



DAFTAR PUSTAKA

- Aertgeerts, K., Ye, S., Tenant, M.G., Kraus, M.L., Rogers, J.O.E., Sang, B.C., Skene, R.J., Webb, D.R. dan Prasad, G.S., 2004. Crystal structure of human dipeptidyl peptidase IV in complex with a decapeptide reveals details on substrate specificity and tetrahedral intermediate formation. *Protein Science*, 13(2), .412-421.
- A.J. Blackman, R.J. Wells, 1976. Caulerpol, a diterpene alcohol, related to vitamin a, from (Algae). *Tetrahedron Letters*, 17(31) , 2729-2730,
- Anjaneyulu, A.S.R., Prakash, C.V.S. dan Mallavadhani, U.V., 1991. Two caulerpin analogues and a sesquiterpene from *Caulerpa racemosa*. *Phytochemistry*, 30(9), 3041-3042.
- Antony, P., Baby, B., Aleissaee, H.M. dan Vijayan, R., 2022. A molecular modeling investigation of the therapeutic potential of marine compounds as DPP-4 Inhibitors. *Marine Drugs*, 20(12), 777.
- Arthur, D.E. dan Uzairu, A., 2019. Molecular docking studies on the interaction of NCI anticancer analogues with human phosphatidylinositol 4, 5-bisphosphate 3-kinase catalytic subunit. *Journal of King Saud University-Science*, 31(4), 1151-1166.
- Banno, Y., Miyamoto, Y., Sasaki, M., Oi, S., Asakawa, T., Kataoka, O., Takeuchi, K., Suzuki, N., Ikeda, K., Kosaka, T. dan Tsubotani, S., 2011. Identification of 3-aminomethyl-1, 2-dihydro-4-phenyl-1-isoquinolones: a new class of potent, selective, and orally active non-peptide dipeptidyl peptidase IV inhibitors that form a unique interaction with Lys554. *Bioorganic & medicinal chemistry*, 19(16), 4953-4970.
- Berger, J.P., SinhaRoy, R., Pocai, A., Kelly, T.M., Scapin, G., Gao, Y.D., Pryor, K.A.D., Wu, J.K., Eiermann, G.J., Xu, S.S. dan Zhang, X., 2018. A comparative study of the binding properties, dipeptidyl peptidase-4 (DPP-4) inhibitory activity and glucose-lowering efficacy of the DPP-4 inhibitors alogliptin, linagliptin, saxagliptin, sitagliptin and vildagliptin in mice. *Endocrinology, Diabetes and Metabolism*, 1(1).
- Bhojwani, H. dan Joshi, U., 2016. Pharmacophore and docking guided virtual screening study for discovery of type i inhibitors of VEGFR-2 Kinase. *Current Computer-Aided Drug Design*, 13(3), 186-207.
- Butt, S.S., Badshah, Y., Shabbir, M. dan Rafiq, M., 2020. Molecular docking using chimera and autodock vina software for nonbioinformaticians. *JMIR Bioinformatics and Biotechnology*, 1(1), 1-25.
- Cavas, L. dan Pohnert, G., 2010. The potential of caulerpa spp. For biotechnological and pharmacological applications. *Seaweeds and their role in globally changing environments*, 385-397.



- Chen, A., Wang, D. dan Ji, C., 2021. Structural and catalytic characterization of TsBGL, a β -glucosidase from *Thermofilum* sp. ex4484_79. *Frontiers in Microbiology*, 12, 1-13. <https://doi.org/10.3389/fmicb.2021.723678>.
- Choi, S.H., Jeong, G.H., Lee, K.B., Jo, C. dan Kim, T.H., 2018. A green chemical oligomerization of phloroglucinol induced by plasma as novel α -glucosidase inhibitors. *Bioscience, Biotechnology, and Biochemistry*, 82(12), 2059-2063.
- Dhorajiwala, T.M., Halder, S.T., dan Samant, L., 2019. Comparative in silico molecular docking analysis of L-threonine-3-dehydrogenase, a protein target against african trypanosomiasis using selected phytochemicals. *Journal of Applied Biotechnology Reports*, 6(3), 101- 108.
- Elkhattabi, L., Zouhdi, S., Moussetad, F., Kettani, A., Barakat, A. dan Saile, R., 2023. Molecular docking analysis of PPAR γ with phytochemicals from Moroccan medicinal plants. *Bioinformation*, 19(7), 795.
- Fallah, Z., Tajbakhsh, M., Alikhani, M., Larijani, B., Faramarzi, M.A., Hamedifar, H., Mohammadi-Khanaposhtani, M. dan Mahdavi, M., 2022. A review on synthesis, mechanism of action, and structure-activity relationships of 1, 2, 3-triazole-based α -glucosidase inhibitors as promising anti-diabetic agents. *Journal of Molecular Structure*, 1255.
- Fan, M., Feng, Q., He, M., Yang, W., Peng, Z., Huang, Y. dan Wang, G., 2022. Synthesis, α -glucosidase inhibition and molecular docking studies of natural product 2-(2-phenylethyl) chromone analogues. *Arabian Journal of Chemistry*, 15(11), 1-14.
- Faulkner, D.J., 1992. Marine natural products. *Natural Product Reports*, 9(4), 323-364.
- Faulkner, D.J., 1995. Marine natural products. *Natural Product Reports*, 12(3), 223-269.
- Faulkner, D.J., 1988. Marine natural products. *Natural Product Reports*, 5(6), 613-663.
- Faulkner, D.J., 2000. Highlights of marine natural products chemistry (1972–1999). *Natural product reports*, 17(1), 1-6.
- Guerriero, A., Meinesz, A., D'Ambrosio, dan Pietra, F., 1992. International diabetes federation. *IDF Diabetes Atlas*. 10th edition. Brussels.
- Hariono, M., Abdullah, N., Damodaran, K.V., Kamarulzaman, E.E., Mohamed, N., Hassan, S.S., Shamsuddin, S. dan Wahab, H.A., 2016. Potential new H1N1 neuraminidase inhibitors from ferulic acid and vanillin: molecular modelling, synthesis and in vitro assay. *Scientific Reports*, 6(1), 38692.



- Lebovitz, H.E., 1999. Type 2 diabetes: an overview. *Clinical chemistry*, 45(8), 1339-1345.
- Li, Y., Zhang, X., Wang, R., Han, L., Huang, W., Shi, H., Wang, B., Li, Z. dan Zou, S., 2020. Altering the inhibitory kinetics and molecular conformation of maltase by tangzhiqing (TZQ), a natural α -glucosidase inhibitor. *BMC Complementary Medicine and Therapies*, 20(1), 1-8.
- Montanari, R., Saccoccia, F., Scotti, E., Crestani, M., Godio, C., Gilardi, F., Loiodice, F., Fracchiolla, G., Laghezza, A., Tortorella, P. dan Lavecchia, A., 2008. Crystal structure of the peroxisome proliferator-activated receptor γ (PPAR γ) ligand binding domain complexed with a novel partial agonist: a new region of the hydrophobic pocket could be exploited for drug design. *Journal of medicinal chemistry*, 51(24), 7768-7776.
- Musfiroh, I., Resti Azura, A. dan Rahayu, D., 2020. Prediction of Asiatic acid derivatives affinity against SARS-CoV-2 main protease using molecular docking. *Pharmaceutical Sciences and Research*, 7(4), 7.
- Nauli, T., 2014. Penentuan sisi aktif selulase aspergillus niger dengan docking ligan. *Indonesian Journal of Applied Chemistry*, 16(2), 94-100.
- Norton, R.S. dan Wells, R.J., 1980. Use of ^{13}C spin-lattice relaxation measurements to determine the structure of a tetrabromo diphenyl ether from the sponge *Dysidea herbacea*. *Tetrahedron Letters*, 21(39), 3801-3804.
- Nusantoro, Y.R. and Fadlan, A., 2020. Analisis sifat mirip obat, prediksi admet, dan penambatan molekular isatinil-2-aminobenzoilhidazon dan kompleks logam transisi Co (II), Ni (II), Cu (II), Zn (II) Terhadap BCL2-XL. *Akta Kimia Indonesia*, 5(2), 114-126.
- Ojeda-Montes, M.J., Gimeno, A., Tomas-Hernández, S., Cereto-Massagué, A., Beltrán-Debón, R., Valls, C., Mulero, M., Pujadas, G. dan Garcia-Vallvé, S., 2018. Activity and selectivity cliffs for DPP-IV inhibitors: Lessons we can learn from SAR studies and their application to virtual screening. *Medicinal Research Reviews*, 38(6), 1874-1915.
- Papriani, N. P., Yusriadi, dan Rusdin, A., 2022. Isolasi dan Penentuan Aktivitas Spesifik Enzim α -Glukosidase Dari Jagung Pulut (*Zea Mays Ceratina L*). *Journal of Health, Education, Economics, Science, and Technology*, 5(1), 39-42.
- Patrick, G. L., 2013. An Introduction to Medicinal Chemistry Fifth Edition. Oxford University Press, Oxford.
- Paul, V.J. dan Fenical, W., 1987. Natural products chemistry and chemical defense in tropical marine algae of the phylum chlorophyta. *Bioorganic Marine Chemistry*, 1-29.



- Paul, N.A., Neveux, N., Magnusson M, De Nys R., 2013. Comparative production and nutritional value of “sea grapes” - the tropical green seaweeds *Caulerpa lentillifera* and *Caulerpa racemosa*. *J Appl. Phycol.*, 26(4), 1833-1844.
- Pratama, M.R.F., Poerwono, H. dan Siswodihardjo, S., 2021. Introducing a two-dimensional graph of docking score difference vs. similarity of ligand-receptor interactions. *Indonesian Journal of Biotechnology*, 26(1), 54-60.
- Prayogi, S., Dhiani, B.A. dan Djalil, A.D., 2023. Molecular Docking of Bicycloproline Derivative Synthetic Compounds on Envelope Protein: Anti-SARS-CoV-2 Drug Discovery. *Jurnal Farmasi dan Ilmu Kefarmasian Indonesia*, 10(1), 11-21.
- Rao, M.M. dan Hariprasad, T.P.N., 2021. In silico analysis of a potential antidiabetic phytochemical erythrin against therapeutic targets of diabetes. *In Silico Pharmacology*, 9, 1-12.
- Rendi, I.P., Maranata, J., Chaerunisa, H., Nugraheni, N. dan Alfathonah, S.S., 2021. Molecular docking of compounds in moringa oleifera lam with dipeptidyl peptidase-4 receptors as antidiabetic candidates. *Jurnal Farmasi dan Ilmu Kefarmasian Indonesia*, 8(3), 242-249.
- Rochfort, S.J., Watson, R. dan Capon, R.J., 1996. Dictyosphaerin: a novel bicyclic lipid from a southern australian marine green algae, *dictyosphaeria sericea*. *Journal of Natural Products*, 59(12), 1154-1156.
- Roig-Zamboni, V., Cobucci-Ponzano, B., Iacono, R., Ferrara, M.C., Germany, S., Bourne, Y., Parenti, G., Moracci, M. dan Sulzenbacher, G., 2017. Structure of human lysosomal acid α -glucosidase—a guide for the treatment of Pompe disease. *Nature communications*, 8(1), 1111.
- Sajal, H., Patil, S.M., Raj, R., Shbeer, A.M., Ageel, M. dan Ramu, R., 2022. Computer-aided screening of phytoconstituents from *ocimum tenuiflorum* against diabetes mellitus targeting DPP4 inhibition: a combination of molecular docking, molecular dynamics, and pharmacokinetics approaches. *Molecules*, 27(16), 1-18.
- Scheuer, P.J. dan Higa, T., 1987. *Bioorganic marine chemistry*. Springer-Verlag.
- Sengupta, S., Datta, M. dan Datta, S., 2023. β -Glucosidase: Structure, function and industrial applications. Academic Press. <https://doi.org/10.1016/B978-0-323-91805-3.00004-6>.
- Shin, H., Seo, D.H., Seo, J., Lamothe, L.M., Yoo, S.H. dan Lee, B.H., 2019. Optimization of in vitro carbohydrate digestion by mammalian mucosal α -glucosidases and its applications to hydrolyze the various sources of starches. *Food hydrocolloids*, 87, 470-476.

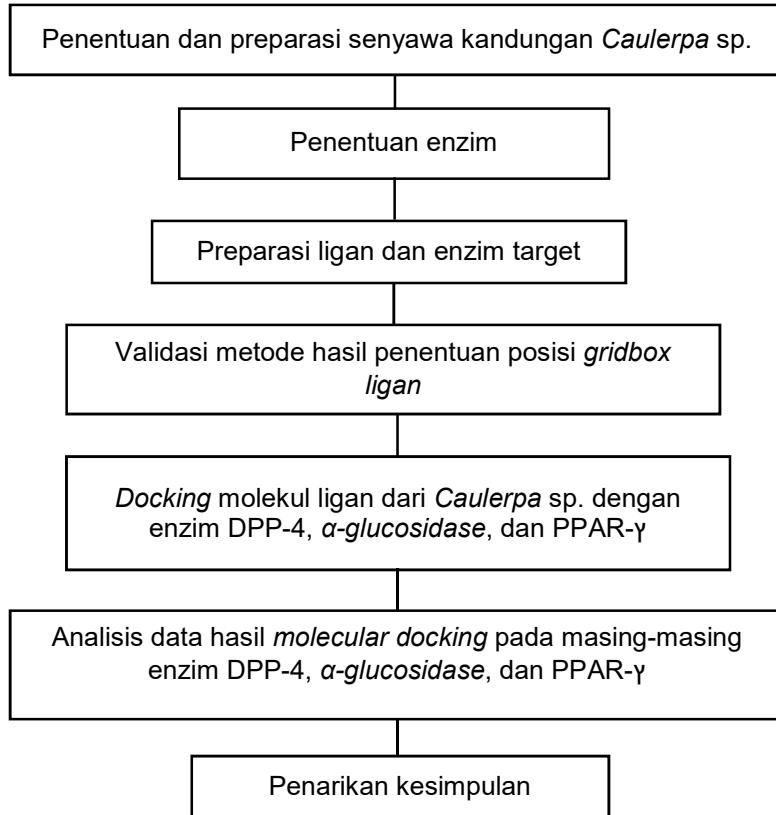


- Sim, L., Quezada-Calvillo, R., Sterchi, E.E., Nichols, B.L. dan Rose, D.R., 2008. Human intestinal maltase–glucoamylase: crystal structure of the N-terminal catalytic subunit and basis of inhibition and substrate specificity. *Journal of Molecular Biology*, 375(3), 782-792.
- Siregar, M., Awaluddin, A., Nurnahari, N., Nur, S., Febrina, E. and Asnawi, A., 2020. Molecular docking and molecular dynamic simulation of the aglycone of curculigoside a and its derivatives as alpha glucosidase inhibitors. *Rasayan Journal of Chemistry*, 13(1).
- Siswandono, 2016. Medicinal Chemistry. Edisi ke-2. Airlangga University Press.
- Su, J.Y., Zhu, Y., Zeng, L.M. dan Xu, X.H., 1997. A new bisindole from alga *Caulerpa serrulata*. *Journal of Natural Products*, 60(10), 1043-1044.
- Trang, N.D. dan Le, L.T., 2012. Targeted proteins for diabetes drug design. *Advances in Natural Sciences: Nanoscience and Nanotechnology*, 3(1).
- Tringali, C., 1997. Bioactive metabolites from marine algae: recent results. *Curr. Org. Chem*, 1(4), 375-394.
- Variya, B.C., Modi, S.J., Savjani, J.K. dan Patel, S.S., 2017. In silico molecular docking and pharmacokinetic prediction of gallic acid derivatives as PPAR- γ agonists. *Int. J. Pharm. Pharm. Sci*, 9, 102-107.
- Yang, P., Liu, D.Q., Liang, T.J., Li, J., Zhang, H.Y., Liu, A.H., Guo, Y.W. dan Mao, S.C., 2015. Bioactive constituents from the green alga *Caulerpa racemosa*. *Bioorganic & Medicinal Chemistry*, 23(1), 38-45.



LAMPIRAN

Lampiran 1. Skema Kerja





Lampiran 2. Senyawa Kandungan *Caulerpa* sp.

2.1 Golongan Alkaloid

Tabel 9. Struktur 2 dimensi senyawa kandungan *Caulerpa* sp. golongan alkaloid

Senyawa 1	Senyawa 2	Senyawa 3
Paul dan Fenical, 1987	Faulkner, 1995	Faulkner, 1995
Senyawa 4	Senyawa 5	Senyawa 6
Faulkner, 1995	Faulkner, 1995	Yang et al., 2015
Senyawa 7	Senyawa 8	Senyawa 9
Scheuer dan Higa, 1987	Scheuer dan Higa, 1987	Faulkner, 2000
Senyawa 10	Senyawa 11	
Faulkner, 1995	Faulkner, 1995	

2.2 Golongan Fenolik

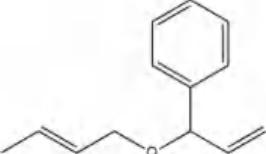
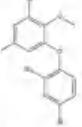
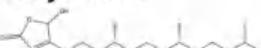
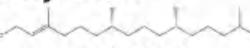
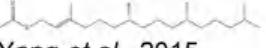
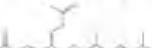
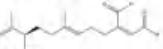
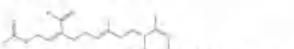
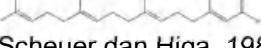
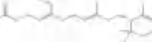
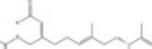
Tabel 10. Struktur 2 dimensi senyawa kandungan *Caulerpa* sp. golongan fenolik

Senyawa 12	Senyawa 13	Senyawa 14
Scheuer dan Higa, 1987	Tringali, 1997	Tringali, 1997
Senyawa 15	Senyawa 16	Senyawa 17
Tringali, 1997	Tringali, 1997	Faulkner, 1988
Senyawa 18	Senyawa 19	
Tringali, 1997	Tringali, 1997	



2.3 Golongan Terpenoid

Tabel 11. Struktur 2 dimensi senyawa kandungan *Caulerpa* sp. golongan terpenoid

Senyawa 20  Faulkner, 1992	Senyawa 21  Faulkner, 1992	Senyawa 22  Norton dan Wells, 1980
Senyawa 23  Yang et al., 2015	Senyawa 24  Yang et al., 2015	Senyawa 25  Faulkner, 1992
Senyawa 26  Faulkner, 1992	Senyawa 27  Yang et al., 2015	Senyawa 28  Yang et al., 2015
Senyawa 29  Yang et al., 2015	Senyawa 30  Yang et al., 2015	Senyawa 31  Yang et al., 2015
Senyawa 32  Yang et al., 2015	Senyawa 33  Guerriero et al., 1992	Senyawa 34  Scheuer dan Higa, 1987
Senyawa 35  Scheuer dan Higa, 1987	Senyawa 36  Scheuer dan Higa, 1987	Senyawa 37  Scheuer dan Higa, 1987
Senyawa 38  Scheuer dan Higa, 1987	Senyawa 39  Scheuer dan Higa, 1987	Senyawa 40  Scheuer dan Higa, 1987
Senyawa 41  Scheuer dan Higa, 1987	Senyawa 42  Scheuer dan Higa, 1987	Senyawa 43  Scheuer dan Higa, 1987

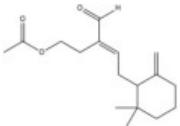
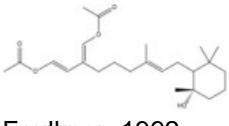
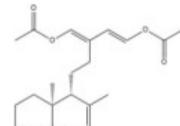
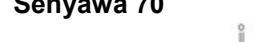
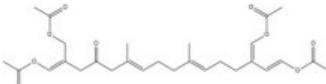
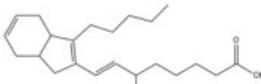
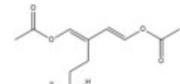


Lanjutan Tabel 11. Struktur 2 dimensi senyawa kandungan *Caulerpa* sp. golongan terpenoid

Senyawa 44 Scheuer dan Higa, 1987	Senyawa 45 Scheuer dan Higa, 1987	Senyawa 46 Guerriero et al., 1992
Senyawa 47 Guerriero et al., 1992	Senyawa 48 Guerriero et al., 1992	Senyawa 49 Guerriero et al., 1992
Senyawa 50 Scheuer dan Higa, 1987	Senyawa 51 Scheuer dan Higa, 1987	Senyawa 52 Scheuer dan Higa, 1987
Senyawa 53 Scheuer dan Higa, 1987	Senyawa 54 Scheuer dan Higa, 1987	Senyawa 55 Scheuer dan Higa, 1987
Senyawa 56 Scheuer dan Higa, 1987	Senyawa 57 Scheuer dan Higa, 1987	Senyawa 58 Scheuer dan Higa, 1987
Senyawa 59 Scheuer dan Higa, 1987	Senyawa 60 Scheuer dan Higa, 1987	Senyawa 61 Scheuer dan Higa, 1987
Senyawa 62 Scheuer dan Higa, 1987	Senyawa 63 Scheuer dan Higa, 1987	Senyawa 64 Scheuer dan Higa, 1987



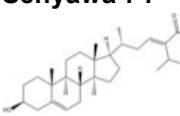
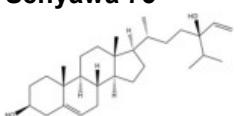
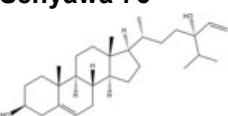
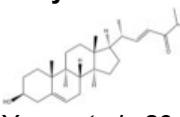
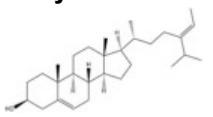
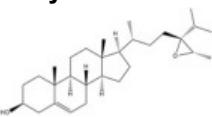
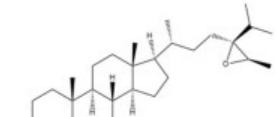
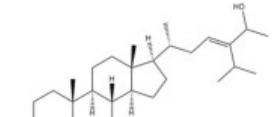
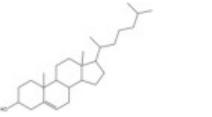
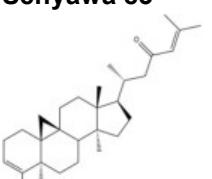
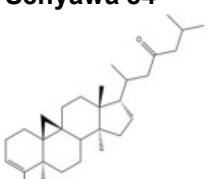
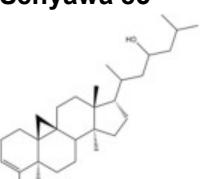
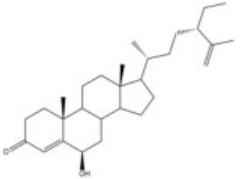
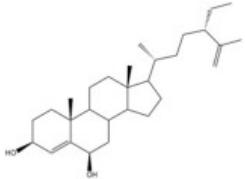
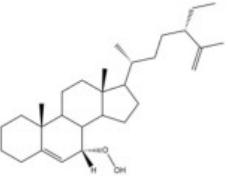
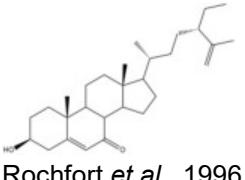
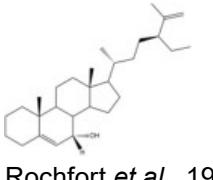
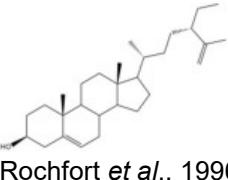
Lanjutan Tabel 11. Struktur 2 dimensi senyawa kandungan *Caulerpa* sp. golongan terpenoid

Senyawa 65  Paul dan Fenical, 1987	Senyawa 66  Faulkner, 1992	Senyawa 67  Faulkner, 1992
Senyawa 68  Faulkner, 1992	Senyawa 69  Faulkner, 1992	Senyawa 70  Anjaneyulu et al., 1991
Senyawa 71  Paul dan Fenical, 1987	Senyawa 72  Tringali, 1997	Senyawa 73  Blackman dan Wells, 1978



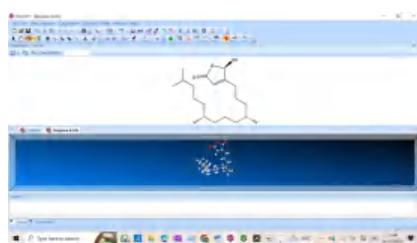
2.4 Golongan Steroid

Tabel 12. Struktur 2 dimensi senyawa kandungan *Caulerpa* sp. golongan steroid

Senyawa 74	Senyawa 75	Senyawa 76
 Yang et al., 2015	 Yang et al., 2015	 Yang et al., 2015
Senyawa 77	Senyawa 78	Senyawa 79
 Yang et al., 2015	 Yang et al., 2015	 Yang et al., 2015
Senyawa 80	Senyawa 81	Senyawa 82
 Yang et al., 2015	 Yang et al., 2015	 Scheuer dan Higa, 1987
Senyawa 83	Senyawa 84	Senyawa 85
 Scheuer dan Higa, 1987	 Scheuer dan Higa, 1987	 Scheuer dan Higa, 1987
Senyawa 86	Senyawa 87	Senyawa 88
 Rochfort et al., 1996	 Rochfort et al., 1996	 Rochfort et al., 1996
Senyawa 89	Senyawa 90	Senyawa 91
 Rochfort et al., 1996	 Rochfort et al., 1996	 Rochfort et al., 1996



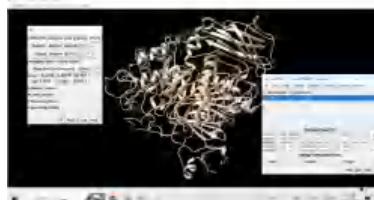
Lampiran 3. Dokumentasi Penelitian



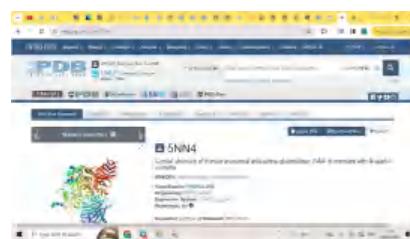
Gambar 52. Proses Penentuan dan Preparasi senyawa kandungan *Caulerpa* sp.



Gambar 54. Preparasi Ligan dan Enzim Target



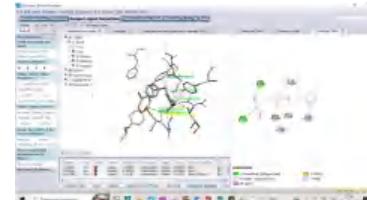
Gambar 56. Proses Analisis Molecular Docking Senyawa Kandungan *Caulerpa* sp.



Gambar 53. Proses Pengunduhan Enzim DPP-4, α -glucosidase, dan PPAR- γ



Gambar 55. Proses Validasi Metode Molecular Docking



Gambar 57. Visualisasi Menggunakan *Discovery Studio Analysis*



CURRICULUM VITAE

A. Data Pribadi

1. Nama : Riry Indhani Kayangan
2. Tempat, tgl. lahir : Rorre, 14 Juni 2001
3. Alamat : Jln. Damai Lorong 2, Tamalanrea Indah
4. Kewarganegaraan : Warga Negara Indonesia

B. Riwayat Pendidikan

1. Tamat SMP tahun 2016 di SMP Negeri 1 Makale
2. Tamat SMA tahun 2019 di SMA Negeri 1 Tana Toraja

C. Pekerjaan dan Riwayat Pekerjaan

1. Jenis pekerjaan : -
2. NIP atau identitas lain (NIK) : -
3. Pangkat/Jabatan : -

D. Karya Ilmiah yang Telah Dipublikasikan

-

E. Makalah Pada Seminar/Konferensi Nasional dan Internasional

-