins and Peptides Biological Activities and Applications. USA: A John Wiley & Sons, Ltd., Publication. Pp. 5-8.
- Ko, W.C., Hwang, M.S. (1995). Contribution of milkfish sarcoplasmic protein to the thermal gelation of myofibrillar protein. *Fish. Sci.* 61:75–78.
- Klesk, K., Yonsawatdigul, J., Park, J.W., Viratchakul, S., Virulhakul, P. (2000). Gel Forming Ability of Tropical Tilapia Surimi as Compared with Alaska Pollock and Pacific Whiting Surimi. *J. Aquat. Food Prod. Technol.* 9: 91-104.
- Kristinsson, H.G., Hultin, H.O. (2003). Effect of low and high pH treatment on the functional properties of codmuscle proteins. *J. Agric. Food Chem.* 51:5103–10.
- Kumazawa, Y., Numazawa, T., Seguro, K., Motoki, M. (1995). Suppression of surimi gel setting by transglutaminase inhibitors. *J. Food Sci.* 60: 715-717.
- Kumazawa, Y., Nakanishi, K., Yasueda, H., Motoki, M. (1996). Purification and Characterization of Transglutaminase from Walleye Pollack Liver. *Fish. Sci.* 62: 959-964.
- Kumazawa, Y., Sano, Y., Seguro, K., Yasueda, H., Nio, N. (1997). Purification and characterization of transglutaminase from Japanese oyster (*Crassostrea gigas*). *J. Agric. Food Chem.* 45: 604–610.
- Ladrat, C., Verrez-Bagnis, V., Noel, J., Fleurence, J. (2003). *in vitro* proteolysis of myofibrillar and sarcoplasmic proteins of white muscle of sea bass (*Dicentrarchus labrax* L.): Effects of cathepsins B, D and L. *Food Chem.* 81:517–25.
- Lan, Y.H., Novakofski, J., McCusker, R.H., Brewer, M.S., Carr, T.R., McKeith, F.K. (1995). Thermal Gelation of Pork, Beef, Fish, Chicken and Turkey Muscles as Affected by Heating Rate and pH. *J. Food Sci.* 60: 936-940.
- Laemmli, U. K. (1970). Cleavage of structural proteins during the assembly of the head of bacteriophage T4. *Nature* 227: 680-685.
- Lanier, T. C. (2000). Surimi gelation chemistry. In: Park, J. W. (Eds). Surimi and surimi seafood, p. 237-265. Marcel Dekker: New York.



- Lanier, T.C. (1992). Measurement of Surimi Composition and Functional Properties. In T. C. Lanier & C. M. Lee (Eds.), *Surimi technology* (pp. 123–154). New York: Marcel Dekker.
- Lanier, T.C., Lee, C.M. (1992). *Surimi Technology*. Marcel Dekker, New York. pp 167-179.
- Lanier, T.C., Yongsawatdigul, J., Carvajal-Rondanelli, P. (2014). Surimi Gelation Chemistry. In: Park JW, editor. *Surimi and surimi seafood*. 2nd ed. Boca Raton, Fla.: Taylor & Francis Group. p 101–39.
- Lee, C.M. (1984). Surimi process technology. *Food Technol.* 38:69–80.
- Lee, C.M. (1986). Surimi manufacturing and fabrication of surimi-based products. *Food Tech.* 40(3):115–124.
- Lee, J.J., Chen, H.C., Jiang, S.T. (1993). Purification and characterization of proteinases identified as cathepsin L and L-like (58kDa) proteinase from mackerel (*Scomber austrocdasicus*). *Biosci. Biotech. Biochem.* 57(9): 1470-1476.
- Lee, H.G., Lanier, T.C., Hamann, D.D., Knopp, J.A. (1997). Transglutaminase Effects on Low Temperature Gelation of Fish Protein Sols. *J. Food Sci.* 62: 20-24.
- Lee, S.M., Chiang, C.F., Pan, B.S. (1998). Occurrence of transglutaminase in grey mullet (*Mugil cephalus*) muscle and it's effect on minced fish product. *J. Food Biochem.* 22: 475-487.
- Lee, N., Park, J.W. (1998). Calcium compounds to improve gel functionality of Pacific whiting and Alaska pollock surimi. *J. Food Sci.* 63: 969–974.
- Lee, H.G., Lanier, T.C., Hamann, D.D., Knopp, J.A. (2006). Transglutaminase effects on low temperature gelation of fish protein sols. *J. Food Sci.* 62: 20–24.
- Lertwittayanon, K., Benjakul, S., Maqsood, S., Encarnacion, A.B. (2013). Effect of different salts on dewatering and properties of yellowtail barracuda surimi. *Int. Aquatic Res.* 5:10.
- Li, S., Zhang, N., Liu, H., Ma, C. (2004). Preliminary study of the relationship between autolysis of silver carp (*Hypophthalmichthys molitrix*) myofibrillar proteins and indigenous cathepsin B, L and H. *J. Agric. China Agric. Univ.* 9:71–75.



- Lin, T.M., Park, J.W. (1996). Extraction of proteins from pacific whiting mince at various washing conditions. *J. Food Sci.* 61: 432-438.
- Lowry, O.H., Rosebrough, N.J., Farr, A.L., Randal, R.J. (1951). Protein measurement with the folin phenol reagent. *J. Biol. Chem.*, 193: 265–275.
- Luo, Y.K., Kuwahara, R., Kaneniwa, M., Murata, Y., Yokoyama, M. (2001). Comparison of Gel Properties of Surimi from Alaska Pollock and Three Freshwater Fish Species: Effects of Thermal Processing and Protein Concentration. *J. Food Sci.* 66: 548-554.
- Luo, Y., Kuwahara, R., Kaneniwa, M., Murata, Y., Yokoyama, M. (2004). Effect of soy protein isolate on gel properties of alaska pollock and common carp surimi at different setting conditions. *J. Sci. Food Agric.* 84: 663–671.
- Luo, Y., Shen, H., pan, d., Bu, G. (2008). Gel properties of surimi from silver carp (*Hypophthalmichthys molitrix*) as affected by heat treatment and soy protein isolate. *Food Hydrocol.* 22; 1513–1519.
- Makinodan, Y., Toyohara, H., Ikeda, S. (1984). Comparison of Muscle Proteinase Activity Among Fish Species. *Comp. Biochem. Physiol.* 79B: 129-134.
- Makinodan, Y., Toyohara, H., Niwa, E. (1985). Implication of Muscle Alkaline Proteinase in the Textural Degradation of Fish Meat Gel. *Food Sci.* 50: 1351-1355.
- Mahawanich, T., Lekhavichitr, J., Duangmal, K. (2010). Gel properties of red tilapia surimi: effects of setting condition, fish freshness and frozen storage. *Int. J. Food Sci. Technol.* 45: 1777–1786.
- Mahyuddin, K. 2008. *Panduan Lengkap Agribisnis Lele*. Jakarta: Penebar Swadaya.
- Martin-Sanchez, A.M., Navarro, C., Perez-Alvarez, J.A., Kuri, V. (2009). Alternatives for Efficient and Sustainable Production of Surimi: A Review. *Comprehens. Rev. Food Sci. Food Saf.* 8: 359-374.
- Maruyama, N, Nozawa, H, Kimura, I, Satake, M, Seki N. (1995). Transglutaminase-induced polymerization of a mixture of different fish myosins. *Fish. Sci.* 61:495–500.
- Mazrouh, M.M. (2015). Effects of freezing storage on the biochemical composition in muscles of *Saurida undosquamis* (Richardson, 1848) comparing with imported frozen. *Int. J. Fish. Aquatic Studies* 3(2): 295-299.



- Montejano, J.G., Hamann, D.D., Lanier, T.C. (1984). Thermally induced gelation of selected comminuted muscle systems: rheological changes during processing, final strengths, and microstructure. *J. Food Sci.* 49:1496–505.
- Morioka, K., Shimizu, Y. (1990). Contribution of sarcoplasmic proteins to gel forming of fish meat. *Nippon Suisan Gakkaishi* 56:929–33.
- Morioka, K., Shimizu, Y. (1992). Heat-coagulation property of fish sarcoplasmic proteins. *Nippon Suisan Gakkaishi* 58(8):1529–33.
- Morioka, K., Shimizu, Y. (1993). Relationship between the heat-gelling property and composition of fish sarcoplasmic proteins. *Nippon Suisan Gakkaishi* 59(9): 1631 p.
- Morioka, K., Nishimura, T., Obatake, A., Shimizu, Y. (1997). Relationship between the myofibrillar protein gel strengthening effect and the composition of sarcoplasmic proteins from Pacific mackerel. *Fish. Sci.* 63(1):111–114.
- Morrissey, M.T., Wu, J.W., Lin, D., An, H. (1993). Proteinase inhibitor effects on torsion measurements and autolysis of Pacific whiting surimi. *J. Food Sci.* 58:1050-1054.
- Morrissey, M.T., Hartley, P.S., An, H. (1995). Proteolytic activity in Pacific Whiting and effects of surimi processing. *J. Aquat. Food Prod. Technol.* 4:5-18.
- Morrissey, M. T., Tan, S. (2000). World resources for surimi. In J. W. Park (Ed.), Surimi and surimi seafood (pp. 1–21). New York, USA: Marcel Dekker.
- Morales, O.G., Ramirez, J.A., Vivanco, D.I., Vazquez, M. (2001). Surimi of fish species from the Gulf of Mexico: evaluation of the setting phenomenon. *Food Chem.* 75: 43-48.
- Muhammad, W.N., Andriyanto, S. (2013). Manajemen budidaya ikan lele dumbo (*Clarias gariepinus*) di Kampung Lele, Kabupaten Boyolali, Jawa Tengah. *Media Akuakultur* 8: 63-71.
- Murthy, L.N., Panda, S.K., Shamasundar, B.A. (2011). Physico-chemical and functional properties of proteins of tilapia (*Oreochromis mossambicus*). *J. Food Proc. Eng.* 34: 83-107.
- Nakagawa, T., Nagayama, F., Ozaki, H., Watabe, S., Hashimoto, K. (1989). Effect of glycolytic enzymes on the gel-forming ability of fish muscle. *Nippon Suisan Gakkaishi* 55: 1045–1050.



- Nakahara, C., Nozawa, H., Seki, N. (1999). A comparison of cross-linking of fish myofibrillar proteins by indigenous and microbial transglutaminases. *Fish. Sci.* 65: 138–144.
- Nakamura, S., Ogawa, M., Saito, M., Nakai, S. (1998). Application of polymannosylated cystatin to surimi from roe-herring to prevent gel weakening. *FEBS Lett* 427:252–54.
- Ni, S., Nozawa, H., Seki, N. (2001). Effect of pH on the gelation of walleye pollack surimi and carp actomyosin pastes. *Fish. Sci.* 67: 920–927.
- Niwa, E. (1992). Chemistry of surimi gelation. In: Lanier, T.C., Lee, C.M., editors. Surimi technology. New York: Marcel Dekker, Inc. P 389-438.
- Nolsoe, H., Undeland, I. (2009). The acid and alkaline solubilization process for the isolation of muscle proteins: state of the art. *Food Bioproc. Technol.* 2(1):1–27.
- Nolsoe, H., Marmon, S.K., Undeland, I. (2011). Application of Filtration to Recover Solubilized Proteins During pH-Shift Processing of Blue Whiting (*Micromesistius poutassou*); Effects on Protein Yield and Qualities of Protein Isolates. *Open Food Sci. J.* 5:1-9.
- Nowsad, A.A., Katoh, E., Kanoh, S., Niwa, E. (1995). Effect of sarcoplasmic proteins on the setting of transglutaminase-free paste. *Fish. Sci.* 61(6):1039–40.
- Nowsad, A.A., Katoh, E., Kanoh, A., Niwa, E. (1996). Contribution of transglutaminase on the setting fish pastes at various temperatures. *Fish. Sci.* 62: 94–97.
- Nozawa, H., Mamagoshi, S., Seki, N. (1997). Partial purification and characterization of six transglutaminase from ordinary muscles of various fishes and marine invertebrates. *Comp. Biochem. Physiol.* 118B: 313–317.
- Ochiai, Y., Ochiai, L., Hashimoto, K., Watabe, S. (2001). Quantitative estimation of dark muscle content in the mackerel meat paste and its products using antisera against myosin light chains. *J. Food Sci.* 66: 1301–1305.
- Offer, G. (1987). Myosin filaments. In: *Fibrous Protein Structure*. JM Squire, PJ Vibert, eds. New York: Academic Press. pp 307–56.
- Ofstad, R., Grahl-Madsen, E., Gundersen, B., Lauritzen, K., Solberg, T., Solberg., C. (1993). Stability of cod (*Gadus morhua* L.) surimi processed with CaCl₂ and MgCl₂ added to the wash water. *Int. J. Food Sci. Tech.* 28(5):419–27.



- Ogata, H., Aranishi, F., Hara, K., Osatomi, K., Ishihara, T. (1998). Proteolytic degradation of myofibrillar components by carp cathepsin L. *J. Sci. Food Agric.* 76: 499-504.
- Ohkubo, M., Osatomi, K., Hara, K., Ishihara, T., Aranishi, F. (2005). A novel type of myofibril-bound serine protease from white croaker (*Argyrosomus argentatus*). *Comp Biochem Physiol. Part B* 141:231–236.
- Orak, H.H., Kayisoglu, S. (2008). Quality changes in whole, gutted and filleted three fish species (*Gadus euxinus*, *Mugil cephalus*, *Engraulis encrasicholus*) at frozen storage period (-26°C). *Acta Sci. Pol., Technol. Aliment.* 7(3): 15-28.
- Osatomi, K., Sasai, H., Cao, M., Hara, K., Ishihara, T. (1997). Purification and characterization of myofibril-bound serine proteinase from carp *Cyprinus carpio* ordinary muscle. *Comp Biochem Physiol. Part B* 116:183–190.
- Osibona, A.O., Kusemiju, K.I., Akande, G.R. (2009). Fatty acid composition and amino acid profile of two freshwater species, african catfish (*clarias gariepinus*) and tilapia (*tilapia zillii*). *African J. Food Agric. Nutr. Develop.* 9: 608-621.
- Paker, I. Mata, K.E. (2015). Impact of sarcoplasmic proteins on texture and color of silver carp and alaska pollock protein gels. *LWT-Food Sci. Technol.* 63: 985–991.
- Panpipat, W., Chaijan, M., Benjakul, S. (2010). Gel properties of croaker-mackerel surimi blend. *Food Chem.* 122: 1122–1128.
- Park J.W., Morrissey, M.T. (2000). Manufacturing of surimi from light muscle fish. *Dalam: Park JW (eds). Surimi and Surimi Seafood.* New York: Marcel Dekker, Inc.
- Park, J.W., Lin, T.M. (2005). Surimi: manufacturing and evaluation. *In: Park JW, editor. Surimi and surimi seafood.* 2nd ed. Boca Raton, Fla.: Taylor & Francis Group. p 33–106.
- Park, J.W. (2005). Surimi seafood: Products, Market and Manufacturing. *In: Park JW, editor. Surimi and surimi seafood.* 2nd ed. Boca Raton, Fla.: Taylor & Francis Group. p 375–433.
- Park, D., Choi, S.S., Ha, K.S. (2010). Transglutaminase 2: a multi-functional protein in multiple subcellular compartments. *Amino Acids* 39, 619–631.
- Park, J.W., Nozaki, H., Suzuki, T., Beliveau, J. (2014) Historical Review of Surimi Technology and Market Developments. *In: Park JW, editor. Surimi and surimi seafood.* 3th ed. Boca Raton, Fla.: Taylor & Francis Group. p 4–6.



Phu, N.V., Morioka, J., Itoh, Y. (2010). Gel-forming characteristics of surimi from white croaker under the inhibition of the polymerization and degradation of protein. *J. Biol. Sci.* 10: 432–439.

Pipatsattayanuwong, S., Park, J.W., Morrissey, M.T. (1995). Functional properties and shelf life of fresh surimi from pacific whiting. *J. Food Sci.* 60(6): 1241–1244.

Piyadhammadviboon, P., Yongsawatdigul, J. (2009). Proteinase inhibitory activity of sarcoplasmic proteins from threadfin bream (*Nemipterus spp.*). *J. Sci. Food Agric.* 90:291–298.

Prawira, A. (2008). Pengaruh penambahan tepung alginat (na-alginat) terhadap mutu kamaboko berbahan dasar surimi ikan gabus (*Channa striata*). *Skripsi*. Fakultas Perikanan dan Ilmu Kelautan. Bogor: Institut Pertanian Bogor.

Raghavan, S., Kristinsson, H.G. (2007). Conformational and rheological changes in catfish myosin as affected by different acids during acid-induced unfolding and refolding. *J. Agric. Food Chem.* 55: 4144–4153.

Ramírez, J.A., Barrera, M., Morales, O.G., Vazquez, M. (2002). Effect of xanthan and locust bean gums on the gelling properties of myofibrillar protein. *Food Hydrocol.* 16(1):11–6.

Ramírez, J.A., Velazquez, G., Echevarría, G.L., Torres, J.A. (2007). Effect of adding insoluble solids from surimi wash water on the functional and mechanical properties of pacific whiting grade A surimi. *Bioresour. Technol.* 98: 2148-2153.

Rawdkuen, S., Sai-Ut, S., Khamsorn, S., Chaijan, M., Benjakul, S. (2009). Biochemical and gelling properties of tilapia surimi and protein recovered using an acid-alkaline process. *Food Chem.* 112: 112-119.

Reynolds, J., Park, J.W., Choi, Y.J. (2002). Physicochemical properties of pacific whiting surimi as affected by various freezing and storage conditions. *J. Food Sci.* 67(6): 2072-2078.

Rusherlistyani, Sudaryati, D., Heriningsih, S. (2017). Budidaya lele dengan sistem kolam bioflok. LPPM UPN VY. Yogyakarta.

Saanin H. 1984. *Taksonomi dan kunci identifikasi ikan*. Jakarta: Bina Cipta.

Samejima, K., Ishioroshi, M., Yasui, T. (1982). Heat induced gelling properties of actomyosin: effect of tropomyosin and troponin. *Agric. Biol. Chem.* 46:535–40.



Santana, P., Huda, N., Yang, T.A. (2012). Technology for production of surimi powder and potential of applications. *Int. Food Res. J.* 19(4): 1313-1323.

Saeki, H., Iseya, Z., Sugiura, S., Seki, N. (1995). Gel forming characteristics of frozen surimi from chum salmon in the presence of protease inhibitors. *J. Food Sci.* 60: 917-921.

Seki, N., Uno, H., Lee, N.H., Kimura, I., Toyoda, K., Fujita, T., Arai, K. (1990). Transglutaminase activity in Alaska pollack muscle and surimi and its reaction with myosin B. *Nippon Suisan Gakkaishi* 56: 125-132.

Seymour, T.A., Morrissey, M.T., Peters, M.Y., An, H.J. (1994). Purification and characterization of Pacific whiting proteases. *J. Agric. Food Chem.* 42: 2421-7.

Sikorski, Z. E. (1994). The myofibrillar proteins in seafoods. In Z. E. Sikorski, B. S. Pan, and F. Shahidi (Eds.), *Seafood proteins*. New York, USA: Chapman & Hall. pp. 40-57.

Silva, J.L., Chamul, R.S. (2000). Composition of marine and freshwater finfish and shellfish species and their products. In: Martin, R.E., E.P. Carter, G.J. Flick and L.M. Davis, editor. *Marine and Freshwater Products Handbook*. Pennsylvania: Technomic Publishing Company Inc. pp 31-45.

Shimizu, Y. (1975). Technology of kamaboko. *Science of Cookery* 8: 184.

Shimizu, Y., Toyohara, H., Lanier, T.C. (1992). Surimi production from fatty and dark-fleshed fish species. In T. C. Lanier & C. M. Lee (Eds.), *Surimi technology* (pp. 181–207). New York: Marcel Dekker.

Shi, J., Luo, Y., Shen, H., Li, Z. (2014). Gel properties of surimi from silver carp (*Hypophthalmichthys molitrix*): Effects of whey protein concentrate, CaCl₂, and setting condition. *J. Aquat. Food Prod. Technol.* 23: 489–497.

Sriket, C. (2014). Proteases in fish and shellfish: Role on muscle softening and prevention. *Int. Food Res. J.* 21: 433-445.

Stone, A.P., Stanley, D.W. (1992). Mechanisms of fish muscle gelation. *Food Res. Int.* 25: 381-388.

Stoknes, I., Rustad, R., Mohr, V. (1993). Comparative Studies of the Proteolytic Activity of Tissue Extracts from Cod (*Codus morhua*) and Herring (*Clupea harengus*). *Comp. Biochem. Physiol.* 106B: 613-619.

Stoknes, I., Rustad, T. (1995). Proteolytic Activity in Muscle from Atlantic Salmon (*Salmo salar*). *Food Sci.* 60: 71 1-71 4.



Suzuki T. 1981. *Fish and Krill Protein in Processing Technology*. London: Applied Science Publishing. Ltd.

Sun, X.D., Holley, R.A. (2011). Factors Influencing Gel Formation by Myofibrillar Proteins in Muscle Foods. *Comprehens. Rev. Food Sci. Food Saf.* 10: 33-51.

Suvanich, V., Marshall, D.L. (1998). Influence of storage time and temperature on quality of cat fish (*Ictalurus punctatus*) frames. *J. Aquat. Food Prod. Technol.* 7: 61–76.

Suvanich, V., Jahncke, M.L., Marshall, D.L. (2000). Changes in selected chemical quality characteristics of channel catfish frame mince during chill and frozen storage. *J. Food Sci.* 65:24–29.

Suyanto, S.R. (2009). *Budidaya Ikan Lele*. Penebar Swadaya. Jakarta.

Sych, J., Lacroix, C., Adambounou, L.T., Castaigne, F. (1990). Cryoprotective effects of lactitol, palatinose and polydextrose on cod surimi proteins during frozen storage. *J. Food Sci.* 55: 356–360.

Szczesniak, A.S. (1986). Sensory texture evaluation methodology. *Reciprocal Meat Conference Proceedings* 39: 86-96.

Takeda, H., Seki, N. (1996). Enzyme-catalyzed cross-linking and degradation of myosin heavy chain in walleye pollack surimi paste during setting. *Fish. Sci.* 62: 462–467.

Taguchi, T., Ishizaka, H., Tanaka, M., Nagashima, Y., Amano, K. (1987). Protein-protein interaction of fish myosin fragments. *J. Food Sci.*, 52: 1103.

Thrash, B. (1983). The Japanese kamaboko industry. In “Pastry and Peanuts.” Alaska Fisheries Development Foundation, Anchorage, AK.

Toyoda, K., Kimura, I., Fujita, T., Noguchi, S.F., Lee, C.M. (1992). The surimi manufacturing process. In: Lanier TC, Lee CM, editors. *Surimi technology*. New York: Marcel Dekker Inc. p 79–112.

Toyohara, H., Kinoshita, M., Shimizu, Y. (1990). Proteolytic degradation of threadfin-bream meat gel. *J Food Sci.* 55:259–260.

Tsukamasa, Y., Shimizu, Y. (1990). Setting property of sardine and Pacific mackerel meat. *Nippon Suisan Gakkaishi*, 56, 1105-1112.



- Tsukamasa, Y., Shimizu, Y. (1991). Factors affecting the transglutaminase-associated setting phenomenon in fish meat sol. *Nippon Suisan Gakkaishi* 57: 535-540.
- Tsukamasa, Y., Miyake, Y., Ando, M., Makinodan, Y. (2002). Total activity of transglutaminase at various temperatures in several fish meats. *Fish. Sci.* 68: 929–933.
- Vareltzis, K., Zetou, F., Soutos, N., Tsiaras, I. (1989). Use of Hake (*Merluccius merluccius*) Surimi in a Frankfurter Formulation. *Int. J. Food Sci. Technol.* 45: 277-281.
- Vareltzis, K. (2000). Fish proteins from unexploited and underdeveloped sources. In: Doxastakis, G., Kiosseoglou, V., eds. *Novel Macromolecules in Food Systems*. Amsterdam: Elsevier, pp. 133–159.
- Venugopal, V. (2009). Seafood proteins: functional properties and protein supplements. In: *Marine Products for Healthcare: Functional and Bioactive Nutraceutical Compounds from the Ocean*. Boca Raton: CRC Press, pp. 51–102.
- Vilhelsson O. (1997). The state of enzyme biotechnology in the fish processing industry. *Trends Food Sci. Technol.* 8(8): 266–70.
- Visessanguan, W., Menino, A.R., Kim, S.M., An, H. (2001). Cathepsin L: A predominant heat-activated proteinase in arrowtooth flounder muscle. *J. Agric. Food Chem.* 49:2633–2640.
- Wan, J., Kimura, I., Satake, M., Seki, N. (1994). Effect of calcium ion concentration on the gelling properties and transglutaminase activity of walleye pollack surimi past. *J. Fish Sci.* 60: 107-114.
- Wan, J., Kimura, I., Satake, M., Seki, N. (1995). Causes of inferior gel forming ability of salmon surimi paste. *Fish. Sci.* 61 : 711–715.
- Wang, X., Hirata, T., Fukuda, Y., Kinoshita, M., Sakaguchi, M. (2002). Acceptability comparison of kamaboko gels derived from silver carp surimi and from walleye pollack surimi between the Chinese and Japanese. *Fish. Sci.* 68: 165–169.
- Wasson DH. 1992. Fish muscle proteases and heat-induced myofibrillar degradation: a review. *J. Aquat. Food Prod. Technol.* 8: 23–41.
- Weng, W.Y., Hamaguchi, P.Y., Osako, K., Tanaka, M. (2007). Effect of indigenous acid proteinases on the properties of edible films prepared from Alaska pollack surimi. *Food Chem.* 105: 996–1002.



- Wijayanti, I., Santoso, J., Jacoeb, A.M. (2012). Pengaruh frekuensi pencucian terhadap karakteristik gel surimi ikan lele dumbo (*clarias gariepinus*). *J. Saintek Perikanan* 8: 32-37.
- Worratao, A., Yongsawatdigul, J. (2003). Cross-linking of actomyosin by crude tilapia (*Oreochromis niloticus*) transglutaminase. *J. Food Biochem.* 27: 35-51.
- Worratao, A., Yongsawatdigul, J. (2005). Purification and characterization of transglutaminase from Tropical tilapia (*Oreochromis niloticus*). *Food Chem.* 93: 651-658.
- Xiong, Y.L., Brekke, C.J. (1991). Protein extractability and thermally induced gelation properties of myofibrils isolated from pre-rigor and post-rigor chicken muscles. *J. Food Sci.* 56:210–5.
- Xiong, Y.L. (1994). Myofibrillar protein from different muscle fiber types: implications of biochemical and functional properties in meat processing. CRC Crit Rev Food Sci. Nutr. 34:293–320.
- Yamashita, M., Konagaya, S. (1990). Participation of Cathepsin L into Extensive Softening of the Muscle of Chum Salmon Caught During Spawning Migration. *Nippon Suisan Gakkaishi* 56: 1271-1277.
- Yang, Z., Wang, W., Wang, H., Ye, Q. (2014). Effects of a highly resistant rice starch and pre-incubation temperatures on the physicochemical properties of surimi gel from grass carp (*Ctenopharynodon Idellus*). *Food Chem.* 145: 212–219.
- Yasueda, H., Kumazawa, H., Motoki, M. (1994). Purification and characterization of a tissue-type transglutaminase from red sea bream (*Pagrus major*). *Biosci. Biotechnol. Biochem.* 58: 2041–2045.
- Yasui, T., Ishioroshi, M., Samejima K. (1980). Heat-induced gelation of myosin in the presence of actin. *J Food Biochem* 4:61–78.
- Yin, T., Park, J.W. (2015). Optimum processing conditions for slowly heated surimi seafood using protease-laden Pacific whiting surimi. *LWT- Food Sci. Technol.* 63: 490–496.
- Yongsawatdigul, J., Park, J.W., Virulhakul, P., Viratchakul, S. (2000). Proteolytic Degradation of Tropical Tilapia Surimi. *J. Food Sci.* 65: 129-133.
- Yongsawatdigul, J., Worratao, A., Park, J.W. (2002). Effect of Indigenous Transglutaminase on Threadfin Bream Surimi Gelation. *J. Food Sci.* 67: 3258-3263.



Yongsawatdigul, J., Park, J.W. (2004). Gelation of threadfin bream surimi as affected by thermal denaturation, transglutaminase, and proteinase(s) activities. *Dev. Food Sci.* 42:343–356.

Yongsawatdigul, J., Piyadhamviboon, P., Singchan, K. (2006). Gel-forming ability of small scale mud carp unwashed and washed mince as related to indigenous proteinases and transglutaminase activities. *Eur. Food Res. Technol.* 223(6):769–74.

Yongsawatdigul, J., Piyadhamviboon, P. (2007). Gel-enhancing effect and protein cross-linking ability of tilapia sarcoplasmic proteins. *J. Sci. Food Agric.* 87:2810–2816.

Zaitsev, V., Kizevetter, I., Lagunov, L., Makarova, T., Minder, L., Podsevalov. (1969). *Fish Curing and Processing*. Mir Publisher, Moscow.

Zayas, J.F. (1997). Functionality of proteins in food. Springer-Verlag Berlin Heidelberg, New York.

Zepeda, C.M.G., Kastner, C.L., Kropf, D.H., Hunt, M.C., Kenney, P.B., Schwenke, J.R., Schleusener, D.S. (1993). Utilization of surimi-like products from pork with sex-odor in restructured, precooked pork roast. *J. Food Sci.* 58: 53-58.

Zhang, L., Q. Li, J. Shi, B. Zhu and Y. Luo. (2018). Changes in chemical interactions and gel properties of heat-induced surimi gels from silver carp (*Hypophthalmichthys molitrix*) fillets during setting and heating: Effects of different washing solutions. *Food Hydrocoll.* 75: 116–124.

Zhou, A., Benjakul, S., Pan, K., Gong, J., Liu, X. (2006). Cryoprotective effects of trehalose and sodium lactate of tilapia (*Sarotherodon niloticus*) surimi during frozen storage. *J. Food Chem.* 96: 96-103.