

DAFTAR KEPUSTAKAAN

- Abdulhafiz, F., Mohammed, A., Kayat, F., Bhaskar, M., Hamzah, Z., Podapati, S. K., & Reddy, L. V. (2020). Xanthine Oxidase Inhibitory Activity, Chemical Composition, Antioxidant Properties and GC-MS Analysis of Keladi Candik (*Alocasia longiloba* Miq). *Molecules*, 25, 2658. <https://doi.org/10.3390/molecules25112658>
- Aghoramurthy, K., Sarma, K., & Seshadri, T. (1961). Chemical investigation of Indian lichens: part XXV—chemical components of some rare Himalayan lichens. *J Sci Ind Res*, 20B, 166–168.
- Ahmadjian, V. (1993). *The Lichens*. New York and London: academic press.
- Apostolidis, E., Kwon, Y., Ghaedian, R., & Shetty, K. (2007). Fermentation of milk and soymilk by *Lactobacillus bulgaricus* and *Lactobacillus acidophilus* enhances functionality for potential dietary management of hyperglycemia and hypertension. *Food Biotechnol*, 21, 217–236.
- Arifa, N. (2018). *Isolasi dan Elusidasi Struktur Senyawa Metabolit Sekunder dari Lichen Sumatera Stereocaulon graminosum serta Pengujian Aktivitas Antibakteri*. Universitas Andalas.
- Balci, M. (2005). *Basic 1H and 13C NMR Spectroscopy* (Elsevier, Ed.).
- Behera, B., Adawadkar, B., & Makhija, U. (2003). Inhibitory activity of xanthine oxidase and superoxide-scavenging activity in some taxa of the lichen family Graphidaceae. *Phytomedicine*, 10(6–7), 536–543.
- Behera, B., Adawadkar, B., & Makhija, U. (2004). Capacity of some Graphidaceous lichens to scavenge superoxide and inhibition of tyrosinase and xanthine oxidase activities. *Curr Sci*, 87(1), 83–87.
- Behera, B., Adawadkar, B., & Makhija, U. (2006). Tyrosinase-inhibitory activity in some species of the lichen family Graphidaceae. *J Herb Pharmacother*, 6(1), 55–69.
- Behera, B., & Makhija, U. (2002). Inhibition of tyrosinase and xanthine oxidase by lichen species *Bulbothrix setschwanensis*. *Curr Sci*, 82(1), 61–66.
- Bhattarai, H., Kim, T., Oh, H., & Yim, J. (2013). A new pseudodepsidone from the Antarctic lichen *Stereocaulon alpinum* and its antioxidant, antibacterial activity. *J Antibiot (Tokyo)*, 66, 559–561. <https://doi.org/https://doi.org/10.1038/ja.2013.41>
- Borges, F., Fernandes, E., & Roleira, F. (2002). Progress Towards the Discovery of Xanthine Oxidase Inhibitors. *Current Medicinal Chemistry*, 9(2), 195–217. <https://doi.org/10.2174/0929867023371229>
- Bouges, H., Monchot, A., & Antoniotti, S. (2018). Enzyme-catalysed conversion

of atranol and derivatives into dimeric hydrosoluble materials: Application to the preparation of a low-atranol oakmoss absolute. *Cosmetics*, 5(4). <https://doi.org/10.3390/cosmetics5040069>

- Bruun, T. (1973). Bourgeanic acid in the lichen *Stereocaulon tomentosum*. *Acta Chem Scand*, 27, 3120.
- Bruun, T. (1976). Brassicasterol in *Cladonia gonecha* and *Stereocaulon tomentosum*. *Phytochemistry*, 15, 1179–1180.
- Bugni, T., Andjelic, C., Pole, A., Rai, P., Ireland, C., & Barrows, L. (2009). Biologically active components of a Papua New Guinea analgesic and anti-inflammatory lichen preparation. *Fitoterapia*, 80(5), 270–273.
- Campanelli, A. R., Domenicano, A., Ramondo, F., & Hargittai, I. (2004). Group electronegativities from benzene ring deformations: A quantum chemical study. *Journal of Physical Chemistry A*, 108(22), 4940–4948. <https://doi.org/10.1021/jp040013p>
- Casselmann, KO and Casselman, K. (2001). Lichen Dyes. *United States of America*.
- Chang, T. S. (2009). An updated review of tyrosinase inhibitors. *International Journal of Molecular Sciences*, 10(6), 2440–2475. <https://doi.org/10.3390/ijms10062440>
- Chang, Y., Ryu, J., Lee, S., Park, S., Bhattarai, H., Yim, J., & Jin, M. (2012). Inhibition of melanogenesis by Ramalin from the Antarctic lichen *Ramalina terebrata*. *J Soc Cosmet Scientists Korea*, 38(7), 247–254.
- Claudia A, Simoes-Pires, Hmicha, B., Martson, A., & Hostettman, K. (2009). A TLC bioautographic method for the detection of α - and β -glucosidase inhibitors in plant extracts. *Phytochem Anal*, 20, 511–515. <https://doi.org/10.1002/pca.1154>
- Cohen, P., & Goedert, M. (2004). GSK3 inhibitors: development and therapeutic potential. *Nat Rev Drug Discov*, 3(6), 479–487. <https://doi.org/10.1038/nrd1415>
- Cui, Y., Yim, J., Lee, D., Kim, Y., & Oh, H. (2012). New diterpene furanoids from the Antarctic lichen *Huea* sp. *Bioorg Med Chem Lett*, 22(24), 7393–7396.
- Devehat, F., Tomasi, S., Elix, J., Bernard, A., Rouaud, I., Uriac, P., & Boustie, J. (2007). Stictic Acid Derivatives from the Lichen *Usnea articulata* and Their Antioxidant Activities. *J Nat Prod*, 70(7), 12118–1220.
- Diabetes. (2020). Retrieved August 27, 2020, from World Health Organization website: <https://www.who.int/news-room/fact-sheets/detail/diabetes>
- Dobson, F. (1992). *Lichens An Illustrated The Guide to British and Irish Species*. Singapore: Stamford Press.

- Ehsan, K., Ehsan, P., Rudi, H., Armin, O., & hawa z. e., J. (2012). Phenolic compounds characterization and biological activities of citrus aurantium bloom. *Molecules*, *17*, 1203–1218. <https://doi.org/10.3390/molecules17021203>
- Engel, K., Schmidt, U., Reuter, J., Weckesser, S., Simon-Haarhaus, B., & Schempp, C. (2007). Usnea barbata extract prevents ultraviolet-B induced prostaglandin E2 synthesis and COX-2 expression in HaCaT keratinocytes. *J Photochem Photobiol B*, *89*(1), 9–14.
- Esimone, C., Ofokansi, K., Adikwu, M., Ibezim, E., Abonyi, D., Odaibo, G., & Olaleye, D. (2007). In Vitro Evaluation of the Antiviral Activity of Extracts from the Lichen *Parmelia perlata*(L.) Ach Againsts Three RNA viruses. *J Infect Dev. Count*, *1*(3), 315–320.
- Fessenden, R., & Fessenden, J. (1982). *Kimia Organik (Ed. 3)*. Jakarta: Erlangga.
- Fitrie, A. (2004). Histologi dari melanosit. *E-USU Repository Universitas Sumatera Utara*, *5*, 1–6.
- Fox, C., & Huneck, S. (1970). Inhaltsstoffe von einigen Stereocaulon-arten. *Phytochemistry*, *9*, 2057. Retrieved from [https://doi.org/10.1016/S0031-9422\(00\)85361-3](https://doi.org/10.1016/S0031-9422(00)85361-3)
- Fraser, M., Cuerrier, A., & Haddad, P. (2007). Medicinal plants of Cree communities (Que´bec, Canada): antioxidant activity of plants used to treat type 2 diabetes symptoms. *Can J Physiol Pharmacol*, *85*, 1200–1214. Retrieved from <https://doi.org/10.1139/Y07-108>
- Frengki. (2010). *Isolasi, Elusidasi Struktur Dan Uji Bioaktivitas Kandungan Kimia Fraksi Etil Asetat Kulit Batang Tanaman Calophyllum Macrophyllum Scheff*. Universitas Indonesia.
- Goel, M., Sharma, P., & Dureja, P. (2011). Antifungal activity of extracts of the lichens *Parmelia reticulata*, *Ramalina roesleri*, *Usnea longissima* and *Stereocaulon himalayense*. *Arch Phytopathol Plant Prot*, *44*, 1300–1311. Retrieved from <https://doi.org/10.1080/03235408.2010.496549>
- Gonzalez, A., Perez, E., Padron, C., & Barrera, J. (1992). Chemical constituents of the lichen *Stereocaulon azureum*. *Z Naturforsch C Bio Sci*, *47*, 503.
- Gritter, R., Bobbit, J., & Schwarting, A. (n.d.). *Pengantar Kromatografi. Edisi Kedua*. Bandung: ITB.
- Grotewold, E. (2005). *The science of Flavonoid*. USA: Springer.
- Gülçin, I., Oktay, M., Küfrevioğlu, O., & Aslan, A. (2002). Determination of Antioxidant Activity of Lichen *Cetraria islandica* (L) Ach. *Ethnopharmacol*, *79*(3), 325–329.
- Gupta, V., Darokar, M., & Saikia, D. (2007). Antimycobacterial activity of lichens. *Pharm Biol*, *45*, 200–204. Retrieved from

<https://doi.org/10.1080/13880200701213088>

- Gupta, V., Darokar, M., Saikia, D., Pal, A., Fatima, A., & Khanuja, S. (2007). Antimycobacterial Activity of Lichens. *Pharm Biol*, 45(3), 200–204.
- Hartanti, L., & Setiawan, H. (2009). Inhibitory potential of some synthetic cinnamic acid derivatives towards tyrosinase enzyme. *Indo J Chem*, 9, 158–168.
- Heng, L., Li, C., Kim, J., Liu, Y., Jung, J., Koh, Y., & Hur, J. (2013). Biruloquinone, an acetylcholinesterase inhibitor produced by lichen-forming fungus *Cladonia macilenta*. *J Microbiol Biotechnol*, 23(2), 161–166.
- Hengameh, P., Rashmi, S., & Rajkumar, H. (2016). In vitro inhibitory activity of some lichen extracts against α -amylase enzyme. *European Journal of Biomedical and Pharmaceutical Sciences*, 3(5), 315–318.
- Honda, N., Gonsalves, K., Brandao, L., Coelho, R., Micheletti, A., Spielmann, A., & Canez, L. (2016). Screening of lichen extracts using tyrosinase inhibition and toxicity against *Artemia salina*. *Electronic J Chem*, 8(3), 181–188.
- Hossain, U., Das, A., Ghosh, S., & Sil, P. (2020). An overview on the role of bioactive α -glucosidase inhibitors in ameliorating diabetic complications. *Food Chem Toxicol*, 145, 111738. <https://doi.org/10.1016/j.fct.2020.111738>
- Huneck, S., & Yoshimura, I. (1996). Identification of lichen substances. *Verlag Berlin Heidelberg New York : Springer*.
- Ingolfssdottir, K., Bloomfield, S., & Hylands, P. (1985). In vitro evaluation of the antimicrobial activity of lichen metabolites as potential preservatives. *Antimicrob Agents Chemother*, 28, 289–292.
- Ingolfssdottir, K., Gissurarson, S., & Muller-Jakic, B. (1996). Inhibitory effects of the lichen metabolite lobaric acid on arachidonate metabolism in vitro. *Phytomedicine*, 2, 243–246. Retrieved from [https://doi.org/10.1016/S0944-7113\(96\)80049-3](https://doi.org/10.1016/S0944-7113(96)80049-3)
- Ingolfssdottir, K., Gissurarson, S., & Nenninger, A. (1997). Biologically active alkamide from the lichen *Stereocaulon alpinum*. *Phytomedicine*, 4, 331–334. [https://doi.org/https://doi.org/10.1016/S0944-7113\(97\)80042-6](https://doi.org/https://doi.org/10.1016/S0944-7113(97)80042-6)
- Ismed, F. (2012). *etude esie Friardi Ismed Phytochimie de lichens du genre Stereocaulon : étude particulière de montagneanum Lamb , deux lichens recoltés en Indonésie Thèse soutenue à Rennes*.
- Ismed, F., Arifa, N., Zaini, E., Bakhtiar, A., Umeda, D., Putra, O. D., & Yonemochi, E. (2018). Ethyl haemmatommate from *Stereocaulon graminosum* Schaer.: Isolation and Crystal Structure. *Natural Product Sciences*, 24(2), 115–118. Retrieved from <https://doi.org/10.20307/nps.2018.24.2.115>
- Ismed, F., Guiller, A., Devehat, F., & Corlay, N. (2018). Phytochemical review of

the lichen genus *Stereocaulon* (Fam. *Stereocaulaceae*) and related Pharmacological activities highlighted by a focus on nine species. *Springer*. Retrieved from <https://doi.org/10.1007/s11101-018-9576-y>

- Ismed, F., Hartati, S., Mulyadi, R., Putra, H. E., Vidian, N. P., & Putra, D. P. (2016). Isolasi senyawa Depside-Depsodone dari Lichen Sumatera (*Stereocaulon halei*) dan Uji Aktivitas Antimikroba serta Anti tuberkulosis. *Jurnal Ilmu Kefarmasian Indonesia*, *14*(1), 49–56.
- Ismed, F., Putra, H. E., Arifa, N., & Putra, D. P. (2021). Phytochemical profiling and antibacterial activities of extracts from five species of Sumatran lichen genus *stereocaulon*. *Jordan Journal of Pharmaceutical Sciences*, *14*, 2.
- Jager, A., Weber, D., & Van, S. J. (1997). Screening of South African lichens for prostaglandin-synthesis inhibitors. *S Afr J Bot*, *63*(5), 300–302.
- Jaiswal, N., Srivastava, S., Bhatia, V., Mishra, A., & Sonkar, A. (2012). Inhibition of alpha-glucosidase by *acacia nilotica* prevents hyperglycemia along with improvement of diabetic complications via aldose reductase inhibition. *Diabetes Metab*, *6*, 1–7.
- Joshi, S., Standl, E., Tong, N., Shah, P., Kalra, S., & Rathod, R. (2015). Therapeutic potential of α -glucosidase inhibitors in type 2 diabetes mellitus: an evidence-based review. *Expert Opin Pharmacother*, *16*(13), 1959–1981. <https://doi.org/10.1517/14656566.2015.1070827>
- Karthik, S., Nandini, K., Kekuda, P., Vinayaka, K., & Mukunda, S. (2011). Total phenol content, insecticidal and amylase inhibitory efficacy of *Heterodermia leucomela* (L). *Ann Biol Res*, *2*(4), 38–44.
- Karunaratne, V., Thadhani, V., Khan, S., & Choudhary, I. (2014). Potent α -glucosidase inhibitors from the lichen *Cladonia* species from Sri Lanka. *J Natn Sci Foundation Sri Lanka*, *42*(1), 95–98.
- Khan, M., Nabila, S., Rashid, R., Rahman, M., Chowdhury, A., & Rashid, M. (2015). In silico molecular docking studies of lichen metabolites against cyclooxygenase-2 enzyme. *Bangladesh Pharm J*, *18*(2), 90–96.
- Kim, J., Kim, H., & Jin, C. (2019). Mechanistic investigation of anthocyanidin derivatives as α -glucosidase inhibitors. *Bioorg Chem*, *87*, 803–809. <https://doi.org/10.1016/j.bioorg.2019.01.033>
- Kim, M., & Cho, H. (2007). Melanogenesis inhibitory effects of methanolic extracts of *Umbilicaria esculenta* and *Usnea longissima*. *J Microbiol*, *45*(6), 578–582.
- Kinoshita, K., Togawa, T., Hiraishi, A., Nakajima, Y., Koyama, K., Narui, T., ... Takashashi, K. (2010). Antioxidant Activity of Red Pigments from the Lichens *Lethariella sernanderi*, *L. cashmeriana*, and *L. sinensis*. *J Nat Med*, *64*(1), 85–88.

- Kokubun, T., Shiu, W., & Gibbons, S. (2007). Inhibitory activities of lichen-derived compounds against methicillin- and multidrug-resistant *Staphylococcus aureus*. *Planta Med*, 73, 176–179. <https://doi.org/https://doi.org/10.1055/s-2006-957070>
- Kong, Y., Li, X., Zhang, N., Miao, Y., Feng, H., Wu, T., & Cheng, Z. (2018). Improved Bioautography Assay on TLC Layers for Qualitative and Quantitative Estimation of Xanthine Oxidase Inhibitors and Superoxide Scavengers. *Journal of Pharmaceutical and Biomedical Analysis*, 150, 87–94.
- Kristmundsdóttir, T., & R.A.E. Aradóttir, K Ingólfssdóttir, R. . (2002). Solubilization of the Lichen Metabolite (+)-Usnic Acid for Testing in Tissue Culture. *J Pharm Pharmacol*, 54(11), 1447–1452.
- Lamb, I. (1951). On the morphology, phylogeny, and taxonomy of the lichen genus *Stereocaulon*. *Can J Bot*, 29, 522–584.
- Lavergne, R. (1989). Plantes medicinales indigenes tisanerie et tisaneurs de la Reunion. *Universite Des Sciences et Techniques Du Languedoc, France*.
- Lee, K, Yim, J., Lee, H., & Pyo, S. (2016). Inhibition of VCAM-1 expression on mouse vascular smooth muscle cells by lobastin via downregulation of p38, ERK 1/2 and NF- κ B signaling pathways. *Arch Pharm Res*, 39, 83–93. <https://doi.org/https://doi.org/10.1007/s12272-015-0687-3>
- Lee, KA, & Kim, M. (2000). Glucosidase inhibitor from *Umbilicaria esculenta*. *Can J Microbiol*, 46(11), 1077–1081.
- Li, D., Qian, Z., & Li, S. (2010). Inhibition of three selected beverage extracts on alpha-glucosidase and rapid identification of their active compounds using HPLC-DAD-MS/MS and biochemical detection. *J Agric Food Chem*, 58(11), 6608–6613. <https://doi.org/126.10.1021/jf100853c>
- Lopes, T., Coelho, R., & Honda, N. (2018). Inhibition of mushroom tyrosinase activity by orsellinates. *Chem Pharm Bull (Tokyo)*, 66(1), 61–64.
- Luo, H., Yamamoto, Y., Kim, J., Jung, J., Koh, Y., & Hur, J. (2009). Lecanoric Acid, a Secondary Lichen Substance with Anti-oxidant Properties from *Umbilicaria antarcticain* Maritime Antarctica (King George Island). *Polar Biol*, 32(7), 103–104.
- Malik, S., Pardeshi, N., & Seshadri, T. (1972). Chemical investigation of Indian lichens. Part XXX. *Indian J Chem*, 10, 1040.
- Manojlovic, N., Vasiljevic, P., Juskovic, M., Najman, S., Jankovic, S., & Andjelkovic, A. (2010). HPLC Analysis and Cytotoxic Potential of Extracts from the Lichen *Thamnolia vermicularis* var. *subuliformis*. *J Med Plant Res*, 4(9), 817–823.
- marck W, H., & Robin M., Z. (n.d.). *basic concepts in medicinal chemistry* (second edi). <https://doi.org/10.37573/9781585286027.002>

- Matsubara, H., Kinoshita, K., Koyama, K., Ye, Y., Takashashi, K., Yoshimura, I., ... Kinoshita, Y. (1997). Anti-tyrosinase activity of lichen metabolites and their synthetic analogues. *J Hattori Bot Lab*, 83, 179–185.
- Momtaz, S., Mapunya, B., Houghton, P., Edgerly, C., Hussein, A., Naidoo, S., & Lall, N. (2008). Tyrosinase inhibition by extracts and constituents of *Sideroxylon inerme* L. stem bark, used in South Africa for skin lightening. *J Ethnopharmacology*, 119, 507–512.
- Montgomery, R., Conway, T., & Spector, A. (1993). *Biokimia Berorientasi pada Kasus-Klinik*. Jakarta: Binarupa Aksara.
- Muggia, L., Schmitt, I., & Grube, M. (2009). Lichen as Treasure Chest Of Natural products. *SIM News*.
- Nash, T. (1996). *Lichen Biology*. Cambridge: Cambridge University Press.
- Nash, T. (2008). *Lichen Biology 2nd Ed*. Cambridge: Cambridge University Press.
- Ogmundsdo'ttir, H., Zoe'ga, G., Gissurarson, S., & Ingo'lfso'ttir, K. (1998). Anti-proliferative effects of lichen-derived inhibitors of 5-lipoxygenase on malignant cell-lines and mitogenstimulated lymphocytes. *J Pharm Pharmacol*, 50, 107–115. <https://doi.org/https://doi.org/10.1111/j.2042-7158.1998.tb03312.x>
- Okuyama, E., Umeyama, K., Yamazaki, M., Kinoshita, Y., & Yamamoto, Y. (1995). Usnic Acid and Diffractic Acid as Analgesic and Antipyretic Components of *Usnea diffracta*. *Plant Med*, 61(2), 113–115.
- Owen, L., Patrick, J., & Timothy. (1998). Xanthine Oxidase inhibitory Activity of Northeastern American Plant remedies Used for Gout. *J Ethnopharmacology*, 64, 149–160.
- Parizadeh, H., & Garampali, R. (2016). Evaluation of some lichen extracts for β -glucosidase inhibitory as a possible source of herbal antidiabetic drugs. *Am J Biochem*, 6(2), 46–50.
- Park, H., Hwang, K., Oh, K., Kim, Y., Lee, J., & Kim, K. (2008). Discovery of novel alpha-glucosidase inhibitors based on the virtual screening with the homology-modeled protein structure. *Bioorg Med Chem*, 16(1), 284–292. <https://doi.org/10.1016/j.bmc.2007.09.036>
- Paudel, B., Bhattarai, H., Koh, H., Lee, S., Han, S., Lee, H., ... Yim, J. (2011). Ramalin, a novel nontoxic antioxidant compound from the Antarctic lichen *Ramalina terebrata*. *Phytomedicine*, 18(14), 1285–1290.
- Pejin, B., Tommonaro, G., Iodice, C., Tesevic, V., & Vajs, V. (2012). Acetylcholinesterase inhibition activity of acetylated depsidones from *Lobaria pulmonaria*. *Nat Prod Res*, 26(17), 1634–1637.
- Pejin, B., Tommonaro, G., Iodice, C., Tesevic, V., Vajs, V., & De, R. S. (2013). A new depsidone of *Lobaria pulmonaria* with acetylcholinesterase inhibition

activity. *J Enzyme Inhib Med Chem*, 28(4), 876–878.

- Proença, C., Freitas, M., Ribeiro, D., Oliveira, E., Sousa, J., & Tomé, S. (2017). α -Glucosidase inhibition by flavonoids: an in vitro and in silico structure-activity relationship study. *J Enzyme Inhib Med Chem*, 32(1), 1216–1228. <https://doi.org/10.1080/14756366.2017.1368503>
- Purvis, O., Coppins, B., & Hawksworth, D. (1992). The lichen flora of great britain and ireland. *The British Lichen Society, London*.
- Raj, P., Prathapan, A., Sebastian, J., Antony, A., Riya, M., Rani, M., ... Raghu, K. (2014). Parmotrema tinctorum exhibits antioxidant, antiglycation and inhibitory activities against aldose reductase and carbohydrate digestive enzymes: an in vitro study. *Nat Prod Res*, 28(18), 1480–1484.
- Rankovic, B. (2015). Lichen Secondary Metabolite Bioactive Properties and Pharmaceutical Potential. *Serbia : Springer*.
- Rankovic, B., Kosanic, M., & Stanojkovic, T. (2014). Stereocaulon paschale lichen as antioxidant, antimicrobial and anti cancer agent. *Farmacia*, 62, 306–317.
- Rankovic, B., Misic, M., & Sukdolak, S. (2007). Antimicrobial Activity of Extracts of the Lichens Cladonia furcata, Parmelia caperata, Parmelia pertusa, Hypogymnia physodes and Umbilicaria polyphylla Br. *J Biomed Sci*, 64(4), 143–148.
- Reddy, R., Veeraval, L., Maitra, S., Chollet-Krugler, M., Tomasi, S., Dévéhat, F., ... Chakravarty, S. (2016). Lichen-derived compounds show potential for central nervous system therapeutics. *Phytomedicine*, 23(12), 1527–1534.
- Reusch, J., & Manson, J. (2017). Management of type 2 diabetes in 2017: getting to goal. *JAMA*, 317(10), 1015–1016. <https://doi.org/10.1001/jama.2017.0241>
- Richardson, D. (1991). Lichens and Man. In Hawksworth DL, Ed., *Frontiers in Mycology*.
- Russo, A., Piovano, M., Lombardo, L., Garvarino, J., & Cardile, V. (2008). Lichen Metabolites Prevent UV Light and Nitric Oxide Mediated Plasmid DNA Damage and Induce Apoptosis in Human Melanoma Cells. *Life Sci*, 83(13–14), 468–474.
- Santiago, K., Borricano, J., & Canal, J. (2010). Antibacterial activities of fructicose lichens collected from selected sites in Luzon Island, Philippines. *Philipp Sci Lett*, 3, 18–29.
- Sarawek, S. (2007). *Xanthin Oxidase Inhibition and Antioxidant Activity Of An Artichoke Leaf Extract (Cynara scolymus L.) And its Compounds*. University of Florida.
- Seo, C., Sohn, J., & Ahn, J. (2009). Protein tyrosine phosphatase 1B inhibitory effects of depsidone and pseudodepsidone metabolites from the Antarctic

lichen *Stereocaulon alpinum*. *Bioorg Med Chem Lett*, 19, 2801–2803.
<https://doi.org/https://doi.org/10.1016/j.bmcl.2009.03.108>

- Sharma, G. (1997). Ethnomedicinal flora: ayurvedic system of medicine in a remote part of the Indo-Tibetan Himalayas. *J Tenn Acad*, 72, 53–54.
- Shivanna, R., Parizadeh, H., & Garampali, R. (2015). Screening of lichen extracts for in vitro antidiabetic activity using alpha amylase inhibitory assay. *International Journal of Biological and Pharmaceutical Research*, 6(5), 364–367.
- Silverstein, R., Bassler, G., & Morrill, T. (1991). *Spectrometric Identification of Organic Compound (4th Ed)*. Singapore: John Wiley and Sons.
- Singh, R., Ranjan, S., & Nayaka, S. (2013). Functional characteristics of a fruticose type of lichen, *Stereocaulon foliolosum* Nyl. in response to light and water stress. *Acta Physiol Plant*, 35, 1605–1615. Retrieved from <https://doi.org/10.1007/s11738-012-1203-8>
- Slama, G., Elgrably, F., Mbemba, J., & Larger, E. (2006). Postprandial glycaemia: a plea for the frequent use of delta postprandial glycaemia in the treatment of diabetic patients. *Diabetes Metab*, 32, 187–192.
- Solberg, Y. (1977). Chemical investigation of the lichen species *Alectoria ochroleuca*, *Stereocaulon vesuvianum* var. *pulvinatum* and *Icmadophila ericetorum*. *Z Naturforsch C Bio Sci*, 32, 182.
- Solberg, Y. (1987). Chemical constituents of the lichens *Cetraria delisei*, *Lobaria pulmonaria*, *Stereocaulon tomentosum* and *Usnea hirta*. *J Hattori Bot Lab*, 63, 357–366.
- Suleyman, H., Odabasoglu, F., Aslan, A., Cakir, A., Karagoz, Y., Gocer, F., ... Bayir, Y. (2003). Anti-inflammatory and Antiulcerogenic Effects of the Aqueous Extract of *Lobaria pulmonaria*(L.) Hoffm. *Phytomedicine*, 10(6–7), 552–557.
- Tanas, S., Odabasoglu, F., Halici, Z., Cakir, A., Aygun, H., Aslan, A., & Suleyman, H. (2010). Evaluation of Anti-inflammatory and Antioxidant Activities of *Peltigera rufescens* Lichen Species in Acute and Chronic Inflammation Models. *J Nat Med*, 64(1), 42–49.
- Tekale, S. (2018). The A-amylase inhibitory and dye degradation potential of the lichen (*parmelia perlata*). *International Journal of Basic and Applied Research*, 8(8), 256–260.
- Thadhani, V., Naas, Q., Choudhary, I., Mesaik, A., & Karunaratne, V. (2014). Enzyme inhibitory and immunomodulatory activities of the depsidone lobaric acid extracted from the lichen *Heterodermia* sp. *J Natn Sci Foundation Sri Lanka*, 42(2), 193–196.
- Tokiwano, T., SAtoh, H., Obara, T., Hirota, H., Yoshizawa, Y., & Yamamoto, Y.

- (2009). A Lichen Substance as an Antiproliferative Compound Against HL-60 Human Leukemia Cells: 16-OAcetyl-leucotylic Acid Isolated from *Myelochroa aurulenta*. *Biosci Biotechnol Biochem*, 73(11), 2525–2527.
- Turk, A., Yilmaz, O., Kivanc, M., & Turk, H. (2003). The Antimicrobial Activity of Extracts of the Lichen *Cetraria aculeate* and Its Protolichesterinic Acid Constituent. *Naturforsch*, 58(11–12), 850–854.
- Umamaheswari, M., Asokkumar, K., Subhadradevi, V., & Sivashanmugam, A. (2009). In vitro Xanthin Oxidase Inhibitory Activity of the Fraction of *erythrina stricta* Roxb. *J Ethnopharmacology*, 124, 646–648.
- Valadbeigi, T. (2016a). Chemical composition and enzymes inhibitory, brine shrimp larvae toxicity, antimicrobial and antioxidant activities of *Caloplaca biatorina*. *Zahedan J Res Med Sci*, 18(11), e4267.
- Valadbeigi, T. (2016b). Chemical composition and enzymes inhibitory, brine shrimp larvae toxicity, antimicrobial and antioxidant activities of *Caloplaca biatorina*. *Zahedan J Res Med Sci*, 18(11), e426.
- Verma, N., Behera, B., & Sharma, B. (2012). Glucosidase inhibitory and radical scavenging properties of lichen metabolites salazinic acid, sekikaic acid and usnic acid. *Hacettepe J Biol Chem*, 40(1), 7–21.
- Verma, N., Behera, B., Sonone, A., & Makhija, U. (2008). Lipid peroxidation and tyrosinase inhibition by lichen symbionts grown in vitro. *Afr J Biochem Res*, 2(12), 225–231.
- Vijayakumar, C., Viswanathan, S., Reddy, M., Parvathavarthini, S., Kundu, S., & Sukumar, E. (2000). Anti-inflammatory Activity of (+) Usnic Acid. *Fitoterapia*, 71(5), 564–566.
- Vila, J., Mollinedo, P., Flores, Y., & Sterner, O. (2008). 1,3,7- trimethylguanaine from the lichen *Stereocaulon ramulosum*. *Rev Bol Quim*, 25, 1–3.
- Vinayaka, K., Karthik, S., Nandini, K., & Kekuda, P. (2013). Amylase inhibitory activity of some macrolichens of Western Ghats, Karnataka, India. *Indian Journal of Novel Drug Delivery*, 5(4), 225–228.
- Vu, T. (2014). *Etude des acides gras du genre Stereocaulon etude phytochimique du lichen S. evolutum Graewe*. Université de Rennes1.
- Vu, T., Le, L. A., & Lalli, C. (2015). Depsides: lichen metabolites active against hepatitis C virus. *PLoS ONE*, 10, 1–14. <https://doi.org/10.1371/journal.pone.0120405>
- Wangthong, S., Tonsiripakdee, I., Monhaphol, T., Nonthanbenjawan, R., & Wanichwecharungruang, S. P. (2007). Post TLC developing technique for tyrosinase inhibitor detection. *Biomed Chromatogr*, 21, 94–100. <https://doi.org/10.1002/bmc.727>
- Xu, H., Yang, T., Xie, P., Liu, S., Liang, Y., Zhang, Y., ... Tang, Z. (2018).

Pheophytin analogues from the medicinal lichen *Usnea diffracta*. *Nat Prod Res*, 32(9), 1088–1094.

Yang, Y., Gu, L., Xiao, Y., Liu, Q., Hu, H., Wang, Z., & Chen, K. (2015). Rapid identification of α -glucosidase inhibitors from *phlomis tuberosa* by sepbox chromatography and thin-layer chromatography bioautography. *PLoS ONE*, 10(2), 1–13. <https://doi.org/10.1371/journal.pone.0116922>

Yao, Y., Sang, W., Zhou, M., & Ren, G. (2010). Antioxidant and α -glucosidase inhibitory activity of colored grains in China. *J Agric Food Chem*, 58, 770–774.

Ye, G., Lan, T., Huang, Z., Cheng, X., Cai, C., & Ding, S. (2019). Design and synthesis of novel xanthone-triazole derivatives as potential antidiabetic agents: α -Glucosidase inhibition and glucose uptake promotion. *Eur J Med Chem*, 177, 362–373. <https://doi.org/10.1016/j.ejmech.2019.05.045>

Yurnaliza. (2002). *Lichens (Karakterisasi, Klasifikasi dan Kegunaan)*. Medan: USU Digitalis Library.

Zeng, Z., Yin, X., Wang, X., Yang, W., Liu, X., & Hong, Y. (2019). ynthesis of water soluble pentacyclic dihydroxyterpene carboxylic acid derivatives coupled amino acids and their inhibition activities on α -glucosidase. *Bioorg Chem*, 86, 277–287. <https://doi.org/10.1016/j.bioorg.2019.02.001>

