DAFTAR PUSTAKA

1. Lo S, Fauzi MB. Current update of collagen nanomaterials—fabrication, characterisation and its applications: A review. Pharmaceutics. 2021;13(3):1–18.
2. Alves AL, Marques ALP, Martins E, Silva TH, Reis RL. Cosmetic potential of marine fish skin collagen. Cosmetics. 2017;4(39):1–16.
3. Wulandari, Suptijah P, Tarman K. Efektivitas pretreatment alkali dan hidrolisis asam asetat terhadap karakteristik kolagen dari kulit ikan gabus. J Pengolah Has Perikan Indones. 2015;18(3):287–302.
4. Listyanto N, Andriyanto S. Ikan Gabus (Channa striata) Manfaat Pengembangan dan Alternatif Teknik Budidayanya. Media Akuakultur. 2009;4(1):18–25.
5. Nofita R. Pembuatan Film Balutan Primer yang Mengandung Kolagen Kulit Ikan Gabus (Channa Striata) dan Pengaruh Film Terhadap Penyembuhan Luka Bakar [disertasi]. Padang: Fakultas Kedokteran Universitas Andalas; 2017.
6. Sionkowska A, Adamiak K, Musial K, Gadomska M. Collagen based materials in cosmetic applications: A review. Materials (Basel). 2020;13(4217):1–15.
7. Setyowati H, Setyani W. Potensi nanokolagen limbah sisik ikan sebagai cosmeceutical. J Farm Sains Dan Komunitas. 2015;12(1):31–40.
8. Friess W. Collagen - biomaterial for drug delivery. Eur J Pharm Biopharm. 1998;45(2):113–36.
9. Avila Rodríguez MI, Rodríguez Barroso LG, Sánchez ML. Collagen: A review on its sources and potential cosmetic applications. J Cosmet Dermatol. 2018 Feb 1;17(1):20–6.
10. Sionkowska A, Wisniewski M, Skopinska J, Mantovani D. Effects of solar radiation on collagen-based biomaterials. Int J Photoenergy. 2006;2006:1–6.
11. Matsumura Y, Ananthaswamy HN. Toxic effects of ultraviolet radiation on the skin. Toxicol Appl Pharmacol. 2004;195(3):298–308.
12. Metreveli NO, Jariashvili KK, Namicheishvili LO, Svintradze D V., Chikvaidze EN, Sionkowska A, Skopinska J. UV-vis and FT-IR spectra of ultraviolet irradiated collagen in the presence of antioxidant ascorbic acid. Ecotoxicol Environ Saf. 2010;73(3):448–55.
13. Sionkowska A, Lewandowska K, Adamiak K. The influence of UV light on rheological properties of collagen extracted from silver carp skin. Materials (Basel). 2020;13(19):1–10.
14. Rabotyagova OS, Cebe P, Kaplan DL. Collagen structural hierarchy and susceptibility to degradation by ultraviolet radiation. Mater Sci Eng C. 2008;28(8):1420–9.
15. Sionkowska A. Effects of solar radiation on collagen and chitosan films. J Photochem Photobiol B Biol. 2006;82(1):9–15.
16. Lewandowska K, Szulc M, Sionkowska A. Effect of solvent on the hydrodynamic properties of collagen. Polymers (Basel). 2021;13(3626):1–8.
17. Jariashvili K, Madhan B, Brodsky B, Kuchava A, Namicheishvili L,

Metreveli N. UV damage of collagen: Insights from model collagen peptides. Biopolymers. 2012;97(3):189–98.
18. Erizal, Abbas B, A.K. RS, G.S. S, Sudirman. Pengaruh Iridiasi Gamma pada Sifat Fisiko-Kimia Kolagen dalam Larutan. J Sains Mater Indones. 2012;33(2):160.
19. Matillano JD. Channa striata (Bloch 1793): Striped snakehead [Internet]. FishBase. [cited 2021 Jun 17]. Available from: https://www.fishbase.se/summary/343
20. Rosmawati, Abustam E, Tawali AB, Said MI, Sari DK. Effect of body weight on the chemical composition and collagen content of snakehead fish Channa striata skin. Fish Sci. 2018;84(6):1081–9.
21. Bower DI. An Introduction to Polymer Physics. New York: Cambridge University Press; 2002. 465 p.
22. Sinko PJ, Singh Y. Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical chemical and biopharmaceutical principles in the pharmaceutical sciences. 6th ed. Philadelphia: Lippincott Williams & Wilkins; 2011.
23. Suprayitno E, Sulistiyati TD. Metabolisme Protein. 1st ed. Malang: Universitas Brawijaya Press; 2017.
24. Zhang X, Xing H, Zhao Y, Ma Z. Pharmaceutical dispersion techniques for dissolution and bioavailability enhancement of poorly water-soluble drugs. Pharmaceutics. 2018;10(74):1–33.
25. Satoh A. Introduction to Molecular-Microsimulation of Colloidal Dispersions. 1st ed. Amsterdam: Elsevier Science; 2003.
26. Gaud RS, Yadav A V, Yeole PG, Gokhale SB. Text Book of Pharmaceutics. 10th ed. Pune: Nirali Prakashan; 2008.
27. Kramer RZ, Bella J, Mayville P, Brodsky B, Berman HM. Sequence dependent conformational variations of collagen triple-helical structure. Nat Struct Biol. 1999;6(5):454–7.
28. Gelse K. Collagens—structure, function, and biosynthesis. Adv Drug Deliv Rev. 2003 Nov 28;55(12):1531–46.
29. Ramshaw JAM, Shah NK, Brodsky B. Gly-X-Y tripeptide frequencies in collagen: A context for host-guest triple-helical peptides. J Struct Biol. 1998;122(1–2):86–91.
30. Van Der Rest M, Garrone R. Collagen family of proteins. FASEB J. 1991;5(13):2814–23.
31. Stryer L. Stryer Biochemistry. 4th ed. Biochemistry textbook. New York: Freeman and Company; 1995. 1120 p.
32. Katili AS. Struktur Dan Fungsi Protein Kolagen. J Pelangi Ilmu. 2009;2(5):19–29.
33. Page DS. Prinsip-Prinsip Biokimia (Terjemahan). 2nd ed. Jakarta: Erlangga; 1989.
34. Sionkowska A, Skrzyński S, Śmiechowski K, Kołodziejczak A. The review of versatile application of collagen. Polym Adv Technol. 2016 Jan;28(1):4–9.
35. MedlinePlus. Osteogenesis imperfecta [Internet]. 2020 [cited 2021 Dec 5]. Available from: https://medlineplus.gov/genetics/condition/osteogenesis-imperfecta/

36. Parenteau-Bareil R, Gauvin R, Berthod F. Collagen-based biomaterials for tissue engineering applications. Materials (Basel). 2010 Mar 16;3(3):1863–87.
37. Kumar VA, Taylor NL, Jalan AA, Hwang LK, Wang BK, Hartgerink JD. A nanostructured synthetic collagen mimic for hemostasis. Biomacromolecules. 2014;15(4):1484–90.
38. Bailey AJ, Paul RG. Collagen: A not so simple protein. J Soc Leather Technol Chem. 1998;82(3):104–10.
39. Sorushanova A, Delgado LM, Wu Z, Shologu N, Kshirsagar A, Raghunath R, Mullen AM, Bayon Y, Pandit A, Raghunath M, Zeugolis DI. The collagen suprafamily: From biosynthesis to advanced biomaterial development. Adv Mater. 2018 Jan;31(1):1–39.
40. Chan BP, So K-F. Photochemical crosslinking improves the physicochemical properties of collagen scaffolds. J Biomed Mater Res Part A. 2005 Dec 1;75A(3):689–701.
41. Zhang Q, Liu L, Zhou H, Wu X, Yao KD. pH-responsive swelling behavior of collagen complex materials. Artif Cells, Blood Substitutes, Biotechnol. 2000 Jan 11;28(3):255–62.
42. Daniel RM, Dines M, Petach HH. The denaturation and degradation of stable enzymes at high temperatures. Biochem J. 1996 Jul 1;317(1):1–11.
43. Masutani EM, Kinoshita CK, Tanaka TT, Ellison AKD, Yoza BA. Increasing thermal stability of gelatin by UV-induced cross-linking with glucose. Int J Biomater. 2014;2014(979636):1–9.
44. Liu D, Nikoo M, Boran G, Zhou P, Regenstein JM. Collagen and gelatin. Annu Rev Food Sci Technol. 2015 Apr 10;6(1):527–57.
45. Chai H-J, Li J-H, Huang H-N, Li T-L, Chan Y-L, Shiau C-Y, Wu C-J. Effects of sizes and conformations of fish-scale collagen peptides on facial skin qualities and transdermal penetration efficiency. J Biomed Biotechnol [Internet]. 2010;2010:1–9. Available from: http://www.hindawi.com/journals/bmri/2010/757301/
46. Nur'Afni R. Formulasi Film Yang Mengandung Kolagen Kulit Ikan Gabus (Channa Striata Bloch,1793) Sebagai Balutan Primer Luka Diabetes Pada Mencit Putih Jantan [skripsi]. Padang: Fakultas Farmasi Universitas Andalas; 2021.
47. Amalia D. Uji Efektivitas Film Kolagen dari Kulit Ikan Gabus (Channa striata) sebagai Pembalut Luka Primer terhadap Penyembuhan Dermatitis Kontak Iritan pada Mencit [skripsi]. Padang: Fakultas Farmasi Universitas Andalas; 2021.
48. Campbell D, Pethrick RA, White JR. Polymer Characterization: Physical Techniques. 2nd ed. Florida: CRC Press; 2000.
49. Riaz T, Zeeshan R, Zarif F, Ilyas K, Muhammad N, Safi SZ, Rahim A, Rizvi SAA, Rehman IU. FTIR analysis of natural and synthetic collagen. Appl Spectrosc Rev. 2018;53(9):703–46.
50. Dachriyanus. Analisis Struktur Senyawa Organik Secara Spektroskopi. Padang: Lembaga Pengembangan Teknologi Infomasi dan Komunikasi Universitas Andalas; 2004.
51. Suhartati T. Dasar-Dasar Spektrofotometri UV-Vis dan Spektrometri Massa untuk Penentuan Struktur Senyawa Organik. Bandar Lampung: AURA;

2017.
52. Ju H, Liu X, Zhang G, Liu D, Yang Y. Comparison of the structural characteristics of native collagen fibrils derived from bovine tendons using two different methods: Modified acid-solubilized and pepsin-aided extraction. Materials (Basel). 2020;13(358):2–13.
53. Seixas MJ, Martins E, Reis RL, Silva TH. Extraction and characterization of collagen from elasmobranch byproducts for potential biomaterial use. Mar Drugs. 2020;18(617):1–18.
54. Samouillan V, Delaunay F, Dandurand J, Merbahi N, Gardou J-P, Yousfi M, Gandaglia A, Spina M, Lacabanne C. The Use of Thermal Techniques for the Characterization and Selection of Natural Biomaterials. J Funct Biomater. 2011 Sep 13;2(3):230–48.
55. Thompson JM. Infrared Spectroscopy. In: 1st ed. New York: Jenny Stanford Publishing; 2018. p. 1–33.
56. Gandjar IG, Rohman A. Analisis Obat Secara Spektrofotometri dan Kromatografi. Yogyakarta: Pustaka Pelajar; 2012.
57. Belbachir K, Noreen R, Gouspillou G, Petibois C. Collagen types analysis and differentiation by FTIR spectroscopy. Anal Bioanal Chem. 2009;395(3):829–37.
58. Stani C, Vaccari L, Mitri E, Birarda G. FTIR investigation of the secondary structure of type I collagen: New insight into the amide III band. Spectrochim Acta - Part A Mol Biomol Spectrosc. 2020;229(118006):1–7.
59. Ausili A, Sánchez M, Gómez-Fernández JC. Attenuated total reflectance infrared spectroscopy: A powerful method for the simultaneous study of structure and spatial orientation of lipids and membrane proteins. Biomed Spectrosc Imaging. 2015;4(2):159–70.
60. Ramli AR, Annisa AR, Bahmid NA, Mustafa MD. Isolation of papain-soluble collagen from the skin of snake-head fish (Channa striata). Canrea J Food Technol Nutr Culin J. 2020;3(2):87–93.
61. Sari NM. Ekstraksi dan Karakterisasi Kolagen Tulang Ayam Broiler (Gallus domesticus) dengan Variasi Lama Perendaman Pelarut Asam Sitrat [skripsi]. Malang: Fakultas Sains dan Teknologi Universitas Islam Negeri Maulana Malik Ibrahim; 2021.
62. Das MP, R. SP, Prasad K, Jv V, M R. Extraction and characterization of gelatin: a functional biopolymer. Int J Pharm Pharm Sci. 2017;9(9):239–42.
63. Abdelmalek BE, Gómez-Estaca J, Sila A, Martinez-Alvarez O, Gómez-Guillén MC, Chaabouni-Ellouz S, Ayadi MA, Bougatef A. Characteristics and functional properties of gelatin extracted from squid (Loligo vulgaris) skin. LWT - Food Sci Technol. 2016 Jan;65:924–31.
64. Sinko PJ, Singh Y. Chapter 19: Rheology. In: Martin's Physical Pharmacy and Pharmaceutical Sciences. 6th ed. Philadelphia; 2011. p. 469–91.
65. Zołek-Tryznowska Z. Rheology of Printing Inks. In: Printing on Polymers: Fundamentals and Applications. 2015. p. 87–99.
66. Ametek Brookfield. More Solutions to Sticky Problems. Measurement Techniques. Massachusetts: AMETEK Brookfield; 2017. 58 p.
67. Rauschkolb JC, Ribeiro BC, Feiden T, Fischer B, Weschenfelder TA, Cansian RL, Junges A. Parameter estimation of mark-houwink equation of polyethylene glycol (PEG) using molecular mass and intrinsic viscosity in

water. Biointerface Res Appl Chem. 2022;12(2):1778–90.
68. Yang H, Deng Y, Xu S, Liu W, Li G. Investigation on the interaction of collagen molecules in solution with different acetic acid concentrations. J Appl Polym Sci. 2017;134(35):45255.
69. Lee DH, Jung JM, Kim SY, Kim KT, Cho YI. Comparison tests for plasma viscosity measurements. Int Commun Heat Mass Transf. 2012;39(10):1474–7.
70. Abdul-Majeed MO. Effect of Diarrheastat® and Enrosol-S® on rumen ecosystem in rams. Iraqi J Vet Sci. 2011;25(1):29–33.
71. Narayanan DL, Saladi RN, Fox JL. Ultraviolet radiation and skin cancer. Int J Dermatol. 2010;49(9):978–86.
72. Anonim. UV Radiation [Internet]. National Center for Environmental Health. 2021 [cited 2021 Jul 1]. Available from: https://www.cdc.gov/nceh/features/uv-radiation-safety/index.html
73. Yarovaya L, Waranuch N, Wisuitiprot W, Khunkitti W. Effect of grape seed extract on skin fibroblasts exposed to UVA light and its photostability in sunscreen formulation. J Cosmet Dermatol. 2020 Apr 21;20(4):1271–82.
74. Diffey BL. Sources and measurement of ultraviolet radiation. Methods. 2002;28(1):4–13.
75. Xu C, Wei X, Shu F, Li X, Wang W, Li P, Li Y, Li S, Zhang J, Wang H. Induction of fiber-like aggregation and gelation of collagen by ultraviolet irradiation at low temperature. Int J Biol Macromol. 2020;153:232–9.
76. Miles CA, Sionkowska A, Hulin SL, Sims TJ, Avery NC, Bailey AJ. Identification of an intermediate state in the helix-coil degradation of collagen by ultraviolet light. J Biol Chem. 2000;275(42):33014–33020.
77. Ramdhani F.G. G, Ariani A. Pengambilan Kolagen Pada Sisik Ikan dari Limbah Pabrik Fillet Ikan Menggunakan Metode Ekstraksi Asam [tugas akhir]. Surabaya: Fakultas Teknologi Industri Institut Teknologi Sepuluh Nopember; 2016.
78. Cao J, Duan Q, Liu X, Shen X, Li C. Extraction and physicochemical characterization of pepsin soluble collagens from golden pompano (Trachinotus blochii) skin and bone. J Aquat Food Prod Technol. 2019;28(8):837–47.
79. Wulandari. Karakterisasi Fisikokimia Kolagen yang Diisolasi dengan Metode Hidro-Ekstraksi dan Stabilsasi Nanokolagen Kulit Ikan Gabus (Channa striata) [tesis]. Bogor: Sekolah Pascasarjana Institut Pertanian Bogor; 2016.
80. Safithri M, Tarman K, Suptijah P, Widowati N. Karakteristik fisikokimia kolagen larut asam dari kulit okan parang-parang (Chirocentrus dorab). J Pengolah Has Perikan Indones. 2019;22(3):441–52.
81. Alberto M, Gabriela M. Hydrodynamic Properties of Gelatin - Studies from Intrinsic Viscosity Measurements. In: Products and Applications of Biopolymers. Argentina: InTech; 2012. p. 85–116.
82. Mitschka P. Simple conversion of Brookfield R.V.T. readings into viscosity functions. Rheol Acta. 1982;21:207–9.
83. Augusto PED, Cristianini M, Ibarz A. Using the Mitschka-Briggs-Steffe method for evaluation of cactus pear concentrated pulps rheological behavior. Int J Food Eng. 2011;7(6):1–9.

84. Brookfield EL. Brookfield Dial Viscometer: Operating Instructions. Massachusetts: Brookfield Engineering Laboratories; 2018. 36 p.
85. Dongoran DS. Pengaruh aktivator sistein dan natrium klorida terhadap aktivitas papain. J Sains Kim. 2004;8(1):26–8.
86. Silaban R, Panggabean FTM, Rahmadani. Kajian Pemanfaatan Enzim Papain Getah Buah Pepaya untuk Melunakkan Daging. Medan: Universitas Negeri Medan; 2012.
87. Ratnasari I, Yuwono S, Nusyam H, Widjanarko S. Extraction and characterization of gelatin from different fresh water fishes as alternative sources of gelatin. Int Food Res J. 2013;20(6):3085–91.
88. ThermoFisher. PageRuler™ Prestained Protein Ladder, 10 to 180 kDa [Internet]. 2022 [cited 2022 Jun 4]. Available from: https://www.thermofisher.com/order/catalog/product/26616
89. Aksamitiene E, Hoek JB, Kholodenko B, Kiyatkin A. Multistrip Western blotting to increase quantitative data output. Electrophoresis. 2007;28(18):3163–73.
90. BSN. Kolagen kasar dari sisik ikan – Syarat mutu dan pengolahan: SNI 8076-2014. Jakarta: Badan Standarisasi Nasional; 2014.
91. Hadinoto S, Kolanus JPM, Idrus S. Karakterisasi gelembung renang ikan tuna sirip kuning (Thunnus sp.) dan kolagen yang dihasilkan melalui ekstraksi asam asetat. J Pascapanen dan Bioteknol Kelaut dan Perikan. 2019;14(2):129–40.
92. Lynch JM, Barbano DM. Kjeldahl nitrogen analysis as a reference method for protein determination in dairy products. J AOAC Int. 1999;82(6):1389–92.
93. Sumerta IN, Simpen IN. Peningkatan potensi ceker broiler hasil samping dari tempat pemotongan ayam (TPA) menjadi gelatin dengan menggunakan metode ekstraksi terkombinasi. J Bumi Lestari. 2009;9(1):82–6.
94. Miwada INS, Simpen. Kajian waktu curing asam asetat dan rasio kombinasi kloroform-etanol untuk ekstraksi protein kulit ceker. Maj Ilm Peternak. 2013;16(1):28–31.
95. Wijanarko B, Putri LD. Ekstraksi lipid dari mikroalga (Nanochloropsis sp.) dengan solven methanol dan chloroform. J Teknol Kim dan Ind. 2012;1(1):130–8.
96. Matmaroh K, Benjakul S, Prodpran T, Encarnacion AB, Kishimura H. Characteristics of acid soluble collagen and pepsin soluble collagen from scale of spotted golden goatfish (Parupeneus heptacanthus). Food Chem. 2011;129(3):1179–86.
97. Humboldt University of Berlin. Investigation of polymers with differential scanning calorimetry. Adv Lab DSC Investig Polym. 2009;1–17.
98. Bak SY, Lee SW, Choi CH, Kim HW. Assessment of the influence of acetic acid residue on type I collagen during isolation and characterization. Materials (Basel). 2018;11(2518):1–16.
99. Zhang F, Wang A, Li Z, He S, Shao L. Preparation and characterisation of collagen from freshwater fish scales. Food Nutr Sci. 2011;2(8):818–23.
100. Shi X, Ma W, Sun C, Wu S. The aggregation behavior of collagen in aqueous solution and its property of stabilizing liposomes in vitro. Biomaterials. 2001;22(12):1627–34.

101. Qi P, Zhou Y, Wang D, He Z, Li Z. A new collagen solution with high concentration and collagen native structure perfectly preserved. RSC Adv. 2015;5(106):87180–6.
102. Tkachenko N V. Optical Spectroscopy: Methods and Instrumentations. 1st ed. Amsterdam: Elsevier; 2006.
103. Cadnum JL, Pearlmutter BS, Redmond SN, Jencson AL, Benner KJ, Donskey CJ. Ultraviolet-C (UV-C) monitoring made simple: Colorimetric indicators to assess delivery of UV-C light by room decontamination devices. Infect Control Hosp Epidemiol. 2021 Mar 16;43(3):1–6.
104. Nature of Factors Impacting UV-Vis Spectroscopy [Internet]. SMACgig WORLD. [cited 2022 Jun 4]. Available from: https://www.smacgigworld.com/blog/factors-affecting-uv-vis-spectroscopy.php
105. Hansen S, Pedersen-Bjergaard S, Rasmussen K. Introduction to Pharmaceutical Chemical Analysis. West Sussex: Wiley; 2011. 624 p.
106. Chen J, Li J, Li Z, Yi R, Shi S, Wu K, Li Y, Wu S. Physicochemical and functional properties of type i collagens in red stingray (Dasyatis akajei) skin. Mar Drugs. 2019;17(558):1–19.
107. Thahir Z, Wahyuni YS. Aktifitas gel kolagen sisik ikan bandeng (Chanos chanos) kombinasi ekstrak etanol daun bidara (Ziziphus jujuba) terhadap penyembuhan luka bakar pada kelinci (Oryctolagus cuniculus). Media Farm Poltekkes Makassar. 2021;17(2):174–84.
108. Brookfield Engineering Laboratories. Brookfield DV2T Viscometer Operating Instructions. Massachusetts: Brookfield Engineering Laboratories; 2018. 93 p.
109. Wagner NJ, Brady JF. Shear thickening in colloidal dispersions. Phys Today. 2009;62(10):27–32.