

DAFTAR PUSTAKA

- Adler-Nissen, J. (2016). "Enzymatic hydrolysis of food proteins: a review". *Food Chemistry*, 15, 130-158.
- Afidah, N., & Ilmiah, S. N. (2024). Pengaruh pH dan suhu terhadap kemampuan enzim bromelin untuk menggumpalkan susu [the effect of ph and temperature on the ability of bromelain enzyme to coagulate milk]. (Vol. 8, Issue 1).
- Ahalya, N., Ramachandra, T. V., & Rao, R. M. (2017). Nutritional advantages of fish protein hydrolysates over conventional fish meal. *Journal of Food Science and Nutrition*, 14(4), 341-349.
- Amalia, A. R., Sumartini, S., Azka, A., Ratrinia, P. W., Suryono, M., Saputra, E. N., & Hasibuan, N. E. (2024). Karakteristik fisikokimia mi basah substitusi jenis ikan berbeda dengan penambahan *egg white powder*. *Jurnal Pengolahan Hasil Perikanan Indonesia (JPHPI)*, 27(11), 1021–1034. <https://doi.org/10.17844/jphpi.v27i11.52207>
- Annisa, S., Darmanto, Y. S., & Amalia, U. (2017). Pengaruh perbedaan spesies ikan terhadap hidrolisat protein ikan dengan penambahan enzim papain (the effect of various fish species on fish protein hydrolysate with the addition of papain enzyme). *Saintek Perikanan: Indonesian Journal of Fisheries Science and Technology*, 13(1), 24. <https://doi.org/10.14710/ijfst.13.1.24-30>
- Andhikawati, A., Permana, R., Oktavia, Y., Perikanan, D., Perikanan dan Ilmu Kelautan, F., Studi Perikanan Pangandaran, P. K., Unpad Pangandaran, P., Pangandaran, K., Studi Teknologi Hasil Perikanan, P., & Ilmu Kelautan dan Perikanan, F. (2021). Review: komposisi gizi ikan terhadap kesehatan tubuh manusia *A Review: Nutritional Composition of Fish For Human Health*. 04(02), 76–84.
- Aryati, E.E., & Dharmayanti A.W.S. (2014). Manfaat ikan teri segar (*Stolephorus* sp) terhadap pertumbuhan tulang dan gigi. *ODONTO Dental Journal*, 1(2), 52-56. <https://dx.doi.org/10.30659/odj.1.2.52-56>
- Ashraf, Z. U., Shah, A., Gani, A., & Gani, A. (2024). Effect of enzymatic hydrolysis of pulse protein macromolecules to tailor structure for enhanced nutraceutical properties. *LWT*, 205, 116502. <https://doi.org/10.1016/j.lwt.2024.116502>
- AOAC. (2005). *Official Method of Analysis of The Association at Official Analytical Chemist*. Washington D.C: Benjamin Franklin Station.
- Arditiana, A., Rochmawati, N., Widinugroho, P., Puspitasari, R. D., Widyaningsih, T. D. (2015). Suplemen cincau hitam dan daun bungur untuk kolesterol, hipertensi dan diabetes. *Jurnal Pangan dan Agroindustri*, Vol. 3 (1): 166-173.

- Arshad, Z. I. M., Amid, A., Yusof, F., Jaswir, I., Ahmad, K., & Loke, S. P. (2014). Bromelain: an overview of industrial application and purification strategies. *Applied Microbiology and Biotechnology*, 98 (17): 7283-7297.
- Astawan, M., & Andayani, R. (2014). Ikan teri jengki sebagai sumber protein dan kalsium yang murah serta tersedia di Indonesia. *Jurnal Gizi dan Pangan*, 9(1), 45-53.
- Astawan, M., et al. (2015). Influence of enzyme concentration on the degree of hydrolysis and antioxidant activity of fish protein hydrolysate. *Journal of Food Processing and Preservation*.
- Astawan, M., Santoso, B., & Wresdiyati, T. (2017). Kandungan gizi dan manfaat kesehatan ikan teri. *Jurnal Gizi dan Pangan*, 12(3), 215–224.
- Astawan, M., et al. (2018). Bioavailability and nutritional benefits of protein from anchovy (*Stolephorus sp*). *Journal of Food Nutrition and Food Sciences*.
- Aung, Sumbono. (2016). Biokimia Pangan Dasar. Deepublish. Yogyakarta.
- Baehaki, A, Shanti Dwita L, Ahmad Rizky Romadhoni. (2015). Hidrolisis protein ikan patin menggunakan enzim papain dan aktivitas antioksidan hidrolisatnya. [Journal.ipb.ac.id/jphpi](http://journal.ipb.ac.id/jphpi)
- Belitz, H. D., Grosch, W., & Schieberle, P. (2016). Food Chemistry (4th ed.). Springer
- Berg, J. M., Tymoczko, J. L., & Stryer, L. (2018). Biochemistry (8th ed.). W. H. Freeman
- Bhalodia, N. R., Nariya, P. B., Acharya, R. N., & Shukla, V. J. (2013). In vitro antioxidant activity of hydro alcoholic extract from the fruit pulp of *cassia fistula* linn. *An International Quarterly Journal of Research*, Vol. 34 (2): 209-214.
- Bhaskar, N., Modi, V. K., Govindaraju, K., Radha, C., & Lalitha, R. G. (2008). Utilization of meat industry by products: Protein hydrolysate from visceral waste from Catla (*Catla catla*). *Bioresource Technology*, 99(6), 1923–1930. <https://doi.org/10.1016/j.biortech.2007.03.036>
- Bjoern, L., Lied, E. and Espe, M. (2000). Enzymatic hydrolysis of byproducts from the fish-filleting industry; chemical characterization and nutritional evaluation. *Journal of the Science of Food and Agriculture* 80: 581-589.
- BPOM. (2023). *Tabel Komposisi Zat Gizi Pangan Indonesia (TKPI)*.
- Bueno-Solano, C., López-Cervantes, J., Campas-Baypoli, O.N., Lauterio-García, R., Adan-Banteand, N.P., and Sánchez-Machado, D.I. (2009). chemical and biological characteristics of protein hydrolysates from fermented shrimp by-products. *Food Chem.* 112: 671–675.

- Butt, M.S., F.M. Anjum, Salim-ur-Rehman, M. Tahir-Nadeem, M.K. Sharif and M. Anwer. (2008). Selected quality attributes of fine basmati rice: effect of storage history and varieties. *International Journal of Food Properties*, 11:3, 698–711,
- Chalamaiah, M., Dinesh, B., Hemalatha, R., & Jyothirmayi, T. (2012). fish protein hidrolisissates: proximate composition, amino acid composition, antioxidant activities and applications: a review. *Food Chemistry*, 135(4), 3020–3038. <https://doi.org/10.1016/j.foodchem.2012.06.100>
- Chalamaiah, M., Dinesh, B., Hemalatha, R., & Jyothirmayi, T. (2018). bioactive peptidas derived from food protein: a review. *Journal of Functional Foods*, 39, 608-619.
- Charoenphun N, Benjamas C, Nualpun S, Wirote Y. (2013). Calcium-binding peptidas derived from tilapia (*Oreochromis niloticus*) protein hidrolisissate. *European Food Research and Technology*. 236(1): 57-63.
- Cheng, I., Liao, J., Ciou, J., Huang, L., Chen, Y., & Hou, C. (2020). Characterization of protein hydrolysates from eel (*anguilla marmorata*) and their application in herbal eel extracts. *catalysts*, Vol. 10: 1-12.
- Damodaran, S., Parkin, K.L., & Fennema, O. R. (2017). *Food Chemistry Fifth Edition*. United States: CRC Press.
- Darmawan, E. (2020). Pengaruh Enzim Bromelin terhadap Sifat Kimia Hidrolisat Protein Lele Dumbo. *Agrotech: Jurnal Ilmiah*.
- De Garmo, E. P., Sullivan, W. G., & Canada, J. R. (1984). *Engineering Economy*. 5th ed. McGraw-Hill Education.
- Desyca Tohata, V., Sormin, R. B. D., & Savitri, I. K. E. (n.d.). (2021). Jurnal Teknologi Hasil Perikanan Profil Asam Amino Dan Kandungan Mineral Ikan Teri (*Stolephorus Commersonii*) Segar Dan Kering Dari Desa Siahoni Kabupaten Buru Profile Of Amino Acids And Mineral Content Of Fresh And Dried Anchovy (*Stolephorus Commersonii*) From Siahoni Village, *Buru Regency*.
- Dos Santos, S. D. A., Martins, V. G., Salas-Mellado, M., & Prentice, C. (2011). Evaluation of functional properties in protein hidrolisissates from bluewing searobin (*prionotus punctatus*) obtained with different microbial enzymes. *Food and Bioprocess Technology*, 4(8), 1399–1406. <https://doi.org/10.1007/s11947-009-0301-0>
- Erpiana. (2018). Studi Pembuatan Dangke Dengan Menggunakan Ekstrak Enzim Bromelin Kasar Dari Batang Nanas (*Ananas Comasus L. Mer*). Skripsi. Fakultas Pertanian Universitas Hasanuddin Makassar.

- Esfandi, R., Walters, M. E., & Tsopmo, A. (2019). Antioxidant properties and potential mechanisms of hydrolyzed proteins and peptidas from cereals. *Heliyon*, Vol. 5 (4): 1-26.
- Fardiaz D, Fardiaz S. (1987). Teknik Penelitian Protein. Bogor: Pangan Dan Gizi.
- Farvin, K. H. S., Baron, C. P., Nielsen, N. S., Otte, J., & Jacobsen, C. (2010). Antioxidant activity of yoghurt peptidas: part 2-characterisation of peptida fractions. *Food Chem.*, Vol. 123: 1090-1097.
- Febrianto, N. A. (2013). Hidrolisat Protein asal Bungkil Kakao dan Ampas Kopi. Jember: Warta Pusat Penelitian Kopi dan Kakao.
- Gan, R.-Y., Li, H.-B., Gunaratne, A., Sui, Z.-Q., Corke, H., (2017). Effects of fermented edible seeds and their products on human health: bioactive components and bioactivities. *Compr. Rev. Food Sci. Food Saf.*, Vol. 16: 489-531.
- Gandy, W., Madeen, A., & Holdsworth, M. (2014). Gizi & Dietika. Jakarta: EGC
- Gautam, S. S., Mishra, S., Dash, V., Amit, K. & Rath, G. (2010). Cooperative study or extraction, purification and estimation of bromelain from stem and fruit of pineapple plant. *The Thai Journal of Pharmaceutical Sciences*, Vol. 34 (2): 67-76.
- Gehring, C. K., Gigliotti, J. C., Moritz, J. S., & Tou, J. C. (2017). Fish protein hydrolysates: Current knowledge and challenges in the industry. *Journal of Food Science*, 82(3), 452-462.
- Hariwan, A. (2015). Pengambilan keputusan: aspek kecerdasan, persepsi, dan falsafah dalam proses Analisis keputusan. *Jurnal Manajemen dan Keputusan*, 12(4), 45-58.
- Haard, N. F., & Simpson, B. K. (2016). Seafood Enzymes: Utilization and Influence on Postharvest Seafood Quality. CRC Press.
- Harahap, M.T. (2022). Pengaruh konsentrasi enzim bromelin terhadap derajat hidrolisis hidrolisat protein belut (*monopterus albus*). *Jurnal Perikanan dan Kelautan. Universitas Riau*.
- Harnedy, P. A., & FitzGerald, R. J. (2012). Bioactive peptides from marine processing waste and shellfish: A review. *Journal of Functional Foods*, 4(1), 6–24. <https://doi.org/10.1016/j.jff.2011.09.001>
- Haslaniza, H., M. Y. Maskat, W. M. Wan Aida, and S. Mamot. (2010). The effects of enzyme concentration, temperature and incubation time on nitrogen content and degree of hydrolysis of protein precipitate from cockle (*anadara granosa*) meat wash water. *International Food Research Journal* 17(1): 147–52.

- Hayuningtyas, C. R. (2015). Formulasi dan Karakterisasi Saus Berbahan Baku Hidrolisat Hasil Hidrolisis Enzimatis dari Ikan Inferior. *Skripsi*. Jurusan Teknologi Hasil Pertanian Universitas Jember.
- Heard, C. M., & Simpson, J. A. (2016). the role of myofibrillar and sarcoplasmic proteins in fish muscle quality. *Journal of Marine Science and Engineering*, 4(3), 211-225.
- Hedstrom, L. (2017). Serine protease mechanism and specificity. *Chemical Reviews*, 102(12), 4501-4524.
- He, S., Franco, C., & Zhang, W. (2013). Functions, applications and production of protein hidrolisissates from fish processing. *FRIN*, 50(1), 289–297. <https://doi.org/10.1016/j.foodres.2012.10.031>
- Henn, F. K., & Alim, K. (2025). Viscosity's impact on nutrient uptake along the gut. arXiv. <https://arxiv.org/abs/2504.19235>
- Hidayah, Z., Nuzula, N. I., & Wiyanto, D. B. (2020). Analisis keberlanjutan pengelolaan sumber daya perikanan di perairan selat madura jawa timur. *Jurnal Perikanan Universitas Gadjah Mada*, 22(2), 101. <https://doi.org/10.22146/jfs.53099>
- Ilfandzahina, A. M. (2020). *Karakterisasi enzim bromelin dari ekstrak nanas untuk aplikasi hidrolisis protein*. [Skripsi, Universitas Negeri].
- Ismed, I., Yenrina, R., & Hasbullah, H. (2023). Pengaruh Konsentrasi Crude Enzim Fisin terhadap Karakteristik Gelatin dari Kulit Ikan Tuna (*Thunnus albacares*). *Prosiding Polbangtan Yoma*, Prosiding Seminar Nasional Politeknik Pembangunan Pertanian Yogyakarta Magelang, 5, 162–174. e-ISSN: 2986-254X.
- Jacobeb, A., Nurjanah, Siagian, I., & Hidayat, T. (2024). Organoleptic, chemical composition, and histology of fresh vs. fried Indonesian anchovies (*Stolephorus* sp.). *Universitas Scientiarum*, 29(2), 169–185. <https://doi.org/10.11144/JAVERIANA.SC292.OCCA>
- Jayathilakan, K., *et al.* (2014). Instant foods and the benefits of modern technologies for global health. *Food Reviews International*
- Jones, R. T., & Johnson, M. L. (2017). Antioxidant properties of human serum albumin. *Biochemical Society Transactions*, 45(1), 102-110.
- Jiang, H. (2016). Characterization and functional properties of fish albumin: a review. *Food Chemistry*, 202, 476-485.
- Jimenez, A., Selga, A., Torres, J. L., & Julia, L. (2004). Reducing activity of polyphenols with stable radicals of the ttm series electron transfer versus h-abstraction reactions in flavan-3-ols. *Organic Letters*, Vol. 6: 4583-4586.

- Kementerian Kesehatan RI. (2018). Tabel Komposisi Pangan Indonesia 2017. Jakarta: Kementerian Kesehatan RI; page 22
- Ketnawa, S., Rawdkuen, S., & Chaiwut, P. (2011). Pineapple wastes: A potential source for bromelain extraction. *Food and Bioproducts Processing*, 89(3), 342–348. <https://doi.org/10.1016/j.fbp.2010.07.002>
- Ketnawa, S., Chaiwut, P., & Rawdkuen, S. (2019). Extraction of bromelain from pineapple peels and application in protein hydrolysate production. *Food Science and Biotechnology*, 28(2), 399-409.
- KKP. (2021). Kelautan dan perikanan dalam angka tahun 2021 (Vol. 1, Issue 1). <http://journal.um-surabaya.ac.id/index.php/JKM/article/view/2203>
- Kristinsson, H. G., & Rasco, B. A. (2000). Fish protein hydrolysates: Production, biochemical, and functional properties. *Critical Reviews in Food Science and Nutrition*, 40(1), 43–81. <https://doi.org/10.1080/10408690091189266>
- Kristinsson HG. (2007). Aquatic food protein hidrolisissates. Di dalam: Shahidi F, editor. Maximising the Value of Marine ByProduct. Boca Raton: CRC Press
- Kurniawan, S., Lestari., dan Hanggita, S.R.J. (2012). Hidrolisis protein tinta cumi-cumi (*Loligo sp.*) dengan enzim papain. *Fishtech*, 1 (1): 41-54.
- Kusumaningtyas, E., Widiastuti, R., Kusumaningrum, H. D., & Suhartono, M. T. (2015). aktivitas antibakteri dan antioksidan hidrolisat hasil hidrolisis protein susu kambing dengan ekstrak kasar bromelin. *Jurnal Teknologi dan Industri Pangan*, Vol. 26 (2): 179-188.
- Lasimpala, R. (2014). Uji Mutu Ikan Teri Kering Pada Lama Pengeringan Berbeda (Thesis). Universitas Negeri Gorontalo, Gorontalo. Retrieved from <http://eprints.ung.ac.id/6433/>
- Lavrentovich, M. O., Koschwanez, J. H., & Nelson, D. R. (2013). Nutrient shielding in clusters of cells. arXiv. <https://arxiv.org/abs/1304.6256>
- Lestari, S., & Suyata, A. (2020). Pengaruh waktu hidrolisis terhadap derajat hidrolisis dan profil peptida dalam proses hidrolisis oleh bromelin. *Jurnal Teknologi Pangan dan Bioteknologi*, 14(1), 78-85.
- Mareta, R. E., Subandiyono, & Hastuti, S. (2017). pengaruh enzim papain dan probiotik dalam pakan terhadap tingkat efisiensi pemanfaatan pakan dan pertumbuhan ikan gurami (*osphronemus gouramy*). *Jurnal Sains Akuakultur Tropis*, Vol. 1 (1): 21-30.
- Mardiyah, M., & Sartika, R. (2014). asupan kalsium dan hubungannya dengan massa tulang. *Jurnal Gizi Indonesia*, 3(2), 150-159.
- Matondang, S. E. (2021). *Perbandingan kadar protein ikan air tawar dan ikan air laut*. Institut Agama Islam Negeri (IAIN) Padangsidimpuan.

<https://pdfs.semanticscholar.org/29f1/28253642d3beb0efe0622bdbb88b4a057885.pdf>

- Mehta, S. K., Joghi, S., dan Gowder, T. (2015). Members of antioxidant machinery and their functions. *Basic Principles and Clinical Significance of Oxidative Stress*, 60-84.
- Litaay, C., Indriati, A., Andriansyah, R. C. E., Novianti, F., Purwandoko, P. B., Rahman, N., Nuraini, L., Rahman, N., & Hidayat, T. (2023). Karakteristik kimia dan keamanan mikrob tepung ikan teri hitam (*Stolephorus commersonnii*). *Jurnal Pengolahan Hasil Perikanan Indonesia*, 26(3), 497–509. <https://doi.org/10.17844/jphpi.v26i3.48355>
- Meldstad, T. (2015). Protein hydrolysis and amino acid analysis in fish protein hydrolysates. *Journal of Food Science and Technology*, 10(2), 134-142.
- Mohan, R., Ayyappan, S., & Joseph, R. (2016). Extraction, purification and properties of bromelain from pineapple (*Ananas comosus*) peel waste. *Asian Journal of Pharmaceutical and Clinical Research*, 9(3), 121–124. <https://innovareacademics.in/journals/index.php/ajpcr/article/view/11716>
- Mohanty, B. P., & Ganguly, S. (2016). Nutritional composition of fish and shellfish. *Present Status and Future Prospects in Production and Utilization of Fish*, 62-82.
- Muchtadi, D. (2013). *Antioksidan dan Kiat Sehat di Usia Produktif*. Bandung: Alfabeta.
- Muñoz, P. D., & Ayer, M. H. (2017). Engraulidae (anchovies). *In Fishes of the Western North Atlantic* (pp. 1-10). Yale University Press.
- Muzaifa, M., Fahrizal, and N. Safriani. (2011). Physicochemical properties of fish protein hydrolysates prepared from by product using algae and flafouryme enzyme. *J.Biological Education*. 3(2): 5 – 8.
- Nakamura, Y. (2018). Collagen and gelatin from marine by-products. *Marine Drugs*, 16(3), 100
- Najihudin, A., Chaerinisaa, A., & Subarnas A. (2017). Aktivitas antioksidan ekstrak dan fraksi kulit batang trengguli (*cassia fistula l*) dengan metode dpph, *Indonesian Journal of Pharmaceutical Science and Technology*, Vol. 4 (2): 70-78
- Nathania, L., & Bratadiredja, R. (2018). Bromelin: enzim proteolitik dari nanas dan aplikasinya dalam hidrolisis protein. *Jurnal Bioteknologi dan Bioindustri*, 9(2), 87-94.
- Nelson, D. L., & Cox, M. M. (2017). *Lehninger Principles of Biochemistry* (7th ed.). W. H. Freeman

- Ngo, D. H. (2016). Bioactive peptidas from fish and shellfish: A review of the isolation, characterization, and applications. *Current Opinion in Food Science*, 6, 25-31
- Nugraha, A. A. (2022). *Hidrolisis protein kacang kedelai dengan enzim bromelain dan aktivitas antikanker terhadap sel kanker payudara MCF-7*. [Tesis, UIN Jakarta].
- Nuraida, L., & Nurjanah, S. (2015). development of instant rice with natural ingredients. *Journal of Food Science and Technology*.
- Nuraida, L., & Nurjanah, S. (2017). calcium content in indonesian anchovy and its contribution to nutritional needs. *Journal of Food and Nutrition Research*, 25(2), 112-120
- Nurjanah, N. (2016). morphological and genetic identification of *stolephorus indicus*. *Indonesian Fisheries Research Journal*, 22(1), 45-54
- Nie R, Liu Y, Liu Z. (2014). The calcium-binding activity of fish scale protein hidrolisissates. *Journal of Agricultural Chemistry and Environmental*. 3(1B): 11-15.
- Oliveira, C., Vilela, L., Santos, L., & Souza, R. (2016). comparative analysis of bromelain and papain: amino acid sequences and mechanistic similarities. *Journal of Enzymology and Protein Chemistry*, 15(3), 225-233.
- Palani Kumar, K., Bhaskar, N., & Mahendrakar, N. S. (2014). Functional properties of protein hydrolysates from anchovy (*Stolephorus indicus*) visceral waste using plant proteases. *Journal of Food Processing and Preservation*, 38(1), 120–130. <https://doi.org/10.1111/j.1745-4549.2012.00754.x>
- Pamungkas, B. Susilo, N. Komar, (2013), Uji fisik dan sifat kimia nasi instan (irsoybean) bersubsitisi larutan kedelai (*Glycine max*). *Jurnal Keteknik Pertanian Tropis dan Biosistem*, Vol. 1, Hal 213-223.
- Pandiangan, M., Sihombing, D. R., Tampubolon, S. D. R., & Sidebang, Y. E. (2025). Uji hidrolisis protein dan aktivitas antioksidan hidrolisat protein ikan nila (*Oreochromis niloticus*). *Jurnal Riset Teknologi Pangan dan Hasil Pertanian (RETIPA)*, 5(2), 84–93
- Pardo, M.F., Lopez, L.M., Canals, F., Aviles, F.X., Natalucci, C.L. dan Caffini, N.O. (2000). Purification of balansain I, an endopeptidase from unripe fruits of *Bromelia balansae* Mez (*Bromeliaceae*). *Journal Agriculture of Food Chemistry*, 48: 3795-3800.
- Parwata MOA. (2016). Kimia Terapan Program Pasca sarjana Universitas Udayana. 1– 54.

- Pasaribu, G., & Setyawati, T. (2011). Aktivitas antioksidan dan toksisitas ekstrak kulit kayu raru (*cotylelobium sp.*). *Jurnal Penelitian Hasil Hutan*, 29(4), 322–330. <https://doi.org/10.20886/jphh.2011.29.4.322-330>
- Pavan, P., Jain, S., Sangeetha, N., & Kothari, I. L. (2016). Mechanisms of bromelain enzyme action: substrate binding and catalysis. *Journal of Enzyme Research*, 12(2), 150-160.
- Perbowo N, Ibrahim, RHS, Andriyani R, Mindrawati E, Setiawati N, P, Kurnia, G E, Supriyanto A, Abdillah J, Candra M A, Rohayati S, Soleh K, Chaidir R N, Trilaksani W, Chasanah E, Fawzya YN. (2016). Inovasi Teknologi Pengolahan Kerjasama Penelitian/Riset Perguruan Tinggi dan Litbang (Hidrolisat Protein Ikan). Direktorat Jendral Penguatan Daya Saing Produk Kelautan dan Perikanan. Jakarta [IDN].
- Poba, H. R., Astawan, M., & Andarwulan, N. (2019). The Effect of Ripening Stages of Pineapple on the Activity of Bromelain Enzyme. *Indonesian Journal of Agricultural Science*, 20(3), 189–196. <https://doi.org/10.21082/ijas.v20n3.2019.p189-196>
- Pownall, T. L., Udenigwe, C. C., dan Aluko, R. E. (2010). amino acid composition and antioxidant properties of pea seed (*pisum sativum l.*) enzymatic protein hydrolysate fractions. *Journal Agro Food Chem*, Vol. 58: 4712-4718.
- Prasert, Waraporn and P. Suwannaporn. (2009). Optimization of instant jasmine rice process and its physicochemical properties. *Journal of Food Engineering* 95: 54–61.
- Prayudi, A., Yuniarti, T., & Taryoto, A. H. (2019). *Potensi hasil samping industri perikanan sebagai sumber bahan baku produk penyedap rasa alami* [Potentially of fishery industrial by-product as a source of raw materials for natural flavor products]. Prosiding Seminar Nasional Perikanan dan Penyuluhan II, 1(1), 1–17.
- Priya, S. P., Jayakumar., Mathai, V., Chintu & Babu, S. (2012). Immobilization and kinetic studies of bromelain: a plant cysteine bromelain from pineapple (ananas comosus) plant parts. *Int J Med Health Sci.*, Vol. 1 (3): 10-16.
- Purwaningsih, I. (2017). Potensi enzim bromelin sari buah nanas (*ananas comosus l.*) dalam meningkatkan kadar protein pada tahu. *Jurnal Teknologi Laboratorium*, Vol. 6(1), 39 - 46.
- Puspawati, G., et al. (2017). Optimization of enzyme concentration and hydrolysis time for producing fish protein hydrolysate. *Journal of Food Processing and Preservation*.
- Putalan, N., Munifah, A., Nurhayati, T., & Chasanah, E. (2018). Optimasi proses hidrolisis protein ikan menggunakan enzim: faktor-faktor yang mempengaruhi. *Jurnal Teknologi Hasil Perikanan*, 11(2), 123-130.

- Putra, R. E., et al. (2017). Antioxidant activity of pangasius fish protein hydrolysate. *Indonesian Journal of Marine Sciences*, 22(2), 45–52.
- Putra, A. Y. T., Rosida, D. F., & Priyanto, A. D. (2021). Influence of enzyme concentration and hydrolysis time on soluble protein content of protein hydrolysate prepared from apple snail (*pila ampullacea*). *International Journal of Eco-Innovation in Science and Engineering*, Vol. 2 (2): 26-30.
- Qian, B., Zhao, X., Yang, Y., & Tian, C. (2020). Antioxidant and anti-inflammatory peptida fraction from oyster soft tissue by enzymatic hydrolysis. *Food Science & Nutrition*, Vol. 8 (7): 3947-3956.
- Raghunath, T. M. & Shamkant, B. B. (2010). biologicals aspects of proteolytic enzymes: a review. *Journal of Pharmacy Research*, Vol. 3 (9): 2048-2062.
- Restiani, R. (2016). Hidrolisis secara enzimatis protein bungkil biji nyamplung (*calophyllum inophyllum*) menggunakan bromelain. *Biota* Vol. 1 (3): 103-110.
- Riyanto, B., Trilaksani, W., & Azzahra, V. A. (2020). Mutu dan umur simpan cookies yang difortifikasi dengan hidrolisat protein ikan. *Jurnal Fishtech*
- Roslan, M. A., Hadi, M. Y., & Sari, R. (2014). Komposisi kimia dan profil asam amino dari hidrolisat protein limbah ikan nila (*oreochromis niloticus*). *Jurnal Teknologi dan Industri Pangan*, 10(3), 212-220.
- Rutherford, S. M. (2010). Methodology for determining degree of hydrolysis of proteins in hydrolysates: a review. *Journal of AOAC International*, Vol. 93 (5): 1515-1522.
- Sari, D. K. (2017). Morphological characteristics and habitat of *stolephorus indicus* in Indonesian waters. *Journal of Marine Biology Research*, 29(2), 112-120
- Sari, N. P., et al. (2019). Antioxidant properties of fish protein hydrolysates from mackerel using papain. *Indonesian Food Science Journal*, 10(1), 23–29.
- Sahraini, F., Razak, A. R., Bahri, S., & Hardi, Y. (2021). *Hidrolisis protein teripang hitam (Holothuria edulis) menggunakan bromelin kasar dari batang nanas (Ananas comocus L)*. KOVALEN: Jurnal Riset Kimia, 7(3), 214–219.
- Samaranayaka, A. G. P., & Li-Chan, E. C. Y. (2016). Food-derived peptides antioxidants: a review of their production, assessment, and potential applications. *Journal of Functional Foods*, 20, 16-29.
- Sa´Nchez, A. & Va´Zquez, A. (2017). Bioactive peptidas. *Food Qual. Saf.* 1: 29-46.
- Saallah, S., Ishak, N. H., & Sarbon, N. M. (2020). Effect of different molecular weight on the antioxidant activity and physicochemical properties of golden

- apple snail (*ampullariidae*) protein hydrolysates. *Food Research*, Vol. 4 (4): 1363-1370.
- Sadeer, N. B., Montesano, D., Albrizio, S., Zengin, G., & Mahomoodally, M. F. (2020). The versatility of antioxidant assays in food science and safety-chemistry, applications, strengths, and limitations. *Antioxidant*, Vol. 9 (8): 709.
- Salami, M., Yousefi, R., Ehsani, M. R., Razavi, S. H., & Faraji, R. (2017). Chemical and enzymatic hydrolysis of food proteins: a review. *Journal of Food Science and Technology*, 54(12), 3939-3950
- Septianingrum, E., Kusbiantoro., (2016)., Balai Besar Penelitian Tanaman Padi Jl Raya, B., Pos, T., Subang, C., & Barat, -Jawa. (n.d.). Review Indeks Glikemik Beras: Faktor-Faktor yang Mempengaruhi dan Keterkaitannya terhadap Kesehatan Tubuh Rice Glycemic Index: The Factors Affecting and The Impact on Human Health.
- Sharma S, Raghvendar S, Shashank R. (2011). A review: bioactive peptidas. *Bioautomation*. 14(4): 223-250.
- Sila, A., dan Ali, B. (2016). Antioxidant peptidas from marine by-product: isolation, identification and application in the food system: a review. *Journal of Fuctional Foods*, Vol. 21:10-26.
- Silva, F. V. M., & Silveira, M. R. (2018). Application of bromelain extract in protein hydrolysis of fish. *Journal of Food Science and Technology*, 55(6), 2228-2236
- Simamora, A. (2015). Buku Ajar Blok 3 Biologi Sel 1: Asam Amino, Peptida, dan Protein. Fakultas Kedokteran Ukrida.
- Singh N, Kaur L, Sodhi NS, Sekhon KS. (2005). Physicochemical, cooking and textural properties of milled rice from different Indian rice cultivars. *Food Chem*. 89:253-259.
- Smith, A., Brown, J., & Williams, K. (2018). Structural and functional analysis of serum albumin. *Journal of Biochemistry*, 275(3), 345-359.
- Sholahuddin, M. A., Lastuti, N. D., & Amin, M. (2024). *Effect of differences bromelain enzyme concentration on protein hydrolysate from waste of tilapia viscera (Oreochromis sp.) on antioxidant activity*. Jurnal Biosains Pascasarjana, 26, 1–8. Sekolah Pascasarjana Universitas Airlangga.
- Sriket, P. (2018). Characteristics and functional properties of proteins in fish muscle. *International Journal of Food Science and Technology*, 53(2), 232-240.

- Suhartono, B., Sari, R. A., & Santoso, M. (2011). Profil asam amino dan pencernaan hidrolisat protein ikan teri dibandingkan dengan tepung ikan teri konvensional. *Jurnal Pangan dan Gizi*, 6(2), 99-106.
- Sunatrio S. (2003). Peran Albumin Pada Penyakit Kritis, Dalam Konsensus Pemberian Albumin Pada Sirosis Hati. Jakarta: Fakultas Kedokteran UI
- Suprayitno, E., & Sulistiyati, W. (2017). Kimia asam amino dan perannya dalam sintesis protein. *Jurnal Biokimia dan Bioteknologi*, 5(1), 45-60.
- Surono, I. S., et al. (2014). Proximate composition, amino acid and fatty acid profiles of marine fish and shellfish from south sulawesi waters. *Journal of Food Science and Technology*.
- Susanti, R. dan Fibriana, F. (2017). Teknologi Enzim. Yogyakarta: CV. Andi Offset.
- Susanty, A., & Kusumaningrum, I. (2021). Pengaruh waktu hidrolisis terhadap karakteristik hidrolisat protein ikan toman (*channa micropeltes*) asal das kalimantan timur effects of hydrolisys time on characteristic of hydrolysat protein of toman fish (*channa micropeltes*) from mahakam river, east kalimantan (Vol. 15, Issue 2).
- Sutrisno, A. (2017). Teknologi Enzim. Malang: Universitas Brawijaya Press
- Syah, Y. M., Andayani, R., & Mulyani, S. (2012). kandungan protein dalam hidrolisat protein ikan teri yang dihasilkan melalui proses hidrolisis enzimatik. *Jurnal Teknologi Hasil Perikanan*, 8(1), 45-52.
- Tacias-Pascacio, V. G., Castañeda-Valbuena, D., Tavano, O., Abellanas-Perez, P., de Andrades, D., Santiz-Gómez, J. A., Berenguer-Murcia, Á., & Fernandez-Lafuente, R. (2024). A review on the immobilization of bromelain. *International Journal of Biological Macromolecules*, 273(Part 2), 133089. <https://doi.org/10.1016/j.ijbiomac.2024.133089>
- Taheri, S., Motallebi, A.A., Fazlara, A., Aghababayan, A. and Aftabsavar, Y. (2017). Changes of fatty acid profiles in fillets of Cobia (*Rachycentron canadum*) during frozen storage. *Iranian Journal of Fisheries Sciences*, 11(1), 204-213
- Taniyo, W., Salimi, Y. K., & Iyabu, H. (2021). The protein hydrolyzate antioxidant characteristics and activities of nile fish (*awoos melanocephalus*). In *Jurnal Pendidikan Kimia dan Ilmu Kimia* (Vol. 4, Issue 2).
- Udenigwe, C. C. dan Aluko, R. E. (2011). Chemometric analysis of the amino acid requirement of antioxidant food protein hydrolysates. *International Journal of Molecular Sciences*, Vol. 12: 3148-3161.
- Utomo, W. B., Suryanigrum, T., & Harianto, T. (2014). Pengaruh variasi suhu dan waktu terhadap hasil hidrolisis protein ikan. *Jurnal Pengolahan dan Bioteknologi Perikanan*, 7(1), 35-42.

- Voet, D., & Voet. J. G. (2016). Biochemistry (4th ed.). John Wiley & Sons.
- Wahyuningtyas, W. S. (2018). Aktivitas Antioksidan Hidrolisat Protein Ikan Air Laut dan Ikan Air Tawar. Skripsi. Jurusan Teknologi Hasil Pertanian Fakultas Teknologi Pertanian Universitas Jember.
- Wang, S., *et al.* (2016). Quality characteristics of instant rice with different cooling methods. *Journal of Cereal Science*.
- Wardhani, A. W. K., Muhandri, T., Faridah, D. N., & Andarwulan, N. (2024). Karakteristik fisik, kimia, fungsional, dan sensori nasi gurih instan dibandingkan dengan nasi putih instan. *Jurnal Teknologi dan Industri Pangan*, 35(1), 92–105. <https://doi.org/10.6066/jtip.2024.35.1.92>
- Warris, P. D. (2017). Meat Science: An Introductory Text (2nd ed.). CABI Publishing
- Wenno, M. R., Leiwakabessy, J., Wattimena, M. L., Lewerissa, S., Savitri, I. K. E., Silaban, B. br., Nanlohy, E. E. E. M., & Tupan, J. (2022). Komposisi kimia dan profil asam amino dari hidrolisat enzimatik daging ikan kembung (*Rastrelliger sp.*). INASUA: Jurnal Teknologi Hasil Perikanan, 2(2), 70–74. <https://doi.org/10.30598/jinasua.2022.2.2.169>
- Whitaker, J.R., Voragen, A.G.J. dan Wong D.W.S. (2003). Handbook Of Food Enzymology, page 1052. New York: Marcel Dekker, Inc.
- Widianingsih, I. (2018). Utilization of anchovy as a sustainable food source in indonesia. *Journal of Marine and Fisheries Research*, 30(3), 156-165
- Widiastuti, R., *et al.* (2018). Effect of bromelain concentration and hydrolysis time on the functional properties of fish protein hydrolysate from mackerel (*rastrelliger sp.*). *International Journal of Food Science and Technology*.
- Widjanarko, S. B., *et al.* (2021). Optimasi waktu hidrolisis protein ikan kakap merah. *Jurnal Teknologi dan Industri Pangan*, 32(1), 17–24.
- Wijayanti, I., dan Laras Rianingsih Program Studi Teknologi Hasil Perikanan, R., Perikanan Fakultas Perikanan dan Ilmu Kelautan, J., Diponegoro Jl Soedarto, U., & Tembalang, S. (2016). Karakteristik hidrolisat protein ikan bandeng (*chanos chanos forsk*) dengan konsentrasi enzim bromelin yang *Indonesian Journal of Fisheries Science and Technology (IJFST)* 11(2), 129–133. www.wpi.kkp.go.id
- Wisuthiphaet, N. dan Kongruang, S. (2015). Production of fish protein hydrolysates by acid and enzymatic hydrolysis. *Journal of Medical and Bioengineering*, Vol. 4 (6): 466-470.
- Witono, Y., Maryanto, M., Taruna, I., Masahid, A. D., & Cahyaningati, K. (2020). Aktivitas antioksidan hidrolisat protein ikan wader (*Rasbora jacobsoni*) dari

- hidrolisis oleh enzim calotropin dan papain. *Jurnal Agroteknologi*, 14(1), 44–57.
- Wu, R., Wu, C., Liu, D., Yang, X., Huang, J., Zhang, J., Li, H. (2016). Overview of antioxidant peptidas derived from marine resources: the sources, characteristic, purification, and evaluation methods. *Applied Biochemistry and Biotechnology*, Vol. 176 (7): 1815-1833.
- Xiong, Y. L. (2010). Antioxidant Peptidas in Bioactive Proteins and Peptidas as Functional Foods and Nutraceuticals. USA: Blackwell Publishing Ltd. and Institute of Food Techonology.
- Yang, X., Li, Y., Li, S., Ren, X., Olayemi Oladejo, A., Lu, F., & Ma, H. (2020). Effects and mechanism of ultrasound pretreatment of protein on the maillard reaction of protein-hydrolysate from grass carp (*Ctenopharyngodon idella*). *Ultrasonics Sonochemistry*, Vol. 64.
- Yu, Kuang-Cheng., Chien-Cheng. Chen, and PeiCheng Wu. (2011). Research on application and rehydration rate of vacuum freeze drying of rice. *Journal of Applied Sciences* 11 (3): 535– 41.
- Yuliani, S., et al. (2015). Nutritional composition and potensial health benefits of anchovies (*Stolephorus spp*). *Journal of Aquatic Food Product Technology*.
- Yuniarti, T., A.Prayudi., L.Supenti., H.Suhrawarden dan P.Martosuyono. (2021). Produksi dan profil kimia hidrolisat protein dari hasil samping pengolahan udang segar. *Jurnal Perikanan*. 23(1):63-69.
- Yusnaini, et al. (2020). Potensi hidrolisat protein kepala ikan tuna sebagai antioksidan. *Jurnal Bioteknologi Tropis*, 17(3), 101–110.
- Zarei, M., Muhialdin, B. J., & Hassanzadeh, K. (2022). *Enzymatic hydrolysis of proteins*. In *Bioactive Peptides from Food: Production and Health Benefits* (pp. 217–245). CRC Press.
- Zayas, J. F. (2016). Functionality of proteins in food. *Journal of Applied Sciences* 15 (6): 65–12
- Zhang, Y., Venkitasamy, C., Pan, Z., & Wang, W. (2015). Mechanism of protein hydrolysis and application of hydrolysates in food industry. *Food Science & Technology*.
- Zhang, S. B., Wang, Z., Xu, S. Y. (2010). Antioxidant activity of a novel peptide from silver carp (*Hypophthalmichthys molitrix*) protein hydrolysate. *Food Chemistry*, 126(1), 121–126.
<https://doi.org/10.1016/j.foodchem.2010.10.086>