

DAFTAR PUSTAKA

- Ahmed, M., Sadek, M.M., Abouzid, K.A., dan Wang, F., 2013, In silico design: Extended molecular dynamic simulations of a new series of dually acting inhibitors against EGFR and HER2, *J. Mol. Graph. Model.*, 44, 220–231.
- Ahmed, M., Sadek, M.M., Serrya, R.A., Kafafy, A.H.N., Abouzid, K.A., dan Wang, F., 2013, Assessment of new anti-HER2 ligands using combined docking, QM/MM scoring and MD simulation, *J. Mol. Graph. Model.*, 40, 91–98.
- Alafeefy, A.M., Ashour, A.E., Prasad, O., Sinha, L., Pathak, S., Alasmari, F.A., Rishi, A.K., dan Abdel-Aziz, H.A., 2015, Development of certain novel N-(2-(2-(2-oxoindolin-3-ylidene)hydrazinocarbonyl)phenyl)-benzamides and 3-(2-oxoindolin-3-ylideneamino)-2-substituted quinazolin-4(3 H)-ones as CFM-1 analogs: Design, synthesis, QSAR analysis and anticancer activity, *Eur. J. Med. Chem.*, 92, 191–201.
- Allen, M. P., 2004, *Introduction to Molecular Dynamic Simulation*, John van Neumann Institute for Computing, Jülich.
- Allen, M. P. dan Tildesly, D. J., 1991, *Computer Simulation of Liquid*, Clarendon Press, Oxford.
- Alonso, H., Bliznyuk, A.A., dan Gready, J.E., 2006, Combining docking dan molecular dynamic simulations in drug design, *Med. Res. Rev.*, 26(5), 531–568.
- Arief, I., Armunanto, R., dan Setiaji, B., 2013, Study on Anti-Hiv Activity of Diarylaniline Derivatives Using Quantitative Structure-Activity Relationship (QSAR), *Indones. J. Chem.*, 13(2), 129–135.
- Armunanto, R., Schwenk, C.F., Tran, H.T., dan Rode, B.M., 2004, Structure and Dynamics of Au⁺ Ion in Aqueous Solution: Ab Initio QM/MM MD Simulations, *J. Am. Chem. Soc.*, 126(8), 2582–2587.
- Baselga, J., 2002, Why the epidermal growth factor receptor? The rationale for cancer therapy, *Oncologist*, 7(4), 2–8.
- Bos, M., Mendelsohn, J., Kim, Y.-M., Albanell, J., Fry, D.W., dan Baselga, J., 1997, PD153035, a Tyrosine Receptor Kinase Inhibitor, Prevents Epidermal Growth factor Receptor Activation and Inhibits Growth of Cancer Cells in a Receptor Number-dependent Manner, *Clin. Cancer Res.*, 3, 2099–2106.
- Brooijmans, N., 2009, *Docking methods, ligand design, and validating data sets in the structural genomics era*, 2nd Ed., John Wiley & Sons, Inc., New York.

- Case, D.A., Betz, R.M., Botello-Smith, W., Cerutti, D.S., Cheatham, T.E., Darden, T.A., Duke, R.E., Giese, T.J., Gohlke, H., Goetz, A.W., Homeyer, N., Izadi, S., Janowski, P., Kaus, J., Kovalenko, A., Lee, T.S., LeGrand, S., Li, P., Lin, C., Luchko, T., Luo, R., Madej, B., Mermelstein, D., Merz, K.M., Monard, G., Nguyen, H., Nguyen, H.T., Omelyan, I., Onufriev, A., Roe, D.R., Roitberg, A., Sagui, C., Simmerling, C.L., Swails, J., Walker, R.C., Wang, J., Wolf, R.M., X., Wu, Xiao, L., York, D.M., dan Kollman, P.A., 2016, *AMBER 2016*, University of California, San Fransisco.
- Chen, Y., Luo, Y., Wu, C., Lee, Y., Perng, R., dan Whang-peng, J., 2015, Erlotinib or Chemotherapy in Second-Line or Later Treatment of Tumor EGFR Wild-Type Pulmonary Adenocarcinoma Patients, *J. Cancer Res. Pr.*, 2(1), 3–11.
- Cheng, H., Nair, S.K., dan Murray, B.W., 2016, Recent progress on third generation covalent EGFR inhibitors, *Bioorg. Med. Chem. Lett.*, 26(8), 1861–1868.
- Cornell, W.D., Cieplak, P., Bayly, C.I., Gould, I.R., Merz, K.M., Ferguson, D.M., Spellmeyer, D.C., Fox, T., Caldwell, J.W., dan Kollman, P.A., 1995, A Second Generation Force Field for the Simulation of Protein, Nucleic Acids, and Organic Molecules, *J. Am. Chem. Soc.*, 117, 5179–5197.
- Dennington, R., Keith, T. dan Millam, J., 2009, *Gauss View, Version 5.*, Semichem Inc., Kansas.
- Eskens, F.A.L.M., Mom, C.H., Planting, A.S.T., Gietema, J.A., Amelsberg, A., Huisman, H., Van Doorn, L., Burger, H., Stopfer, P., Verweij, J., dan De Vries, E.G.E., 2008, A phase I dose escalation study of BIBW 2992, an irreversible dual inhibitor of epidermal growth factor receptor 1 (EGFR) and 2 (HER2) tyrosine kinase in a 2-week on, 2-week off schedule in patients with advanced solid tumours, *Br. J. Cancer*, 98(1), 80–85.
- Faidallah, H.M., Panda, S.S., Serrano, J.C., Girgis, A.S., Khan, K.A., Alamry, K.A., Therathanakorn, T., Meyers, M.J., Sverdrup, F.M., Eickhoff, C.S., Getchell, S.G., dan Katritzky, A.R., 2016, Synthesis, antimalarial properties and 2D-QSAR studies of novel triazole-quinine conjugates, *Bioorganic Med. Chem.*, 24(16), 3527–3539.
- Frenkel, D. dan Smit, B., 2001, *Understanding Molecular Simulation*, 2nd Ed., Academic Press, Inc., Florida.
- Frisch, M. J. Trucks, G.W., Schlegel, H.B., Scuseria, G.E., Robb, M.A., Cheeseman, J.R., Scalmani, G., Barone, V., Petersson, G.A., Nakatsuji, H., Li, X., Caricato, M., Marenich, A., Bloino, J., Janesko, B.G., Gomperts, R., Mennucci, B., Hratchian, H.P., Ortiz, J. V., Izmaylov, A.F., Sonnenberg, J.L., WilliamsYoung, D., Ding, F., Lipparini, F., Egidi, F., Goings, J., Peng, B., Petrone, A., Henderson, T., Ranasinghe, D., Zakrzewski, V.G., Gao, J., Rega,

N., Zheng, G., Liang, W., Hada, M., Ehara, M., Toyota, K., Fukuda, R., Hasegawa, J., Ishida, M., Nakajima, T., Honda, Y., Kitao, O., Nakai, H., Vreven, T., Throssell, K., Montgomery, J.A., Jr., Peralta, J.E., Ogliaro, F., Bearpark, M., Heyd, J.J., Brothers, E., Kudin, K.N., Staroverov, V.N., Keith, T., Kobayashi, R., Normand, J., Raghavachari, K., Rendell, A., Burant, J.C., Iyengar, S.S., Tomasi, J., Cossi, M., Millam, J.M., Klene, M., Adamo, C., Cammi, R., Ochterski, J.W., Martin, R.L., Morokuma, K., Farkas, O., dan Foresman, J.B., Fox, D.J., 2016, Gaussian 09 Inc.

Golbraikh, A. dan Tropsha, A., 2002, Predictive QSAR modeling based on diversity sampling of experimental datasets for the training and test set selection, *J. Comput. Aided. Mol. Des.*, 16, 357–369.

Haile, J.M., 1992, *Molecular Dynamics Simulation: Elementary Methods*, Wiley-Interscience, Clemson.

Hemmer, M.C., 2006, *Handbook of Vibrational Spectroscopy*, John Wiley & Sons Inc., New Jersey.

Hou, T., Zhu, L., Chen, L., dan Xu, X., 2003, Mapping the binding site of a large set of quinazoline type EGF-R inhibitors using molecular field analyses and molecular docking studies, *J. Chem. Inf. Comput. Sci.*, 43(1), 273–283.

Huang, S.-Y., Grinter, S.Z., dan Zou, X., 2010, Scoring functions and their evaluation methods for protein–ligand docking: recent advances and future directions, *Phys. Chem. Chem. Phys.*, 12, 12899–12908.

Huey, R., Morris, G.M., Olson, A.J., dan Goodsell, D.S., 2007, A Semiempirical Free Energy Force Field with Charge-Based Desolvation, *J. Comput. Chem.*, 28, 1145–1152.

Humphrey, M.C., Dalke, A., dan Schulten, K., 1996, VMD: Visual Molecular Dynamics, *J. Mol. Graph.*, 33–38.

Ismail, R.S.M., Ismail, N.S.M., Abuserii, S., dan Abou El Ella, D.A., 2016, Recent advances in 4-aminoquinazoline based scaffold derivatives targeting EGFR kinases as anticancer agents, *Futur. J. Pharm. Sci.*, 2, 9–19.

Jedhe, G.S., Paul, D., Gonnade, R.G., Santra, M.K., Hamel, E., Nguyen, T.L., dan Sanjayan, G.J., 2013, Correlation of hydrogen-bonding propensity and anticancer profile of tetrazole-tethered combretastatin analogues, *Bioorganic Med. Chem. Lett.*, 23, 4680–4684.

Jeffrey, G.A. dan Saenger, W., 1991, *Hydrogen Bonding in Biological Structure*, Springer-Verlaig, Berlin.

- Karelson, M., Lobanov, V.S., dan Katritzky, A.R., 1996, Quantum-Chemical Descriptors in QSAR/QSPR Studies, *Chem. Rev.*, 96, 1027–1043.
- Katritzky, A.R. dan Gordeevat, E. V, 1993, Traditional Topological Indices vs Electronic, Geometrical, and Combined Molecular Descriptors in QSAR/QSPR Research, *J. Chem. Inf. Comput. Sci.*, 33, 835–857.
- Khairullina, V.R., Gimadieva, A.R., Gerchikov, A.Y., Mustafin, A.G., dan Zarudii, F.S., 2018, Quantitative structure–activity relationship of the thymidylate synthase inhibitors of *Mus musculus* in the series of quinazolin-4-one and quinazolin-4-imine derivatives, *J. Mol. Graph. Model.*, 85, 198–211.
- Kier, L.B., Tute, M.S. dan Foye, O.W., 1989, *Principle of Medicinal Chemistry Theoretical Aspect of Drug Design*, Lea & Febiger, Philadelphia.
- Kobayashi, S., Boggon, T.J., Dayaram, T., Jänne, P.A., Kocher, O., Meyerson, M., Johnson, B.E., Eck, M.J., Tenen, D.G., dan Halmos, B., 2005, EGFR Mutation and Resistance of Non–Small-Cell Lung Cancer to Gefitinib, *N. Engl. J. Med.*, 352(8), 786–792.
- Lakshmanan, S., Govindaraj, D., Ramalakshmi, N., dan Antony, S.A., 2017, Synthesis, molecular docking, DFT calculations and cytotoxicity activity of benzo[g]quinazoline derivatives in choline chloride-urea, *J. Mol. Struct.*, 1150, 88–95.
- Leach, A. R., 2001, *Molecular Modelling: Principles and Applications*, 2nd Ed., Prentice Hall Limited, Essex.
- Lee, C., Hill, C., dan Carolina, N., 1988, Development of the Colle-Salvetti correlation-energy formula into a functional of the electron density, *Chem. Phys. Lett.*, 37(2), 165–169.
- Lehn, J.M., 2002, Towards complex matter: Supramolecular chemistry and self-organization, *Introd. Perspect.*, 99, 4763–4768.
- Li, D., Ambrogio, L., Shimamura, T., Kubo, S., Takahashi, M., Chirieac, L.R., Padera, R.F., Shapiro, G.I., Baum, A., Himmelsbach, F., Rettig, W.J., Meyerson, M., Solca, F., Greulich, H., dan Wong, K.K., 2008, BIBW2992; an irreversible EGFR/HER2 inhibitor highly effective in preclinical lung cancer models, *Oncogene*, 27, 4702–4711.
- Lipinski, C.A., Lombardo, F., Dominy, B.W., dan Feeney, P.J., 2001, Experimental and Computational Approaches to Estimate Solubility and Permeability in Drug Discovery and Development Settings, *Adv. Drug Deliv. Rev.*, 46, 3–26.

- Lü, S., Zheng, W., Ji, L., Luo, Q., Hao, X., Li, X., dan Wang, F., 2013, Synthesis, characterization, screening and docking analysis of 4-anilinoquinazoline derivatives as tyrosine kinase inhibitors, *Eur. J. Med. Chem.*, 61, 84–94.
- Masone, D. dan Grosdidier, S., 2014, Collective variable driven molecular dynamics to improve protein-protein docking scoring, *Comput. Biol. Chem.*, 49, 1–6.
- Morris, G. dan Huey, R., 2009, AutoDock4 and AutoDockTools4: Automated docking with selective receptor flexibility, *J. Comput. Chem.*, 30, 2785–2791.
- Mukesh, B. dan Rakesh, K., 2011, Molecular Docking: A Review, *Int J Res Ayurveda Pharm*, 2, 1746–1751.
- Noolvi, M.N. dan Patel, H.M., 2013, A comparative QSAR analysis and molecular docking studies of quinazoline derivatives as tyrosine kinase (EGFR) inhibitors: A rational approach to anticancer drug design, *J. Saudi Chem. Soc.*, 17, 361–379.
- Panagiotou, E., 2015, The linking number in systems with Periodic Boundary Conditions, *J. Comput. Phys.*, 300, 533–573.
- Pao, W., Miller, V.A., Politi, K.A., Riely, G.J., Somwar, R., Zakowski, M.F., Kris, M.G., dan Varmus, H., 2005, Acquired resistance of lung adenocarcinomas to gefitinib or erlotinib is associated with a second mutation in the EGFR kinase domain, *PLoS Med.*, 2(3), 0225–0235.
- Patel, H., Pawara, R., Ansari, A., dan Surana, S., 2017, Recent updates on third generation EGFR inhibitors and emergence of fourth generation EGFR inhibitors to combat C797S resistance, *Eur. J. Med. Chem.*, 142, 32–47.
- Patrick, G.L., 2013, *An Introduction to Medicinal Chemistry*, 5th Ed., Oxford University Press, Oxford.
- Pettersen, E., Goddard, T., Huang, C., Couch, G., Greenblatt, D., Meng, E., dan Te, F., 2004, UCSF Chimera--a visualization system for exploratory research and analysis, *J. Comput. Chem.*, 25(13), 1605–1612.
- Poulikakos, D., Arcidiacono, S., dan Maruyama, S., 2003, Molecular Dynamics Simulation in Nanoscale Heat Transfer: A Review, *Micro. Thermophys. Eng.*, 7, 181–206.
- Pranowo, H.D., 2003, *Kimia Komputasi*, Pusat Kimia Komputasi Indonesia-Austria Kimia, FMIPA UGM, Yogyakarta.

- Pranowo, H.D. dan Hetadi, A.K.R., 2010, *Pengantar Kimia Komputasi*, Edisi Pertama, Lubuk Agung, Bandung.
- Pranowo, H.D., Tahir, I., dan Widiatmoko, A., 2007, Quantitative Relationship Of Electronic Structure And Inhibition Activity Of Curcumin Analogs On Ethoxyresorufin O-Dealkylation (EROD) Reaction, *Indones. J. Chem.*, 7, 78–82.
- Qin, X., Li, Z., Yang, L., Liu, P., Hu, L., Zeng, C., and Pan, Z., 2016, Discovery of new [1,4]dioxino[2,3-f]quinazoline-based inhibitors of EGFR including the T790M/L858R mutant, *Bioorganic Med. Chem.*, 24, 2871–2881.
- Rabindran, S.K., Discafani, C.M., Rosfjord, E.C., Baxter, M., Floyd, M.B., Golas, J., Hallett, W.A., Johnson, B.D., Nilakantan, R., Overbeek, E., Reich, M.F., Shen, R., Shi, X., Tsou, H.R., Wang, Y.F., dan Wissner, A., 2004, Antitumor activity of HKI-272, an orally active, irreversible inhibitor of the HER-2 tyrosine kinase, *Cancer Res.*, 64, 3958–3965.
- Roy, K., Kar, S., dan Das, R.N., 2015, *A Primer on QSAR/QSPR Modeling Fundamental Concepts*, Springer Briefs in Molecular Science, Berlin.
- Sharma, V.K., Nandekar, P.P., Sangamwar1, A., Pérez-Sánchez, H., dan Agarwal, S.M., 2016, Structure guided design and binding analysis of EGFR inhibiting analogues of erlotinib and AEE788 using ensemble docking, molecular dynamics and MM-GBSA, *RSC Adv.*, 6, 65725–65735.
- Singh, M. dan Jadhav, H.R., 2018, Targeting non-small cell lung cancer with small-molecule EGFR tyrosine kinase inhibitors, *Drug Discov. Today*, 23, 745–753.
- Śledź, P. dan Caflisch, A., 2018, Protein structure-based drug design: from docking to molecular dynamics, *Curr. Opin. Struct. Biol.*, 48, 93–102.
- Smits, R.A., Adami, M., Istyastono, E.P., Zuiderveld, O.P., Van Dam, C.M.E., De Kanter, F.J.J., Jongejan, A., Coruzzi, G., Leurs, R., dan De Esch, I.J.P., 2010, Synthesis and QSAR of Quinazoline Sulfonamides As Highly Potent Human Histamine H4 Receptor Inverse Agonists, *J. Med. Chem.*, 53, 2390–2400.
- Sousa, S.F., Fernandes, P.A., dan Ramos, M.J., 2007, General performance of density functionals, *J. Phys. Chem. A*, 111, 10439–10452.
- Stamos, J., Sliwkowski, M.X., dan Eigenbrot, C., 2002, Structure of the epidermal growth factor receptor kinase domain alone and in complex with a 4-anilinoquinazoline inhibitor, *J. Biol. Chem.*, 277(48), 46265–46272.
- Syahri, J., Purwono, B., dan Armunanto, R., 2016, Design of new potential antimalaria compound based on QSAR analysis of chalcone derivatives, *Int.*

J. Pharm. Sci. Rev. Res., 36(2), 71–76.

Syahri, J., Yuanita, E., dan Nurohmah, B.A., 2017, Xanthone as Antimalarial: QSAR Analysis, Synthesis, Molecular Docking and In-vitro Antimalarial Evaluation, *Orient. J. Chem.*, 33(1), 29–40.

Tahir, I., Wijaya, K., Purwono, B., dan Widianingsih, D., 2003, QSAR Study of Flavone/Flavonol Analogues as The Antiradical Compounds based on Hansch Analysis, *Indones. J. Chem.*, 3(1), 48–54.

Teraishi, F., Kagawa, S., Watanabe, T., Tango, Y., Kawashima, T., Umeoka, T., Nisizaki, M., Tanaka, N., dan Fujiwara, T., 2005, ZD1839 (Gefitinib, 'Iressa'), an epidermal growth factor receptor-tyrosine kinase inhibitor, enhances the anti-cancer effects of TRAIL in human esophageal squamous cell carcinoma, *FEBS Lett.*, 579, 4069–4075.

Thar, J. dan Kirchner, B., 2006, Hydrogen Bond Detetion, *J. Phys. Chem. A.*, 110, 4229–4237.

Traxler, P., Bold, G., Frei, J., Lang, M., Lydon, N., Mett, H., Buchdunger, E., Meyer, T., Mueller, M., dan Furet, P., 1997, Use of a pharmacophore model for the design of EGFR tyrosine kinase inhibitors: 4-(Phenylamino)pyrazolo[3,4-d]pyrimidines, *J. Med. Chem.*, 40, 3601–3616.

Traxler, P., Green, J., Mett, H., Séquin, U., dan Furet, P., 1999, Use of a pharmacophore model for the design of EGFR tyrosine kinase inhibitors: Isoflavones and 3-phenyl-4(1H)-quinolones, *J. Med. Chem.*, 42, 1018–1026.

Tu, Y., Ouyang, Y., Xu, S., Zhu, Y., Li, G., Sun, C., Zheng, P., dan Zhu, W., 2016, Design, synthesis, and docking studies of afatinib analogs bearing cinnamamide moiety as potent EGFR inhibitors, *Bioorganic Med. Chem.*, 24, 1495–1503.

Veerasamy, R., Rajak, H., Jain, A., Sivadasan, S., Varghese, C.P., dan Agrawal, R.K., 2011, Validation of QSAR Models-Strategies and Importance, *Int. J. Drug Des. Discovery*, 2(3), 511–519.

Verma, G., Khan, M.F., Akhtar, W., Alam, M.M., Akhter, M., Alam, O., Hasan, S.M., dan Shaquiquzzaman, M., 2016, Pharmacophore modeling, 3D-QSAR, docking and ADME prediction of quinazoline based EGFR inhibitors, *Arabian J. Chem.*, Article in Press.

Vijayakumar, S., Manogar, P., Prabhu, S., dan Sanjeevkumar, R.A.S., 2018, Novel ligand-based docking; molecular dynamic simulations; and absorption, distribution, metabolism, and excretion approach to analyzing potential acetylcholinesterase inhibitors for Alzheimer's disease, *J. Pharm. Anal.*, 8,

413–420. 0063

- Vyas, B., Singh, M., Kaur, M., dan Singh, M., 2015, Reductase inhibitors for diabetic complications: Receptor induced atom-based 3D-QSAR analysis, synthesis and biological evaluation, *J. Mol. Graph. Model.*, 59, 59–71.
- Wang, S., Song, Y., dan Liu, D., 2017, EAI045: The fourth-generation EGFR inhibitor overcoming T790M and C797S resistance, *Cancer Lett.*, 385, 51–54.
- Xu, X., 2017, Method for preparing afatinib and intermediate thereof, United States Patent, US 9,845,315 B2.
- Xu, Y.Y., Cao, Y., Ma, H., Li, H.Q., dan Ao, G.Z., 2013, Design, synthesis and molecular docking of α,β -unsaturated cyclohexanone analogous of curcumin as potent EGFR inhibitors with antiproliferative activity, *Bioorganic Med. Chem.*, 21, 388–394.
- Young, D.C., 2001, *Computational Chemistry: A Practical Guide for Applying Techniques to Real-World Problems*, John Wiley & Sons, Inc., New York.
- Yu, H., Li, Y., Ge, Y., Song, Z., Wang, C., Huang, S., Jin, Y., Han, X., Zhen, Y., Liu, K., Zhou, Y., dan Ma, X., 2016, Novel 4-anilinoquinazoline derivatives featuring an 1-adamantyl moiety as potent EGFR inhibitors with enhanced activity against NSCLC cell lines, *Eur. J. Med. Chem.*, 110, 195–203.
- Yun, C.H., Boggon, T.J., Li, Y., Woo, M.S., Greulich, H., Meyerson, M., dan Eck, M.J., 2007, Structures of Lung Cancer-Derived EGFR Mutants and Inhibitor Complexes: Mechanism of Activation and Insights into Differential Inhibitor Sensitivity, *Cancer Cell*, 11, 217–227.
- Zuo, L., Yao, S., Wang, W., dan Duan, W., 2008, An efficient method for demethylation of aryl methyl ethers, *Tetrahedron Lett.*, 49, 4054–4056.