

DAFTAR PUSTAKA

- Abrahams, S., Haylett, W. L., Johnson, G., Carr, J. A., & Bardien, S. 2019. *Antioxidant Effects of Curcumin in Models of Neurodegeneration, Ageing, Oxidative and NITROSATIVE Stress: A Review*. *Neuroscience* 406: 1-21
- Aini, N., Purwono, B., dan Tahir, I. 2007. Analisis Hubungan Struktur – Aktivitas Antioksidan dari Isoeugenol, Eugenol, Vanilin dan Turunannya. *Indo. J. Chem* (1): 61–66
- Ak, T., dan Gulcin, I. 2008. *Antioxidant and Radical Scavenging Properties of Curcumin*. *Chemico-Biological Interaction* 174: 27-37
- Adelakun, O. E., Kudanga, T., Parker, A., Green, I. R., le Roes-Hill, M., & Burton, S. G. 2012. *Laccase-catalyzed dimerization of ferulic acid amplifies antioxidant activity*. *Journal of Molecular Catalysis B: Enzymatic*, 74(1-2), 29–35.
- Andayani, R., Maimunah., dan Lisawati, Y. 2008. Penentuan Aktivitas Antioksidan, Kadar Fenolat Total, dan Likopen pada Buah Tomat (*Solanum lycopersicum L*). *Jurnal Sains dan Teknologi Farmasi*. 13(1)
- Anita, Y., dan Mulyani, H. 2014. *Brassica juncea* Peroksidase Sebagai Biokatalis Dalam Sintesis Kopling Oksidatif Senyawa Guaiakol. *Jurnal Ilmu Kefarmasian Indonesia* 12(1): 99-103
- Asouri, M. Ataee, R., Ahmadi, A.A., Amni, A., Moshaei, M.R. 2013. *Antioxidant and Free Radical Scavenging Activities of Curcumin*. *Asian Journal of Chemistry* 25(13): 7593-7595.
- Astina, D., Nugroho, T.T., dan Linggawati, A. 2017. Penentuan Aktivitas Enzim *Laccase Rhus vernicifera* Menggunakan *Guaiacol* Sebagai Substrat. *Jurnal Penelitian Farmasi Indonesia* 5(2): 74-79.
- Antosiewicz, J. M. dan Shugar, D. 2016. UV–Vis spectroscopy of tyrosine side-groups in studies of protein structure. Part 2: selected applications. Crossmark, *Biophys Rev* 8: 163-177.
- Ayucitra, A., Indaswati, N., Mulyandasari, V. Dengi, Y.K., Francisco, G., Dan Yudha, A. 2011. Potensi Senyawa Fenolik Bahan Alami Sebagai Antioksidan Alami Minyak Goreng Nabati. *Widya Teknik* 10(1):1-10
- Azadfar, M., Gao, A. H., Bule, M. V., & Chen, S. 2015. *Structural characterization of lignin: A potential source of antioxidants guaiacol and 4-vinylguaiacol*. *International Journal of Biological Macromolecules*, 75: 58–66.
- Badan Pusat Statistik (BPS), 2017. *Statistik Tanaman Biofarmaka Statistics of Medicinal Plants* Indonesia. ISSN: 2339-0956. Jakarta.
- Bele, Archana dan Khale, Anubha. 2011. An overview on thin layer chromatography. *Int. J. Pharm. Pharm. Sci.* 2(2):256-267.

- Bijang, C. M., Tehubijuluw, H., dan Kaihatu, T. G. 2018. Biosorpsi Ion Logam Kadmium (Cd²⁺) Pada Biosorben Rumput Laut Coklat (*Padina australis*) Asal Pantai Liti Pulau Kisar. *Indo. J. Chem. Res.* 6(1): 51-58.
- Brighente, I.M.C., Dias, M., Verdi, L.G., dan Pizzolatti, M.G. 2007. *Antioxidant Activity and Total Phenolic Content of Some Brazilian Species*. *Pharmaceutical Biology* 45(2): 156-161
- Cahyana, A.H., Wibowo, W., dan Setiawan, R. 2013. Studi Reaksi Oksidasi Kopling Guaiakol-Isoeugenol dengan Bantuan Katalis Cu-Montmorillonit dan Uji Aktivitasnya Sebagai Antioksidan. FMIPA UI. Depok
- Cahyana, A.H., dan Wulandari, N. 2006. Antioksidan Senyawa Baru Dari Guaiakol Dengan Biokatalis Enzim Lakase Jamur Tiram Putih (*Pleurotus ostreatus*). *Jurnal Ilmu dan Teknologi Pangan* 4(1): 13-22.
- Cai, L. 2014. *Thin Layer Chromatography. Current Protocols Essential Laboratory Techniques*, 8(1), 6.3.1–6.3.18.
- Cazes, J. 2010. *Encyclopedia of Chromatograph, Third Edition, Vol 1*, halaman 1779. CRC Press Taylor & Francis Group. New York.
- Dawin, Grit., Kastner, M., Michels, J., Poppitz, W., Gunther, W., dan Fritsche, W. 1997. Structure of a Laccase-Mediated Product of Coupling of 2,4-Diamino-6-Nitrotoluene to Guaiacol, a Model for Coupling of 2,4,6-Trinitrotoluene Metabolites to a Humic Organic Soil Matrix. *Applied and Environmental Microbiology* 63(7): 2560-2565
- Doerge, D. R., Divi, R. L., & Churchwell, M. I. 1997. *Identification of the Colored Guaiacol Oxidation Product Produced by Peroxidases*. *Analytical Biochemistry*, 250(1), 10–17.
- Dutta, S., Padhye, S., Priyadarsini, K. I., & Newton, C. 2005. *Antioxidant and antiproliferative activity of curcumin semicarbazone*. *Bioorganic & Medicinal Chemistry Letters*, 15(11), 2738–2744.
- Esparan, V., Krings, U., Struch, M., dan Berger, R.G. 2015. *A Three-Enzyme-System to Degrade Curcumin to Natural Vanillin*. *Molecules* 20: 6640-6653.
- Faghizadeh, F., Anaya, N. M., Schifman, L. A., & Oyanedel-Craver, V. 2016. Fourier transform infrared spectroscopy to assess molecular-level changes in microorganisms exposed to nanoparticles. *Nanotechnology for Environmental Engineering*, 1(1).
- Fahryl, N., dan Carolina, N. 2019. Kunyit (*Curcuma domestica Val*) sebagai Terapi Arthritis Gout. *Majority* 8(1): 251-255
- Feng, J. Y., dan Liu, Z. Q. (2009). *Phenolic and Enolic Hydroxyl Groups in Curcumin: Which Plays the Major Role in Scavenging Radicals?* *Journal of Agricultural and Food Chemistry*, 57(22), 11041–11046.
- Ferdes, M., Dinca, M., Zabava, B., Paraschiv, G., Munteanu, M., dan Ionescu, M. 2018. *Laccase Enzyme Production and Biomass Growth in Liquid Cultures*

- of Wood-Degrading Fungal Strains.* Izvorni znanstveni rad Original scientific paper 46: 341-348.
- Fujisawa, S., Atsumi, T., Ishihara, M., dan Kadoma, Y. 2004. *Cytotoxicity, ROS-generation Activity and Radical-scavenging Activity of Curcumin and Related Compounds.* Anticancer Reaserch 24:563-570.
- Galano, A., León-Carmona, J. R., & Alvarez-Idaboy, J. R. 2012. *Influence of the Environment on the Protective Effects of Guaiacol Derivatives against Oxidative Stress: Mechanisms, Kinetics, and Relative Antioxidant Activity.* The Journal of Physical Chemistry B, 116(24), 7129–7137
- Gangwar, M., Gautam, M. K., Sharma, A. K., Tripathi, Y. B., Goel, R. K., & Nath, G. 2014. *Antioxidant Capacity and Radical Scavenging Effect of Polyphenol RichMallotus philippensisFruit Extract on Human Erythrocytes: An In Vitro Study.* The Scientific World Journal, 2014, 1–12.
- Haerudin, A., Pujilestari, T., dan Atika, V. 2017. *Solvent Type Effect to Seaweed Gracilaria's sp. Extraction as Natural Dyes on Cotton and Silk Batik Fabric.* Dinamika Kerajinan dan Batik 34(2): 83-92
- Hilden, K., Hakala, T.K., Lundell, T., 2009. *Thermotolerant and Thermostable Laccases.* Biotechnol Lett 31:1117-1128.
- Integrated Taxonomic Information System (ITIS). 2019. IT IS Report: *Curcuma longa* L. Taxonomic Serial No: 42394. Available from https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=42394#null. Diakses 2019 Oktober 7.
- Jayaprakasha, G. K., Jaganmohan Rao, L., & Sakariah, K. K. (2006). *Antioxidant activities of curcumin, demethoxycurcumin and bisdemethoxycurcumin.* Food Chemistry, 98(4): 720–724.
- Jomová, K., Hudecová, L., Lauro, P., Simunková, M., Alwasel, S. H., Alhazza, I. M., & Valko, M. 2019. *A Switch between Antioxidant and Prooxidant Properties of the Phenolic Compounds Myricetin, Morin, 3',4'-Dihydroxyflavone, Taxifolin and 4-Hydroxy-Coumarin in the Presence of Copper(II) Ions: A Spectroscopic, Absorption Titration and DNA Damage Study.* Molecules, 24(23), 4335 :1-28
- Junaidi, L. 2007. Antioksidan Alami: Sumber, Kimia, dan Teknologi Ekstraksi. J. of Agro-Based Industry 24(2): 52-69
- Kirste, A., Schnakenburg, G., & Waldvogel, S. R. 2011. *Anodic Coupling of Guaiacol Derivatives on Boron-Doped Diamond Electrodes.* Organic Letters, 13(12), 3126–3129
- Kurisawa, M., Chung, J.E., Uyama, H. dan Kobayashi, S. 2003. *Oxidative Coupling of Epigallocatechin Gallate Amplifies Antioxidant Activity and Inhibits Xanthine Oxidase Activity.* ChemComm 294-295.

- Kumar, V., dan Sonkar, P. 2013. *Lacasse: Source and Their Environmental Application*. International Jurnal of Bioassays 2(6): 909-911.
- Li, D.-B., Liu, Y.-Q., Ye, Y.-Y., Li, S.-R., & Wang, D. 2018. *Study of reaction mechanism between guaiacol and Ca(OH) 2 in water: Development of a novel phenol extraction method*. Journal of Cleaner Production, 172, 2853–2861.
- Li, F., Yu, Y., Wang, Q., Yuan, J., Wang, P., & Fan, X. (2018). *Polymerization of dopamine catalyzed by laccase: Comparison of enzymatic and conventional methods*. Enzyme and Microbial Technology, 119, 58–64.
- Li, S. Yuan, W., Deng, G., Wang, P., Yang, P., dan Aggarwal. B. B. 2011. Chemical Composition and Product Quality Control of Turmeric (*Curcuma longa* L.). Pharmaceutical Crops 2: 28-54
- Listyana, N.H. 2018. Analisis Keterkaitan Produksi Kunyit di Indonesia dan Faktor-Faktor yang Mempengaruhinya. Caraka Tani: Journal of Sustainable Agriculture. 33(2), 106-114.
- Mangurana W. O. I., Yusnaini., dan Sahidin. Analisis LC-MS/MS (Liquid Chromatograph Mass Spectrometry) dan Metabolit Sekunder serta Potensi Antibakteri Ekstrak n-Heksana Spons Callyspongia aerizusa yang diambil pada kondisi tutupan Terumbu Karang yang berbeda di Perairan Teluk Staring. Jurnal Biologi Tropis 19(2): 131-141.
- Masuda, T., Maekawa, T., Hidaka, K., Bando, H., Takeda, Y., dan Yamaguchi, H. 2001. *Chemical Studies on Antioxidant Mechanism of Curcumin: Analysis of Oxidative Coupling Products from Curcumin and Linoleate*. J. Agric. Food Chem 49(5): 2539-2547.
- Mecozzi, M., Pietroletti, M., Scarpitini, M., Acquistucci, R., dan Conti, M. C. 2011. *Monitoring of Marine Mucilage Formation in Italian Seas Investigation Spectroscopy and Independent Component Analysis*. Springer Science+Business Media B.V
- Miyata, M., dan Chujo, Y. 2003. *Stable crosslinked-conjugated boron containing polymers prepared by hydroboration polymerization or allylboration polymerization*. Polymer Bulletin, 51(1): 9–16.
- Mutiah, R. 2015. *Evidance Based Kurkumin dari Tanaman Kunyit (*Curcuma longa*) Sebagai Terapi Kanker Pada Pengobatan Modern*. Jurnal FArma Sains 1(1): 28-41.
- Ncanana, S. dan Burton, S. 2007. *Oxidation of 8-hydroxyquinoline catalyzed by laccase from Trametes pubescens yields an antioxidant aromatic polymer*. Science Direct, Elsvier. 44: 66-71.
- Neldawati, R., dan Gusendi. 2013. Analisis Nilai Absorbansi dalam Penentuan Kadar Flavonoid untuk Berbagai Jenis Daun Tanaman Obat. Pillar Of Physics, 2: 76-83.

- Niranjan, A. dan Prakash, D. 2008. *Chemical constituents and biological activities of turmeric (Curcuma longa L.) - A review*. J Food Sci Technol 45(2): 109-116.
- Pereira, D. M., Valentao, P., Pereira, J. A., dan Andrade, P. B. 2009. *Phenolics: From Chemistry to Biology*. Molecules. ISSN 1420-3049.
- Ravindran, P.N., Babu, K.N., dan Sivaraman, K. 2007. "Turmeric: The Genus Curcuma". CRC Press, Florida.
- Risttsieg, K., Suurnaki, A., Suortti, T., Kruus, K., Guebitz, G.M., dan Buchert, J. 2003. *Polymerization of Guaiacol and a Phenolic beta-O-4-Substructure by Trametes hirsuta Laccase in the Presence of ABTS*. Biotechnol 19(5): 1505-1509.
- Rohman, A., Sudjadi., Devi., Ramadhani, D., dan Nugroho, A. 2015. *Analysis of Curcumin in Curcuma longa and Curcuma xanthorrhiza Using FTIR Spectroscopy and Chemometrics*. Research Journal of Medicinal Plant 9(4): 179-186.
- Santoso, B., Utomo, R. S., dan Wiyoga, M. D. 2016. Analisis Hubungan Senyawa Golongan Flavonoid Dari 24 Famili Tanaman Terhadap Aktivitas Penangkap Radikalnya. Prosiding Seminar Nasional Kimia UNJANI-HKI.
- Schneider, N., Werkmeister, K., & Pischetsrieder, M. 2011. *Analysis of nisin A, nisin Z and their degradation products by LCMS/MS*. Food Chemistry, 127(2), 847–854.
- Shalit, H., Dyaduk, A., dan Pappo, D. 2019. Selective Oxidative Phenol Coupling by Iron Catalysis. The Journal of Chemistry Organic. JOC 84: 1677-1686.
- Shen, L., & Ji, H.-F. 2007. *Theoretical study on physicochemical properties of curcumin*. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 67(3-4): 619–623.
- Simmons, K. E., Minard, R. D., dan Bollag, J. M. 1988. *Oxidative Coupling and Polymerization of Guaiacol, a Lignin Derivative*. Soil Sci. Soc. Am, J. 52:1356-1360.
- Siregar, T.M., Cahyana, A.H., dan Natalia. 2012. Pengaruh Penambahan Lakase Dari Jamur Tiram Putih (*Pleurotus ostreatus*) Terhadap Aktivitas Antioksidan Teh Hijau. J. Teknol. Dan Industri Pangan 23(1): 23-28.
- Snajdr, J., dan Baldrian, P. 2007. *Temperature Affects the Production, Activity and Stability of Ligninolytic Enzymes in Pleurotus ostreatus and Trametes versicolor*. Folia Microbiol 53(5): 498-502.
- Somparn, P., Phisalaphong, C., Nakornchai, S., Unchern, S., dan Morales, N.P. 2007. *Comparative Antioxidant Activities of Curcumin and its Demethoxy and Hydrogenated Deratives*. Biol. Pharm. Bull. 30(1): 74-78

- Susanti, M., Dachriyanus., dan Putra, D. P. 2012. Aktivitas Perlindungan Sinar UV Kulit Buah *Garcinia mangostana Linn* Secara *In Vitro*. Pharmacon. 13(2): 61-64
- Suwarso, W, P., Budianto, E., dan Jayadi, I. 2002. Semi-Sintesis Vanili dari Guaiakol Via Reaksi Reimer-Tiemann yang Dikatalis dengan Katalis Transfer Fase/PTC: [18]- Crown Ether-6. Makara, Sains 6(2)
- Tanasal, N dan Cahyana, A.H. 2017. Characteristic and Antioxidant Activity of Curcuminoids-Nanoemulsion from Tumeric (*Curcuma longa L.*). And The Application in Kunyit Asam Drink. Universitas Pelita Harapan. Tangerang.
- Tohma H., Gulcin, I, Bursal, E., Goren, A.C., Alwasel, S.H., Koksal, E. 2016. *Antioxidant activity and phenolic compounds of ginger (Zingiber officinale Rosc.) determined by HPLC-MS/MS*. Food Measure. Springer. New York.
- Tohyeng, N. Hariyadi, R.D., dan Lioe, H.N. 2018. Aplikasi Ekstrak Kunyit untuk Pengendalian Pertumbuhan Mikroba pada Tahu Selama Penyimpanan. J. Teknol. dan Industri Pangan 29(1): 19-28.
- Tristina D., Ismawati, A., Pradana, B.D., dan Jonathan, J.G. 2016. Pengujian Aktivitas Antioksidan Menggunakan Metode DPPH pada Daun Tanjung (*Mimusops elengi* L). Prosiding Seminar Nasional Teknik Kimia "Kejuangan". ISSN 1693-4393. Yogyakarta.
- Triyati, H. 1985. Spektrofotometer Ultra-Violet Dan Sinar Tampak Serta Aplikasinya Dalam Orseanologi. Oseana 10(1): 39 -47.
- Veronika, H. H., Mappiratu., dan Sumarni N, K. 2017. Ekstraksi dan Karakterisasi Ekstrak Zat Rumput Laut (*Eucheuma Cottonii*). KOVALEN, 3(1): 7-16.
- Wong, S.P., Leong, L.P., dan Koh, J H.W. 2005. *Antioxidant Activities of Aqueous Extracts of Selected Plants*. Food Chemistry 99(2006): 775-783
- Wulandari, A., Afrizal., Emriadi., Imelda., Efdi. M. 2020. Studi komputasi terhadap struktur, sifat antioksidan, toksisitas dan skor obat dari scopoletin dan turunannya. Chempublish 5(1): 77-92.
- Yuliantari, N. W. A., Widarta, I. W. R., dan Permana, I. D. G. M. Pengaruh Suhu dan Waktu Ekstraksi Terhadap Kandungan Flavonoid dan Aktivitas Antioksidan Daun Sirsak (*Annona muricata L.*) Menggunakan Ultrasonik. Media Ilmiah Teknologi Pangan 4(1): 35-42.
- Zhao, H., Gao, J., Zhou, W., Wang, Z., dan Wu, S. 2015. Quantitative detection of hydroxyl radicals in Fenton system by UV-vis spectrophotometry. Analytical 7: 5447-5453.