

DAFTAR PUSTAKA

- Affandi, A. R. (2018). Kajian sifat antibakteri *emulsifier* monolaurin yang dihasilkan dari reaksi kimiawi dan enzimatis. *Jurnal Ilmu Pangan Dan Hasil Pertanian*, 1(2), 93. <https://doi.org/10.26877/jiphp.v1i2.2097>
- Aldridge, M. (2020). Review of the antiviral activity and pharmacology of monoglycerides and implications for treatment of COVID-19. *OSF Preprints*, April(11), 1–10. <https://doi.org/10.31219/osf.io/qdsef>
- Alfieri, A., Imperlini, E., Nigro, E., Vitucci, D., Orr, S., Daniele, A., Buono, P., & Mancini, A. (2018). Effects of plant oil interesterified triacylglycerols on lipemia and human health. *International Journal of Molecular Sciences*, 19(104), 1–11. <https://doi.org/10.3390/ijms19010104>
- Amadou, I., Sun, G. W., Gbadamosi, O. S., & Le, G. W. (2016). Antimicrobial and cell surface hydrophobicity effects of chemically synthesized fermented foxtail millet meal fraction peptide (FFMp10) mutants on *Escherichia coli* ATCC 8099 strain. *International Food Research Journal*, 23(2), 708–714.
- Amin Zare, M., Razavi Rohani, S. M., Raeisi, M., Javadi Hosseini, S. H., & Hashemi, M. (2014). Antibacterial effects of monolaurin, sorbic acid and potassium sorbate on *Staphylococcus aureus* and *Escherichia coli*. *Journal of Food Quality and Hazards Control*, 1(2), 52–55.
- Amira, A., Olaniyi, P., Babalola, O. O., & Mary, O. A. (2014). Physicochemical Properties of Palm Kernel Oil. *Current Research Journal of Biological Sciences*, 6(5), 205–207. <https://doi.org/10.19026/crjbs.6.5194>
- Amperayani, K. R., Kumar, K. N., & Parimi, U. D. (2018). Synthesis and in vitro and in silico antimicrobial studies of novel piperine–pyridine analogs. *Research on Chemical Intermediates*, 44(5), 3549–3564. <https://doi.org/10.1007/s11164-018-3324-1>
- Andi, S. N., Angopadhyay, S. G., & Hosh, S. G. (2004). Production of Medium Chain Glycerides and Monolaurin from Coconut Acid Oil by Lipase-Catalyzed Reactions. *Journal of Oleo Science*, 53(10), 497–501.
- Andriani, Y., Safitri, R., Rochima, E., & Fakhrudin, S. D. D. (2017). Characterization of *Bacillus subtilis* and *B. licheniformis* potentials as probiotic bacteria in Vanamei shrimp feed (*Litopenaeus vannamei* Boone, 1931). *Nusantara Bioscience*, 9(2), 188–193. <https://doi.org/10.13057/nusbiosci/n090214>
- Anggoro, D. D., Oktavianty, H., Kurniawan, B. P., & Daud, R. (2019). Optimization of glycerol monolaurate (GML) synthesis from glycerol and lauric acid using dealuminated zeolite Y catalyst. *Jurnal Teknologi*, 81(4), 133–141. <https://doi.org/10.11113/jt.v81.13511>
- AOCS 2003a. (2003). AOCS Official Method Ca 5a-40, 1997. Official Methods and Recommended Practices of the AOCS. 5th Edn. American Oil Chemist's Society Champaign, Illinois, 1–2.
- Asif, M. (2012). Oxidation and polymorphism of fatty acids and nutritional aspects

- conjugated of linoleic acids. *Indonesian J. Pharm*, 24(2), 65–74.
- Azahari, D. H. (2019). Hilirisasi kelapa sawit: kinerja, kendala, dan prospek. *Forum Penelitian Agro Ekonomi*, 36(2), 81. <https://doi.org/10.21082/fae.v36n2.2018.81-95>
- Barker, L. A., Bakkum, B. W., & Chapman, C. (2019). The clinical use of monolaurin as a dietary supplement: a review of the literature. *Journal of Chiropractic Medicine*, 18(4), 305–310. <https://doi.org/10.1016/j.jcm.2019.02.004>
- Batovska, D. I., Todorova, I. T., Tsvetkova, I. V., & Najdenski, H. M. (2009). Antibacterial study of the medium chain fatty acids and their 1-monoglycerides: Individual effects and synergistic relationships. *Polish Journal of Microbiology*, 58(1), 43–47.
- Bautista, D. A., Durisin, M. D., Razavi-Rohani, S. M., Hill, A. R., & Griffiths, M. W. (1993). Extending the shelf-life of cottage cheese using monolaurin. *Food Research International*, 26(3), 203–208. [https://doi.org/10.1016/0963-9969\(93\)90054-M](https://doi.org/10.1016/0963-9969(93)90054-M)
- Bornscheuer, U. T. (1995). Lipase-catalyzed syntheses of monoacylglycerols. *Enzyme and Microbial Technology*, 17(7), 578–586. [https://doi.org/10.1016/0141-0229\(94\)00096-A](https://doi.org/10.1016/0141-0229(94)00096-A)
- Bozic, A. K., Anderson, R. C., Callaway, T. R., Nisbet, D. J., Ricke, S. C., Crandall, P. G., & O'Bryan, C. A. (2010). In vitro comparison of nitroethane, 2-nitro-1-propanol, lauric Acid, lauricidin (R) and the Hawaiian Marine Algae, *Chaetoceros* activity against anaerobically grown *Staphylococcus aureus*. *International Journal of Applied Research in Veterinary Medicine*, 8(3), 180–184.
- BPS. (2020). Statistik kelapa sawit Indonesia. In *BPS*. <https://www.bps.go.id/publication/2021/11/30/5a3d0448122bc6753c953533/statistik-kelapa-sawit-indonesia-2020.html>
- Budianto, B., & Suprastyani, H. (2017). Aktivitas antagonis *Bacillus subtilis* terhadap *Streptococcus iniae* dan *Pseudomonas fluorescens*. *Jurnal Veteriner*, 18(3), 409–415. <https://doi.org/10.19087/jveteriner.2017.18.3.403>
- Buňková, L., Buňka, F., Janiš, R., Krejčí, J., Doležálková, I., Pospíšil, Z., Růžička, J., & Tremlová, B. (2011). Comparison of antibacterial effect of seven 1-monoglycerides on food-borne pathogens or spoilage bacteria. *Acta Veterinaria Brno*, 80(1), 029–039. <https://doi.org/10.2754/avb201180010029>
- Busche, J. F., Möller, S., Stehr, M., & Dietzel, A. (2019). Cross-flow filtration of *Escherichia coli* at a nanofluidic gap for fast immobilization and antibiotic susceptibility testing. *Micromachines*, 10(10). <https://doi.org/10.3390/mi10100691>
- Calero, J., Verdugo, C., Luna, D., Sancho, E. D., Luna, C., Posadillo, A., Bautista, F. M., & Romero, A. A. (2014). Selective ethanolysis of sunflower oil with Lipozyme RM IM, an immobilized *Rhizomucor miehei* lipase, to obtain a

- biodiesel-like biofuel, which avoids glycerol production through the monoglyceride formation. *New Biotechnology*, 31(6), 596–601. <https://doi.org/10.1016/j.nbt.2014.02.008>
- Chai, X., Meng, Z., Jiang, J., Cao, P., Liang, X., Piatko, M., Campbell, S., Lo, S. K., & Liu, Y. (2018). Non-triglyceride components modulate the fat crystal network of palm kernel oil and coconut oil. *Food Research International*, 105, 423–431. <https://doi.org/10.1016/j.foodres.2017.11.060>
- Chaibi, A., Ababouch, L. H., & Busta, F. F. (1996). Inhibition of bacterial spores and vegetative cells by glycerides. *Journal of Food Protection*, 59(7), 716–722. <https://doi.org/10.4315/0362-028X-59.7.716>
- Chandler, I. C. (2001). Determining the regioselectivity of immobilized lipases in triacylglycerol acidolysis reactions. *JAOCs, Journal of the American Oil Chemists' Society*, 78(7), 737–742. <https://doi.org/10.1007/s11746-001-0335-7>
- Cheirsilp, B., & Kittikul, A. (2007). A mathematical model approach to a glycerolysis reaction for monoacylglycerol production. *WIT Transactions on Modelling and Simulation*, 46, 225–232. <https://doi.org/10.2495/CMEM070241>
- Chen, C. W., Chong, C. L., Ghazali, H. M., & Lai, O. M. (2007). Interpretation of triacylglycerol profiles of palm oil, palm kernel oil and their binary blends. *Food Chemistry*, 100(1), 178–191. <https://doi.org/10.1016/j.foodchem.2005.09.044>
- Chen, F., Zhang, G., Liu, C., Zhang, J., Zhao, F., & Xu, B. (2019). Highly selective synthesis of monolaurin via enzymatic transesterification under batch and continuous flow conditions. *Journal of Oleo Science*, 68(11), 1125–1132. <https://doi.org/10.5650/jos.ess19165>
- Chen, H., Sun, Z., & Yang, H. (2019). Effect of carnauba wax-based coating containing glycerol monolaurate on the quality maintenance and shelf-life of Indian jujube (*Zizyphus mauritiana* Lamk.) fruit during storage. *Scientia Horticulturae*, 244(May 2018), 157–164. <https://doi.org/10.1016/j.scienta.2018.09.039>
- Chinatangkul, N., Limmatvapirat, C., Nunthanid, J., Luangtana-Anan, M., Sriamornsak, P., & Limmatvapirat, S. (2018). Design and characterization of monolaurin loaded electrospun shellac nanofibers with antimicrobial activity. *Asian Journal of Pharmaceutical Sciences*, 13(5), 459–471. <https://doi.org/10.1016/j.ajps.2017.12.006>
- Cho, W. Il, & Chung, M. S. (2020). *Bacillus* spores: a review of their properties and inactivation processing technologies. *Food Science and Biotechnology*, 29(11), 1447–1461. <https://doi.org/10.1007/s10068-020-00809-4>
- Choong, T. S. Y., Yeoh, C. M., Phuah, E. T., Siew, W. L., Lee, Y. Y., Tang, T. K., & Abdullah, L. C. (2018). Kinetic study of lipase-catalyzed glycerolysis of palm olein using Lipozyme TLIM in solvent-free system. *PLoS ONE*, 13(2), 1–13. <https://doi.org/10.1371/journal.pone.0192375>
- Damstrup, M. L., Jensen, T., Sparsø, F. V., Kiil, S. Z., Jensen, A. D., & Xu, X. (2006). Production of heat-sensitive monoacylglycerols by enzymatic

- glycerolysis in tert-pentanol: Process optimization by response surface methodology. *JAACS, Journal of the American Oil Chemists' Society*, 83(1), 27–33. <https://doi.org/10.1007/s11746-006-1171-5>
- Damstrup, M. L., Jensen, T., Sparsø, F. V., Kiil, S. Z., Jensen, A. D., & Xu, X. (2005). Solvent optimization for efficient enzymatic monoacylglycerol production based on a glycerolysis reaction M.L. *JAACS*, 82(8), 559–564.
- Danchik, C., & Casadevall, A. (2021). Role of cell surface hydrophobicity in the pathogenesis of medically-significant fungi. *Frontiers in Cellular and Infection Microbiology*, 10(January), 1–7. <https://doi.org/10.3389/fcimb.2020.594973>
- Dantas, J. H., Daniel De Paris, L., Barao, C. E., Arroyo, P. A., Soares, C. M. F., Visentainer, J. V., & Zanin, F. F. and G. M. (2013). Influence of alcohol: oil molar ratio on the production of ethyl esters by enzymatic transesterification of canola oil. *African Journal of Biotechnology*, 12(50), 6968–6979. <https://doi.org/10.5897/ajb2013.12313>
- Dayrit, F. M. (2015). The properties of lauric acid and their significance in coconut oil. *Journal of the American Oil Chemists' Society*, 92(1), 1–15. <https://doi.org/10.1007/s11746-014-2562-7>
- de Oliveira, G. M., Badan Ribeiro, A. P., dos Santos, A. O., Cardoso, L. P., & Kieckbusch, T. G. (2015). Hard fats as additives in palm oil and its relationships to crystallization process and polymorphism. *LWT - Food Science and Technology*, 63(2), 1163–1170. <https://doi.org/10.1016/j.lwt.2015.04.036>
- De Siena, M., Raoul, P., Costantini, L., Scarpellini, E., Cintoni, M., Gasbarrini, A., Rinninella, E., & Mele, M. C. (2022). Food emulsifiers and metabolic syndrome: The role of the gut microbiota. *Foods*, 11(15), 1–20. <https://doi.org/10.3390/foods11152205>
- Destailats, F., Cruz-Hernandez, C., Nagy, K., & Dionisi, F. (2010). Identification of monoacylglycerol regio-isomers by gas chromatography-mass spectrometry. *Journal of Chromatography A*, 1217(9), 1543–1548. <https://doi.org/10.1016/j.chroma.2010.01.016>
- Di Ciccio, P., Vergara, A., Festino, A. R., Paludi, D., Zanardi, E., Ghidini, S., & Ianieri, A. (2015). Biofilm formation by *Staphylococcus aureus* on food contact surfaces: Relationship with temperature and cell surface hydrophobicity. *Food Control*, 50, 930–936. <https://doi.org/10.1016/j.foodcont.2014.10.048>
- Diao, X., Guan, H., Kong, B., & Zhao, X. (2017). Preparation of diacylglycerol from lard by enzymatic glycerolysis and its compositional characteristics. *Korean Journal for Food Science of Animal Resources*, 37(6), 813–822. <https://doi.org/10.5851/kosfa.2017.37.6.813>
- Dijkstra, A. J. (2015). Lauric Oils. In *Encyclopedia of Food and Health* (1st ed.). Elsevier Ltd. <https://doi.org/10.1016/B978-0-12-384947-2.00513-4>
- Ditjenbun. (2022). Direktorat Jenderal Perkebunan. 2020. *Statistik Perkebunan Indonesia, 2020*.
- Dufour, M., Manson, J. M., Bremer, P. J., Dufour, J. P., Cook, G. M., & Simmonds,

- R. S. (2007). Characterization of monolaurin resistance in *Enterococcus faecalis*. *Applied and Environmental Microbiology*, 73(17), 5507–5515. <https://doi.org/10.1128/AEM.01013-07>
- Echeverri, D. A., Cardeno, F., & Rios, L. A. (2011). Glycerolysis of soybean oil with crude glycerol containing residual alkaline catalysts from biodiesel production. *JAACS, Journal of the American Oil Chemists' Society*, 88(4), 551–557. <https://doi.org/10.1007/s11746-010-1688-5>
- Esperón-Rojas, A. A., Torres-Palacios, C., Santos-Luna, D., Baeza-Jiménez, R., Cano-Sarmiento, C., & García, H. S. (2018). A specific thin layer chromatography method for the identification and separation of medium chain acylglycerols. *Journal of Oleo Science*, 67(11), 1397–1403. <https://doi.org/10.5650/jos.ess18081>
- Esterchem Limited, E. (2020). *Fatty acid Esters Sorbitan Derivatives Glyceryl Esters*. 354.
- Farhanghi, A., Aliakbarlu, J., Tajik, H., Mortazavi, N., Manafi, L., & Jalilzadeh-Amin, G. (2022). Antibacterial interactions of pulegone and 1,8-cineole with monolaurin ornisin against *Staphylococcus aureus*. *Food Science & Nutrition, October 2021*, 1–8. <https://doi.org/10.1002/fsn3.2870>
- Fauzi, S. H. M., Rashid, N. A., & Omar, Z. (2013). Effects of chemical interesterification on the physicochemical, microstructural and thermal properties of palm stearin, palm kernel oil and soybean oil blends. *Food Chemistry*, 137(1–4), 8–17. <https://doi.org/10.1016/j.foodchem.2012.09.086>
- Fauzi, S. H. M., Rashid, N. A., & Omar, Z. (2016). Physicochemical and microstructural properties of refined palm oil-palm kernel oil blends following chemical interesterification. *International Journal of Chemical Engineering and Applications*, 7(2), 81–84. <https://doi.org/10.7763/ijcea.2016.v7.547>
- Folayan, A. J., Anawe, P. A. L., Aladejare, A. E., & Ayeni, A. O. (2019). Experimental investigation of the effect of fatty acids configuration, chain length, branching and degree of unsaturation on biodiesel fuel properties obtained from lauric oils, high-oleic and high-linoleic vegetable oil biomass. *Energy Reports*, 5, 793–806. <https://doi.org/10.1016/j.egyr.2019.06.013>
- Freitas, L., Perez, V. H., Santos, J. C., & De Castro, H. F. (2007). Enzymatic synthesis of glyceride esters in solvent-free system: Influence of the molar ratio, lipase source and functional activating agent of the support. *Journal of the Brazilian Chemical Society*, 18(7), 1360–1366. <https://doi.org/10.1590/S0103-50532007000700011>
- Fu, X., Huang, B., & Feng, F. (2008). Shelf life of fresh noodles as affected by the food grade monolaurin microemulsion system. *Journal of Food Process Engineering*, 31(5), 619–627. <https://doi.org/10.1111/j.1745-4530.2007.00178.x>
- Fuchs, B., Süß, R., Teuber, K., Eibisch, M., & Schiller, J. (2011). Lipid analysis by thin-layer chromatography-A review of the current state. *Journal of Chromatography A*, 1218(19), 2754–2774.

- <https://doi.org/10.1016/j.chroma.2010.11.066>
- Ghamgui, H., Miled, N., Rebaï, A., Karra-chaâbouni, M., & Gargouri, Y. (2006). Production of mono-olein by immobilized *Staphylococcus simulans* lipase in a solvent-free system: Optimization by response surface methodology. *Enzyme and Microbial Technology*, 39(4), 717–723. <https://doi.org/10.1016/j.enzmictec.2005.12.014>
- Gogra, A. B., Yao, J., Sandy, E. H., Zheng, S., Zaray, G., Koroma, B. M., & Hui, Z. (2010). Cell surface hydrophobicity (CSH) of *Escherichia coli*, *Staphylococcus aureus* and *Aspergillus niger* and the biodegradation of Diethyl Phthalate (DEP) via Microcalorimetry. *Journal of American Science*, 6(7), 78–88.
- Goon, D. E., Hamimah, Abdul Kadir, S. H. S., & Latip, Normala Ab, Rahim, Sharaniza Ab, Mazlan, M. (2019). Palm oil in lipid-based formulations and drug delivery systems. *Biomolecules*, 9(64), 1–20. <https://doi.org/10.3390/biom9020064>
- Graber, M., Irague, R., Rosenfeld, E., Lamare, S., Franson, L., & Hult, K. (2007). Solvent as a competitive inhibitor for *Candida antarctica* lipase B. *Biochimica et Biophysica Acta - Proteins and Proteomics*, 1774(8), 1052–1057. <https://doi.org/10.1016/j.bbapap.2007.05.013>
- Green, J., Korza, G., Granados, M. R., Zenick, B., Schlievert, P. M., Mok, W. M. K., & Setlow, P. (2020). Lack of efficient killing of purified dormant spores of *Bacillales* and *Clostridiales* species by glycerol monolaurate in a non-aqueous gel. *Letters in Applied Microbiology*, 70(6), 407–412. <https://doi.org/10.1111/lam.13290>
- Gunawan, R., & Nandiyanto, A. B. D. (2021). How to read and interpret 1H-NMR and 13C-NMR spectrums. *Indonesian Journal of Science and Technology*, 6(2), 267–298. <https://doi.org/10.17509/ijost.v6i2.34189>
- Hariyadi, P. (1996). Katalisis Enzimatis Dalam Pelarut Organik (Enzymatic Catalysis in Organic Solvents). *J. Ilmu Dan Tek. Pangan*, 1(1), 52–61.
- Hauerlandova, I. (2012). Antimicrobial Activity of Non-Traditional Monoacylglycerol. In *Food Chemistry and Technology*, Tomas Bata University. Faculty of Technology, Tomas Bata University, Zlin. https://digilib.k.utb.cz/bitstream/handle/10563/22410/hauerlandová_2012_dp.pdf?sequence=1&isAllowed=y
- Hess, D. J., Henry-Stanley, M. J., & Wells, C. L. (2014). Antibacterial synergy of glycerol monolaurate and aminoglycosides in *Staphylococcus aureus* biofilms. *Antimicrobial Agents and Chemotherapy*, 58(11), 6970–6973. <https://doi.org/10.1128/AAC.03672-14>
- Hoo, P., & Abdullah, A. Z. (2016). Monolaurin yield optimization in selective esterification of glycerol with lauric acid over post impregnated HPW/SBA-15 catalyst. *Korean Journal of Chemical Engineering*, 33(4), 1200–1210. <https://doi.org/10.1007/s11814-015-0246-0>
- Hung, L. C., Ismail, R., Basri, M., Lik Nang, H. L., Tejo, B. A., Hassan, H. A., &

- May, C. Y. (2010). Testing of glyceryl monoesters for their anti-microbial susceptibility and their influence in emulsions. *Journal of Oil Palm Research*, 22(Desember), 846–855.
- Hunter, J. E. (2001). Studies on effects of dietary fatty acids as related to their position on triglycerides. *Lipids*, 36(7), 655–668. <https://doi.org/10.1007/s11745-001-0770-0>
- Hyatt, J., Zhang, S., & Akoh, C. (2022). *Characterization and comparison of oleogels and emulgels prepared from Schizochytrium algal oil using monolaurin and MAG / DAG as gelators*. American Oil Chemist Society. 1–10.
- Ibrahim, N. A. (2013). Characteristics of malaysian palm kernel and its products. *Journal of Oil Palm Research*, 25(2), 245–252.
- Inácio, Â. S., Mesquita, K. A., Baptista, M., Ramalho-Santos, J., Vaz, W. L. C., & Vieira, O. V. (2011). In vitro surfactant structure-toxicity relationships: Implications for surfactant use in sexually transmitted infection prophylaxis and contraception. *PLoS ONE*, 6(5). <https://doi.org/10.1371/journal.pone.0019850>
- Jackman, J. A., Lavergne, T. A., & Elrod, C. C. (2022). Antimicrobial monoglycerides for swine and poultry applications. *Frontiers in Animal Science*, 3(October), 1–9. <https://doi.org/10.3389/fanim.2022.1019320>
- Jamlus, Norul Naziraa Ahmad, Salimon, J., & Derawi, D. (2016). Enzymatic glycerolysis of methyl laurate utilizing *Candida antarctica* Lipase b. *Malaysian Journal of Analytical Science*, 20(6), 1365–1372. <https://doi.org/10.17576/mjas-2016-2006-15>
- Jiang, Z., Xiao, C., Zhang, X., Zhao, M., Liu, T., Xu, Y., Zhang, H., Zheng, J., & Feng, F. (2020). Antimicrobial emulsifier – glycerol monolaurate impacts gut microbiome inducing distinct effects on metabolic syndrome in low-fat diet fed mice. *BioRxiv Preprint*, 86(0), 1–30. <https://doi.org/https://doi.org/10.1101/2020.09.11.294454>
- Jin, J., Li, D., Zhu, X. M., Adhikari, P., Lee, K. T., & Lee, J. H. (2011). Production of diacylglycerols from glycerol monooleate and ethyl oleate through free and immobilized lipase-catalyzed consecutive reactions. *New Biotechnology*, 28(2), 190–195. <https://doi.org/10.1016/j.nbt.2010.10.005>
- Jin, Q., Zhang, T., Shan, L., Liu, Y., & Wang, X. (2008). Melting and solidification properties of palm kernel oil, tallow, and palm olein blends in the preparation of shortening. *JAACS, Journal of the American Oil Chemists' Society*, 85(1), 23–28. <https://doi.org/10.1007/s11746-007-1152-3>
- Jin, Y., Yuan, Y., Gao, L., Sun, R., Chen, L., Li, D., & Zheng, Y. (2017). Characterization and functional analysis of a type 2 diacylglycerol acyltransferase (DGAT2) gene from oil palm (*elaeis guineensis* jacq.) mesocarp in *saccharomyces cerevisiae* and transgenic *arabidopsis thaliana*. *Frontiers in Plant Science*, 8(October), 1–10. <https://doi.org/10.3389/fpls.2017.01791>
- Jumina, J., Lavendi, W., Singgih, T., Triono, S., Steven Kurniawan, Y., & Koketsu, M. (2019). Preparation of Monoacylglycerol Derivatives from Indonesian Edible

- Oil and Their Antimicrobial Assay against *Staphylococcus aureus* and *Escherichia coli*. *Scientific Reports*, 9(1), 1–8. <https://doi.org/10.1038/s41598-019-47373-4>
- Kabara, J. J., Vrable, R., & Lie Ken Jie, M. S. F. (1977). Antimicrobial lipids: Natural and synthetic fatty acids and monoglycerides. *Lipids*, 12(9), 753–759. <https://doi.org/10.1007/BF02570908>
- Kabara, Jon J. (1984). Inhibition of *Staphylococcus aureus* in a model agar-meat system by monolaurin: A research note. *Journal of Food Saety*, 6(1984), 197–201.
- Kaewthong, W., Sirisansaneeyakul, S., Prasertsan, P., & H-Kittikun, A. (2005). Continuous production of monoacylglycerols by glycerolysis of palm olein with immobilized lipase. *Process Biochemistry*, 40(5), 1525–1530. <https://doi.org/10.1016/j.procbio.2003.12.002>
- Kahveci, D., Zhong, N., & Xu, X. (2016). Ionic Liquids in Acylglycerol Synthesis and Modification. In *Ionic Liquids in Lipid Processing and Analysis: Opportunities and Challenges*. AOCS Press. <https://doi.org/10.1016/B978-1-63067-047-4.00008-8>
- Kamal, Z., Yedavalli, P., Deshmukh, M. V., & Rao, N. M. (2013). Lipase in aqueous-polar organic solvents: Activity, structure, and stability. *Protein Science*, 22(7), 904–915. <https://doi.org/10.1002/pro.2271>
- Kasmiyatun, M., Purwaningtyas, E. F., Mulyaningsih, M. S., & Soleh, K. (2015). Kinetika reaksi gliserolisis minyak pupa ulat sutera menggunakan katalis MgO. *Prosiding Senatek Fakultas Teknik Ump, 2015: Proding Senatek Tahun 2015, 28 November 2015*, 98–103. <http://senatekprosiding.ump.ac.id/index.php/snt/article/view/22>
- Khasbullah, F., Murhadi, & Suharyono. (2013). The study of functional characteristics of ethanolysis product of CPO (Crude Palm Oil) and PKO (Palm Kernel Oil) mixture at level two ethanolysis reaction. *Jurnal Teknologi Industri Dan Hasil Pertanian*, 18(1), 13–27.
- Khayatnouri, M. H., & Topchi, A. (2013). Evaluation of antibacterial effect of monolaurin on *Staphylococcus aureus* isolated from bovine mastitis. *African Journal of Pharmacy and Pharmacology*, 7(19), 1163–1166. <https://doi.org/10.5897/AJPP11.291>
- Khor, G. K., Sim, J. H., Kamaruddin, A. H., & Uzir, M. H. (2010). Thermodynamics and inhibition studies of lipozyme TL IM in biodiesel production via enzymatic transesterification. *Bioresource Technology*, 101(16), 6558–6561. <https://doi.org/10.1016/j.biortech.2010.03.047>
- Kmiha, S., Aouadhi, C., Aziza, K., Bejaoui, A., & Maaroufi, A. (2021). Comparison of Synergistic Effect of Nisin and Monolaurin on the Inactivation of Three Heat Resistant Spores Studied by Design of Experiments in Milk. *Journal of Food Quality*, 2021. <https://doi.org/10.1155/2021/9977646>
- Koay, G. F. L., Chuah, T. G., & Choong, T. S. Y. (2013). Economic feasibility

- assessment of one and two stages dry fractionation of palm kernel oil. *Industrial Crops and Products*, 49, 437–444. <https://doi.org/10.1016/j.indcrop.2013.05.019>
- Koblitz, M. G. B., & Pastore, G. M. (2005). Contribution of response surface design to the synthesis of monoacylglycerols catalyzed by *Rhizopus sp.* lipase. *Journal of Food Science*, 70(8), c503–c505. <https://doi.org/10.1111/j.1365-2621.2005.tb11508.x>
- Kurniasih, E. (2014). Sintesa mono-digliserida melalui reaksi gliserolisis. *Jurnal Teknologi*, 4, 25–28.
- Kwon, S. J., Han, J. J., & Rhee, J. S. (1995). Production and in situ separation of mono- or diacylglycerol catalyzed by lipases in n-hexane. *Enzyme and Microbial Technology*, 17(8), 700–704. [https://doi.org/10.1016/0141-0229\(94\)00117-A](https://doi.org/10.1016/0141-0229(94)00117-A)
- Lan, J., Chen, G., Cao, G., Tang, J., Li, Q., Zhang, B., & Yang, C. (2021). Effects of α -glyceryl monolaurate on growth, immune function, volatile fatty acids, and gut microbiota in broiler chickens. *Poultry Science*, 100(3), 100875. <https://doi.org/10.1016/j.psj.2020.11.052>
- Langone, M. A. P., De Abreu, M. E., Rezende, M. J. C., & Sant’Anna, G. L. (2002). Enzymatic synthesis of medium chain monoglycerides in a solvent-free system. *Applied Biochemistry and Biotechnology - Part A Enzyme Engineering and Biotechnology*, 98–100, 987–996. <https://doi.org/10.1385/ABAB:98-100:1-9:987>
- Lather, P., Mohanty, A. K., Jha, P., & Garsa, A. K. (2016). Contribution of cell surface hydrophobicity in the resistance of *Staphylococcus aureus* against antimicrobial Agents. *Biochemistry Research International*, 2016. <https://doi.org/10.1155/2016/1091290>
- Li, Y., Liu, T., Zhang, X., Zhao, M., Zhang, H., & Feng, F. (2019). *Lactobacillus plantarum* helps to suppress body weight gain, improve serum lipid profile and ameliorate low-grade inflammation in mice administered with glycerol monolaurate. *Journal of Functional Foods*, 53(September 2018), 54–61. <https://doi.org/10.1016/j.jff.2018.12.015>
- Lieberman, S., Enig, M. G., & Preuss, H. G. (2006). A review of monolaurin and lauric acid: Natural virucidal and bactericidal agents. *Alternative and Complementary Therapies*, 12, 310–314. <https://doi.org/10.1089/act.2006.12.310>
- Liu, C., Meng, Z., Chai, X., Liang, X., Piatko, M., Campbell, S., & Liu, Y. (2019). Comparative analysis of graded blends of palm kernel oil, palm kernel stearin and palm stearin. *Food Chemistry*, 286(September 2018), 636–643. <https://doi.org/10.1016/j.foodchem.2019.02.067>
- Liu, Y., Su, A., Tian, R., Li, J., Liu, L., & Du, G. (2020). Developing rapid growing *Bacillus subtilis* for improved biochemical and recombinant protein production. *Metabolic Engineering Communications*, 11(June), e00141. <https://doi.org/10.1016/j.mec.2020.e00141>

- Lopes, L. Q. S., de Almeida Vaucher, R., Giongo, J. L., Gündel, A., & Santos, R. C. V. (2019). Characterisation and anti-biofilm activity of glycerol monolaurate nanocapsules against *Pseudomonas aeruginosa*. *Microbial Pathogenesis*, *130*(November 2018), 178–185. <https://doi.org/10.1016/j.micpath.2019.03.007>
- Loung, F. S., Silalahi, J., & Suryanto, D. (2014). Antibacterial activity of enzymatic hydrolyzed of virgin coconut oil and palm kernel oil against *staphylococcus aureus*, *Salmonella thypi* and *Escherichia coli*. *International Journal of PharmTech Research*, *6*(2), 628–633.
- Luna, P., Hoerudin, Habiddin, & Andarwulan, N. (2020). Characterisation of functional monoglyceride and its potential application. *AIP Conference Proceedings*, *2215*(April). <https://doi.org/10.1063/5.0000576>
- Luo, X., Liu, W., Zhao, M., Huang, Y., & Feng, F. (2022). Glycerol monolaurate beyond an emulsifier: Synthesis, in vivo fate, food quality benefits and health efficacies. *Trends in Food Science and Technology*, *127*(March), 291–302. <https://doi.org/10.1016/j.tifs.2022.05.017>
- Ma, L., Jia, I., Guo, X., & Xiang, L. (2014). High performance of Pd catalysts on bimodal mesopore for the silica catalytic oxidation of toluene. *Chinese Journal of Catalysis*, *35*(0), 108–119. <https://doi.org/10.1016/S1872>
- Mamtani, K., Shahbaz, K., & Farid, M. M. (2021). Glycerolysis of free fatty acids: A review. *Renewable and Sustainable Energy Reviews*, *137*(xxxx), 110501. <https://doi.org/10.1016/j.rser.2020.110501>
- Mansour, M., & Millièrè, J. B. (2001). An inhibitory synergistic effect of a nisin-monolaurin combination on *Bacillus sp.* vegetative cells in milk. *Food Microbiology*, *18*(1), 87–94. <https://doi.org/10.1006/fmic.2000.0379>
- Manurung, R., Hasibuan, R., Taslim, T., Rahayu, N. S., & Darusmy, A. (2015). Enzymatic transesterification of DPO to produce biodiesel by using Lipozyme RM IM in ionic liquid system. *Procedia - Social and Behavioral Sciences*, *195*, 2485–2491. <https://doi.org/10.1016/j.sbspro.2015.06.310>
- Mappiratu, M., Fardiaz, D., & Hasanuddi, A. (2003). Produksi dan aplikasi monoasilgliserol dari minyak kelapa dalam pengolahan santan awet [Production and Application of Monoacylglycerol Product from Coconut Oil in the Processing of Coconut Milk] Metode. *Jurnal. Teknol. Dan Industri Pangan*, *XIV*(3), 233–240.
- May, C. Y., & Nesaretnam, K. (2014). Research advancements in palm oil nutrition. *European Journal of Lipid Science and Technology*, *116*(10), 1301–1315. <https://doi.org/10.1002/ejlt.201400076>
- Mba, O. I., Dumont, M. J., & Ngadi, M. (2015). Palm oil: Processing, characterization and utilization in the food industry - A review. *Food Bioscience*, *10*, 26–41. <https://doi.org/10.1016/j.fbio.2015.01.003>
- Mbandi, E., Brywig, M., & Shelef, L. A. (2004). Antilisterial effects of free fatty acids and monolaurin in beef emulsions and hot dogs. *Food Microbiology*, *21*(6), 815–818. <https://doi.org/10.1016/j.fm.2003.12.005>

- McClements, D. J., & Jafari, S. M. (2018). Improving emulsion formation, stability and performance using mixed emulsifiers: A review. *Advances in Colloid and Interface Science*, 251, 55–79. <https://doi.org/10.1016/j.cis.2017.12.001>
- Mhetras, N., Patil, S., & Gokhale, D. (2010). Lipase of *Aspergillus niger* NCIM 1207: A Potential Biocatalyst for Synthesis of Isoamyl Acetate. *Indian Journal of Microbiology*, 50(4), 432–437. <https://doi.org/10.1007/s12088-011-0087-4>
- Miao, Shanshan, & Li, X. (2021). Enzymatic esterification of lauric acid to give monolaurin in a microreactor. *Journal of Chemical Research*, 45(7–8), 660–667. <https://doi.org/10.1177/1747519820977164>
- Miao, Song, & Lin, D. (2018). Monoglycerides: Categories, structures, properties, preparations, and applications in the food industry. In *Encyclopedia of Food Chemistry*. Elsevier. <https://doi.org/10.1016/B978-0-08-100596-5.21595-3>
- Mladenoska, I., Nikolovska, V., & Puzderliska, L. (2010). Model Meat Pasteurized Sausages Enriched With Monolaurin As Nutraceuticals With Pronounced Antimicrobial Properties. *Food and Feed Research*, 39(2), 69–71.
- Mladenoska, I., Temkov, M., & Dimitrovski, D. (2017). The effect of monolaurin on the colour and microbiological safety of nitrite reduced sausages. *Advanced Technologies*, 6(2), 11–17. <https://doi.org/10.5937/savteh1702011m>
- Mo, Q., Fu, A., Deng, L., Zhao, M., Li, Y., Zhang, H., & Feng, F. (2019). High-dose glycerol monolaurate up-regulated beneficial indigenous microbiota without inducing metabolic dysfunction and systemic inflammation: New insights into its antimicrobial potential. *Nutrients*, 11(9). <https://doi.org/10.3390/nu11091981>
- Mueller, E. A., & Schlievert, P. M. (2015). Non-aqueous glycerol monolaurate gel exhibits antibacterial and anti-biofilm activity against gram-positive and gram-negative pathogens. *PLoS ONE*, 10(3), 1–12. <https://doi.org/10.1371/journal.pone.0120280>
- Muhardi. (2009). Senyawa dan Aktivitas Antimikroba Golongan Asam Lemak dan Esternya Dari Tanaman. *Jurnal Teknologi Industri Dan Hasil Pertanian*, 14(1), 97–105.
- Mujdalipah, S., Sasmita, A. H., Amalia, I. K., & Suryani, A. (2016). Separation of glycerolysis product using hexane. *IOP Conference Series: Materials Science and Engineering*, 128(1). <https://doi.org/10.1088/1757-899X/128/1/012025>
- Murhadi, Hidayati, S., & Sugiharto, R. (2019). Profile of monoglyceride and diglyceride compounds of the ethanolysis products from palm kernel Oil (PKO). *IOP Conference Series: Earth and Environmental Science*, 292(1). <https://doi.org/10.1088/1755-1315/292/1/012002>
- Musa, N., Latip, W., Abd Rahman, R. N. Z., Salleh, A. B., & Ali, M. S. M. (2018). Immobilization of an antarctic *Pseudomonas* AMS8 lipase for low temperature ethyl hexanoate synthesis. *Catalysts*, 8(6). <https://doi.org/10.3390/catal8060234>
- Mustafa, A., Karmali, A., & Abdelmoez, W. (2016). Optimisation and economic assessment of lipase-catalysed production of monoesters using *Rhizomucor miehei* lipase in a solvent-free system. *Journal of Cleaner Production*, 137, 953–

964. <https://doi.org/10.1016/j.jclepro.2016.07.056>
- Naik, M. K., Naik, S. N., & Mohanty, S. (2014). Enzymatic glycerolysis for conversion of sunflower oil to food based emulsifiers. *Catalysis Today*, 237, 145–149. <https://doi.org/10.1016/j.cattod.2013.11.005>
- Nandi, S., Gangopadhyay, S., & Ghosh, S. (2004). Production of Medium Chain Glycerides and Monolaurin from Coconut Acid Oil by Lipase-Catalyzed Reactions. *Journal of Oleo Science*, 53(10), 497–501. <https://doi.org/10.5650/jos.53.497>
- Neyriz-Nagadehi, M., Mehdi Razavi-Rohani, S., Karim, G., & Zeynali, A. (2012). Effects of monolaurin and lactic acid bacteria starter culture on growth of vegetative cells of *Bacillus cereus* in Iranian white fresh cheese 76 Neyriz-Nagadehi M. *Iranian Journal of Veterinary Science and Technology*, 4(1), 75–84.
- Nicholson, R. A., & Marangoni, A. G. (2021). Lipase-catalyzed glycerolysis extended to the conversion of a variety of edible oils into structural fats. *Current Research in Food Science*, 4(March), 163–174. <https://doi.org/10.1016/j.crfs.2021.03.005>
- Nisa, Cf., Zahrina, I., & Sunarno, S. (2020). *Produksi Monogliserida dengan Esterifikasi Asam Lemak*. 2, 1318–1322.
- Nitbani, F. O., & Jumina, J. (2020). Monoglycerides as an Antifungal Agent. In *Apolipoproteins, Triglycerides and Cholesterol*. <https://doi.org/10.5772/intechopen.91743>
- Nitbani, F. O., Jumina, J., Siswanta, D., Sholikhah, E. N., & Fitriastuti, D. (2016). Synthesis and antibacterial activity of 2-monolaurin. *Oriental Journal of Chemistry*, 32, 3113–3120. <https://doi.org/10.13005/ojc/320632>
- Nitbani, F. O., Jumina, J., Siswanta, D., & Solikhah, E. N. (2015). Reaction path synthesis of monoacylglycerol from fat and oils. *International Journal of Pharmaceutical Sciences Review and Research*, 35(1), 126–136.
- Nitbani, F. O., Jumina, J., Siswanta, D., & Solikhah, E. N. (2016). Isolation and Antibacterial Activity Test of Lauric Acid from Crude Coconut Oil (*Cocos nucifera* L.). *Procedia Chemistry*, 18(February), 132–140. <https://doi.org/10.1016/j.proche.2016.01.021>
- Nitbani, F. O., Jumina, J., Tjitda, P. J. P., Wogo, H. E. M., Detha, A. I. R., & Nurohmah, B. A. (2021). Synthesis of 2-monolaurin from pure lauric acid. *AIP Conference Proceedings*, 2370(April 2020). <https://doi.org/10.1063/5.0062214>
- Nitbani, F. O., Jumina, Siswanta, D., Sholikhah, E. N., & Fitriastuti, D. (2018). Synthesis and antibacterial activity of 1-monolaurin. *Oriental Journal of Chemistry*, 34(2), 863–867. <https://doi.org/10.13005/ojc/340233>
- Nitbani, F. O., Tjitda, P. J. P., Nitti, F., Jumina, J., & Detha, A. I. R. (2022). Antimicrobial Properties of Lauric Acid and Monolaurin in Virgin Coconut Oil: A Review. *ChemBioEng Reviews*, 9(5), 442–461. <https://doi.org/10.1002/cben.202100050>

- Nitbani, F. O., Tjitda, P. J. P., Nurohmah, B. A., & Wogo, H. E. (2020). Preparation of fatty acid and monoglyceride from vegetable oil. *Journal of Oleo Science*, 69(4), 277–295. <https://doi.org/10.5650/jos.ess19168>
- Nobmann, P., Bourke, P., Dunne, J., & Henehan, G. (2010). In vitro antimicrobial activity and mechanism of action of novel carbohydrate fatty acid derivatives against *Staphylococcus aureus* and MRSA. *Journal of Applied Microbiology*, 108(6), 2152–2161. <https://doi.org/10.1111/j.1365-2672.2009.04622.x>
- Oh, D. H., & Marshall, D. L. (1993). Antimicrobial activity of ethanol, glycerol monolaurate or lactic acid against *Listeria monocytogenes*. *International Journal of Food Microbiology*, 20(4), 239–246. [https://doi.org/10.1016/0168-1605\(93\)90168-G](https://doi.org/10.1016/0168-1605(93)90168-G)
- Omar, K. A., Gounga, M. E., Liu, R., Mwinyi, W., Aboshora, W., Ramadhan, A. H., Sheha, K. A., & Wang, X. (2017). Triacylglycerol composition, melting and crystallization profiles of lipase catalysed anhydrous milk fats hydrolysed. *International Journal of Food Properties*, 20(2), 1230–1245. <https://doi.org/10.1080/10942912.2017.1301954>
- Pangestu, A., Dharmawan, B., & Satriani, R. (2022). Daya saing ekspor minyak kelapa (*Crude Coconut Oil*) Indonesia di pasar internasional. *Jurnal Ekonomi Pertanian Dan Agribisnis*, 6(1), 51–61. <https://doi.org/10.21776/ub.jepa.2022.006.01.6>
- Park, K. M., Lee, S. J., Yu, H., Park, J. Y., Jung, H. S., Kim, K., Lee, C. J., & Chang, P. S. (2018). Hydrophilic and lipophilic characteristics of non-fatty acid moieties: significant factors affecting antibacterial activity of lauric acid esters. *Food Science and Biotechnology*, 27(2), 401–409. <https://doi.org/10.1007/s10068-018-0353-x>
- Parsons, J. B., Yao, J., Frank, M. W., Jackson, P., & Rock, C. O. (2012). Membrane disruption by antimicrobial fatty acids releases low-molecular-weight proteins from *staphylococcus aureus*. *Journal of Bacteriology*, 194(19), 5294–5304. <https://doi.org/10.1128/JB.00743-12>
- Paula, A., Ribeiro, B., Masuchi, M. H., & Miyasaki, E. K. (2015). Crystallization modifiers in lipid systems. *J. Food Sci. Technol.*, 52(July), 3925–3946. <https://doi.org/10.1007/s13197-014-1587-0>
- Pereira, C. C. B., Da Silva, M. A. P., & Langone, M. A. P. (2004). Enzymatic synthesis of monolaurin. *Applied Biochemistry and Biotechnology - Part A Enzyme Engineering and Biotechnology*, 114(1–3), 433–445. <https://doi.org/10.1385/ABAB:114:1-3:433>
- Pham, L. J., Casa, E. P., Gregorio, M. A., & Kwon, D. Y. (1998). Triacylglycerols and regiospecific fatty acid analyses of Philippine seed oils. *JAOCS, Journal of the American Oil Chemists' Society*, 75(7), 807–811. <https://doi.org/10.1007/s11746-998-0230-5>
- Pinyaphong, P., Sriburi, P., & Phutrakul, S. (2012). Synthesis of monoacylglycerol from glycerolysis of crude glycerol with coconut oil catalyzed by *Carica*

- Papaya* Lipase. *International Journal of Chemical and Molecular Engineering*, 6(10), 506–511.
- Prime Surfactan, L. (2020). *Product Specification Primesurf Monolaurin* (Vol. 44, Issue 0). https://primesurfactants.com/wp-content/uploads/2020/02/Primesurf_Monolaurin_Sales_Spec_Issue_1.pdf
- Priscilia, B., Nugraha, M. F. I., Novita, H., & Elya, B. (2020). Antioxidant and antibacterial assay against fish pathogen bacteria of *Kjellbergiodendron celebicum* (Koord.) merr. leaf extract. *Pharmacognosy Journal*, 12(1), 173–179. <https://doi.org/10.5530/pj.2020.12.26>
- Putri, N. I. C. A., Ramadhani, R., & Wasito, E. B. (2021). Gram negative bacteria (*Escherichia coli*) win against gram positive bacteria (*Staphylococcus aureus*) in the same media. *Biomolecular and Health Science Journal*, 4(2), 113. <https://doi.org/10.20473/bhsj.v4i2.30177>
- Rabiah, A., Sebayang, F., & Siahaan, D. (2021). Enzymatic glycerolysis of palm kernel oil using lipase enzyme catalyst from *Candida rugosa* with variations of 1-propanol, 2-propanol, n-Heptane, and isooctane solvents. *Journal of Chemical Natural Resources*, 02(01), 14–21.
- Rarokar, N. R., Menghani, S., Kerzare, D., & Khedekar, P. B. (2017). Progress in synthesis of monoglycerides for use in food and pharmaceuticals. *Journal of Experimental Food Chemistry*, 03(03), 1–6. <https://doi.org/10.4172/2472-0542.1000128>
- Rashid, N. A., Jumari, fatin N., & Omar, Z. (2018). Physicochemical properties of palm kernel oil and palm kernel olein blends. *International Journal of Engineering & Technology*, 7(4.14), 249–252. <https://doi.org/10.19026/crjbs.6.5194>
- Reifsteck, F., Wee, S., & Wilkinson, B. J. (1987). Hydrophobicity-hydrophilicity of staphylococci. *Journal of Medical Microbiology*, 24(1), 65–73. <https://doi.org/10.1099/00222615-24-1-65>
- Ristiati, N. P., Suata, K., & Suprpta, D. N. (2009). Bioaktivitas Forbazol-E terhadap Kerusakan Ultrastruktur Dinding Sel *Staphylococcus aureus*. *Jurnal Veteriner*, 10(4), 208–212.
- Robach, M. C., Hickey, C. S., & To, E. C. (1981). Comparison of antimicrobial actions of monolaurin and sorbic acid. *Journal of Food Safety*, 3(2), 89–98. <https://doi.org/10.1111/j.1745-4565.1981.tb00413.x>
- Rodrigues, R. C., & Fernandez-Lafuente, R. (2010). Lipase from *Rhizomucor miehei* as a biocatalyst in fats and oils modification. *Journal of Molecular Catalysis B: Enzymatic*, 66(1–2), 15–32. <https://doi.org/10.1016/j.molcatb.2010.03.008>
- Rohim, R. A. A., Ahmad, W. M. A. W., Ismail, N. H., Ghazali, F. M. M., & Alam, M. K. (2020). Modeling the growth of bacteria *Streptococcus sobrinus* using exponential regression. *Pesquisa Brasileira Em Odontopediatria e Clinica Integrada*, 20, 1–7. <https://doi.org/10.1590/pboci.2020.108>
- Rumondang, I., Setyaningsih, D., Hermanda, A., Besar, B., & Ri, K. P. (2016).

- Synthesis of mono-diacylglycerol based glycerol and palm fatty acid distillate. *J Kimia Dan Kemasan*, 38(1), 1–6.
- Saberi, A. H., Kee, B. B., Oi-Ming, L., & Miskandar, M. S. (2011). Physico-chemical properties of various palm-based diacylglycerol oils in comparison with their corresponding palm-based oils. *Food Chemistry*, 127(3), 1031–1038. <https://doi.org/10.1016/j.foodchem.2011.01.076>
- Sadiq, S., Imran, M., Habib, H., Shabbir, S., Ihsan, A., Zafar, Y., & Hafeez, F. Y. (2016). Potential of monolaurin based food-grade nano-micelles loaded with nisin Z for synergistic antimicrobial action against *Staphylococcus aureus*. *LWT - Food Science and Technology*, 71, 227–233. <https://doi.org/10.1016/j.lwt.2016.03.045>
- Sangadah, K., Handayani, S., Setiasih, S., & Hudiyono, S. (2018). Enzymatic synthesis of glycerol ester hydrolyzed coconut oil fatty acid and lauric acid as emulsifier and antimicrobial compound. *AIP Conference Proceedings*, 2023(2018). <https://doi.org/10.1063/1.5064108>
- Santisawadi, S., Chaiseri, S., Jinda, N., & Klinkesorn, U. (2013). Process optimization using response surface design for diacylglycerol synthesis from palm fatty acid distillate by enzymatic esterification. *Songklanakarinn Journal of Science and Technology*, 35(1), 23–32.
- Satriana, Arpi, N., Lubis, Y. M., Adisalamun, Supardan, M. D., & Mustapha, W. A. W. (2016). Diacylglycerol-enriched oil production using chemical glycerolysis. *European Journal of Lipid Science and Technology*, 118(12), 1880–1890. <https://doi.org/10.1002/ejlt.201500489>
- Satyawali, Y., Cauwenberghs, L., Maesen, M., & Dejonghe, W. (2021). Lipase catalyzed solvent free synthesis of monoacylglycerols in various reaction systems and coupling reaction with pervaporation for in situ water removal. *Chemical Engineering and Processing - Process Intensification*, 108475. <https://doi.org/10.1016/j.cep.2021.108475>
- Schlievert, P. M., Deringer, J. R., Kim, M. H., Projan, S. J., & Novick, R. P. (1992). Effect of glycerol monolaurate on bacterial growth and toxin production. *Antimicrobial Agents and Chemotherapy*, 36(3), 626–631. <https://doi.org/10.1128/AAC.36.3.626>
- Schlievert, P. M., Kilgore, S. H., Kaus, G. M., Ho, T. D., & Ellermeier, C. D. (2018). Glycerol Monolaurate (GML) and a Nonaqueous Five-Percent GML Gel Kill *Bacillus* and *Clostridium* Spores. *MSphere*, 3(6), 1–9. <https://doi.org/10.1128/mspheredirect.00597-18>
- Schlievert, P. M., Kilgore, S. H., Seo, K. S., & Leung, D. Y. M. (2019). Glycerol Monolaurate Contributes to the Antimicrobial and Anti-inflammatory Activity of Human Milk. *Scientific Reports*, 9(1), 1–9. <https://doi.org/10.1038/s41598-019-51130-y>
- Schlievert, P. M., & Peterson, M. L. (2012). Glycerol monolaurate antibacterial activity in broth and biofilm cultures. *PLoS ONE*, 7(7), e40350.

- <https://doi.org/10.1371/journal.pone.0040350>
- Schlievert, P. M., Strandberg, K. L., Brosnahan, A. J., Peterson, M. L., Pambuccian, S. E., Nephew, K. R., Brunner, K. G., Schultz-Darken, N. J., & Haase, A. T. (2008). Glycerol monolaurate does not alter rhesus macaque (*Macaca mulatta*) vaginal *Lactobacilli* and is safe for chronic use. *Antimicrobial Agents and Chemotherapy*, 52(12), 4448–4454. <https://doi.org/10.1128/AAC.00989-08>
- Seleem, D., Chen, E., Benso, B., Pardi, V., & Murata, R. M. (2016). In vitro evaluation of antifungal activity of monolaurin against *Candida albicans* biofilms. *PeerJ*, 2016(6), 1–17. <https://doi.org/10.7717/peerj.2148>
- Setianto, W. B., Wibowo, T. Y., Yohanes, H., Illaningsy, F., & Anggoro, D. D. (2017). Synthesis of glycerol mono-laurate from lauric acid and glycerol for food antibacterial additive. *IOP Conference Series: Earth and Environmental Science*, 65(1). <https://doi.org/10.1088/1755-1315/65/1/012046>
- Setlow, P. (2014). Germination of spores of *Bacillus* species: What we know and do not know. *Journal of Bacteriology*, 196(7), 1297–1305. <https://doi.org/10.1128/JB.01455-13>
- Ševčíková, P., Kašpárková, V., Hauerlandová, I., Humpolíček, P., Kuceková, Z., & Buňková, L. (2014). Formulation, antibacterial activity, and cytotoxicity of 1-monoacylglycerol microemulsions. *European Journal of Lipid Science and Technology*, 116(4), 448–457. <https://doi.org/10.1002/ejlt.201300171>
- Shahrin, N. A. M., Chin, P. W., & Serri, N. A. (2019). Crude glycerol utilisation in monolaurin production using immobilised *Rhizomucor miehei* lipase: Optimisation and thermodynamics study. *Journal of Oil Palm Research*, 31(4), 615–623. <https://doi.org/10.21894/jopr.2019.0054>
- Siew, W. L. (2001). Crystallisation and melting behaviour of palm kernel oil and related products by differential scanning calorimetry. *European Journal of Lipid Science and Technology*, 103(11), 729–734. [https://doi.org/10.1002/1438-9312\(200111\)103:11<729::AID-EJLT729>3.0.CO;2-L](https://doi.org/10.1002/1438-9312(200111)103:11<729::AID-EJLT729>3.0.CO;2-L)
- Silalahi, J., Lida Karo Karo, Sinaga, S. M., & Yosy Cinthya Eriwaty Silalahi. (2018). Composition of Fatty Acid and Identification of Lauric Acid Position in Coconut and Palm Kernel Oils. *Indonesian Journal of Pharmaceutical and Clinical Research*, 1(2), 1–8. <https://doi.org/10.32734/idjpcr.v1i2.605>
- Silalahi, J., Yademetripermata, & Putra, E. de L. (2014). Antibacterial activity of hydrolyzed virgin coconut oil. *Asian Journal of Pharmaceutical and Clinical Research*, 7(SUPPL. 2), 90–94.
- Silva-Dias, A., Miranda, I. M., Branco, J., Monteiro-Soares, M., Pina-Vaz, C., & Rodrigues, A. G. (2015). Adhesion, biofilm formation, cell surface hydrophobicity, and antifungal planktonic susceptibility: Relationship among *Candida* spp. *Frontiers in Microbiology*, 6(MAR). <https://doi.org/10.3389/fmicb.2015.00205>
- Singh, A. K., & Mukhopadhyay, M. (2012). Olive oil glycerolysis with the immobilized lipase *Candida antarctica* in a solvent free system. *Grasas y*

- Aceites*, 63(2), 202–208. <https://doi.org/10.3989/gya.094811>
- Singh, Abhishek Kumar, & Mukhopadhyay, M. (2014). Optimizacija reakcije glycerolize maslinovog ulja pomoću lipaze *Candida rugosa* pomoću metodologije površine odziva. *Chemical Industry and Chemical Engineering Quarterly*, 20(1), 127–134. <https://doi.org/10.2298/CICEQ120626117S>
- Solaesa, A., Sanz, M., Melgosa, R., Bucio, S. L., & Beltrán, S. (2015). Glycerolysis of sardine oil catalyzed by a water dependent lipase in different tert-alcohols as reaction medium. *Grasas y Aceites*, 66(4). <https://doi.org/10.3989/gya.0238151>
- Solaesa, Á., Sanz, M. T., Falkeborg, M., Beltrán, S., & Guo, Z. (2016). Production and concentration of monoacylglycerols rich in omega-3 polyunsaturated fatty acids by enzymatic glycerolysis and molecular distillation. *Food Chemistry*, 190(17743), 960–967. <https://doi.org/10.1016/j.foodchem.2015.06.061>
- Strandberg, K. L., Peterson, M. L., Lin, Y. C., Pack, M. C., Chase, D. J., & Schlievert, P. M. (2010). Glycerol monolaurate inhibits *Candida* and *Gardnerella vaginalis* in vitro and in vivo but not *Lactobacillus*. *Antimicrobial Agents and Chemotherapy*, 54(2), 597–601. <https://doi.org/10.1128/AAC.01151-09>
- Štumpf, S., Hostnik, G., Primožič, M., Leitgeb, M., & Bren, U. (2020). Generation times of e. Coli prolong with increasing tannin concentration while the lag phase extends exponentially. *Plants*, 9(12), 1–11. <https://doi.org/10.3390/plants9121680>
- Subroto, E. and Indiaro, R. (2020). Bioactive monolaurin as an antimicrobial and its potential to improve the immune system and against COVID-19: a review. *Food Research*, 4(6), 2355–2365.
- Subroto, E. (2020). Monoacylglycerols and diacylglycerols for fat-based food products: A review. *Food Research*, 4(4), 932–943. [https://doi.org/10.26656/fr.2017.4\(4\).398](https://doi.org/10.26656/fr.2017.4(4).398)
- Subroto, E., Indiaro, R., Wulandari, E., & Azimah, H. N. (2021). Oil to glycerol ratio in enzymatic and chemical glycerolysis for the production of mono- And diacylglycerol. *International Journal of Engineering Trends and Technology*, 69(8), 117–125. <https://doi.org/10.14445/22315381/IJETT-V69I8P215>
- Subroto, E., Supriyanto, Utami, T., & Hidayat, C. (2019). Enzymatic glycerolysis–interesterification of palm stearin–olein blend for synthesis structured lipid containing high mono- and diacylglycerol. *Food Science and Biotechnology*, 28(2), 511–517. <https://doi.org/10.1007/s10068-018-0462-6>
- Tajik, H., Raeisi, M., Razavi Rohani, S. M., Hashemi, M., Amin Zare, M., Naghili, H., Rozbani, D., & Ben Ammar, D. (2014). Effect of monolaurin alone and in combination with EDTA on viability of *Escherichia coli* and *Staphylococcus aureus* in culture media and Iranian white cheese. *Journal of Food Quality and Hazards Control*, 1(4), 108–112.
- Tangwacharin, P., & Khopaibool, P. (2012). Inhibitory effects of the combined application of lauric acid and monolaurin with lactic acid against *Staphylococcus*

- aureus* in pork. *ScienceAsia*, 38(1), 54–63. <https://doi.org/10.2306/scienceasia1513-1874.2012.38.054>
- Tee, V. P., & Nesaretnam, K. (2006). Significance of the SN-2 Hypothesis. *Palm Oil Developments*, 48, 14–19.
- Thaddeus, N., Francis, E., Jane, O., Obumneme, A., & Okechukwu, E. (2018). Effects of some common additives on the antimicrobial activities of alcohol-based hand sanitizers. *Asian Pacific Journal of Tropical Medicine*, 11(3), 222–226. <https://doi.org/10.4103/1995-7645.228437>
- Torres, C. F., Munir, F., Blanco, R. M., & Otero, C. (2002). Catalytic transesterification of corn oil and tristearin using immobilized lipases from *Thermomyces lanuginosa*. *JAACS, Journal of the American Oil Chemists' Society*, 79(8), 775–781. <https://doi.org/10.1007/s11746-002-0558-7>
- Tough, M., & Mengesha, A. (2015). Photostability of nifedipine in monolaurin solid matrix and micellar solution. *Journal of Applied Pharmaceutical Science*, 5(2), 066–073. <https://doi.org/10.7324/JAPS.2015.50210>
- Triana, R. N., Andarwulan, N., Affandi, A. R., Wincy, W., & Kemenady, E. (2014). Aplikasi mono-diasilgliserol dari fully hydrogenated palm kernel oil sebagai *emulsifier* untuk margarin. *Mutu Pangan*, 1(2), 137–144.
- Tripathi, V., Trivedi, R., & Singh, R. P. (2006). Lipase-catalyzed synthesis of diacylglycerol and monoacylglycerol from unsaturated fatty acid in organic solvent system. *Journal of Oleo Science*, 55(2), 65–69. <https://doi.org/10.5650/jos.55.65>
- Tüter, M., Babalı, B., Köse, Ö., Dural, Ş., & Aksoy, H. A. (1999). Solvent-free glycerolysis of palm and palm kernel oils catalyzed by a 1,3-specific lipase and fatty acid composition of glycerolysis products. *Biotechnology Letters*, 21(3), 245–248. <https://doi.org/10.1023/A:1005464021613>
- Van Heerden, J. H., Kempe, H., Doerr, A., Maarleveld, T., Nordholt, N., & Bruggeman, F. J. (2017). Statistics and simulation of growth of single bacterial cells: Illustrations with *B. subtilis* and *E. coli*. *Scientific Reports*, 7(1), 1–11. <https://doi.org/10.1038/s41598-017-15895-4>
- Vázquez, L., Jordán, A., Reglero, G., & Torres, C. F. (2016). A first attempt into the production of acylglycerol mixtures from Echium oil. *Frontiers in Bioengineering and Biotechnology*, 3(JAN), 1–11. <https://doi.org/10.3389/fbioe.2015.00208>
- Vereecken, J., Meeussen, W., Foubert, I., Lesaffer, A., Wouters, J., & Dewettinck, K. (2009). Comparing the crystallization and polymorphic behaviour of saturated and unsaturated monoglycerides. *Food Research International*, 42(10), 1415–1425. <https://doi.org/10.1016/j.foodres.2009.07.006>
- Vetter, S. M., & Schlievert, P. M. (2005). Glycerol monolaurate inhibits virulence factor production in *Bacillus anthracis*. *Antimicrobial Agents and Chemotherapy*, 49(4), 1302–1305. <https://doi.org/10.1128/AAC.49.4.1302-1305.2005>

- Wallis, J. G., Bengtsson, J. D., & Browse, J. (2022). Molecular approaches reduce Saturated and eliminate trans fats in food oils. *Frontiers in Plant Science*, 13(June). <https://doi.org/10.3389/fpls.2022.908608>
- Wang, T., Wang, X., & Wang, X. (2016). Effects of Lipid Structure Changed by Interesterification on Melting Property and Lipemia. *Lipids*, 51(10), 1115–1126. <https://doi.org/10.1007/s11745-016-4184-3>
- Wang, W., Wang, R., Zhang, G., Chen, F., & Xu, B. (2020). In vitro antibacterial activities and mechanisms of action of fatty acid monoglycerides against four foodborne bacteria. *Journal of Food Protection*, 83(2), 331–337. <https://doi.org/10.4315/0362-028X.JFP-19-259>
- Wang, X., Liu, K., Wang, Y., Huang, Z., & Wang, X. (2022). Preparation of 2-Arachidonoylglycerol by Enzymatic Alcoholysis: Effects of Solvent and Water Activity on Acyl Migration. *Foods*, 11(20). <https://doi.org/10.3390/foods11203213>
- Welch, J. L., Xiang, J., Okeoma, C. M., Schlievert, P. M., & Stapleton, J. T. (2020). Glycerol Monolaurate, an Analogue to a Factor Secreted by *Lactobacillus*, Is Virucidal against Enveloped Viruses, Including HIV-1. *MBio*, 11(3), 1–17.
- Widiyarti, G., & Hanafi, M. (2008). Molaritas Reaktan Pada Sintesis Senyawa A - Monolaurin. *Reaktor*, 12(2), 90–97.
- Widiyarti, G., Hanafi, M., & Soewarso, W. P. (2010). Studi on the synthesis of monolaurin as antibacterial agent againsts *Staphylococcus aureus*. *Indonesian Journal of Chemistry*, 9(1), 99–106. <https://doi.org/10.22146/ijc.21569>
- Wong, D. P., Chua, M. T., & Enriquez, E. P. (2006). Composition of Glyceride Esters of Lauric Acid by FTIR Band Shape Analysis. *Kimika*, 22(1), 7–13.
- Xie, Z., Peng, Y., Li, C., Luo, X., Wei, Z., Li, X., Yao, Y., Fang, T., & Huang, L. (2020). Growth kinetics of *Staphylococcus aureus* and background microorganisms in camel milk. *Journal of Dairy Science*, 103(11), 9958–9968. <https://doi.org/10.3168/jds.2020-18616>
- Yang, T., Rebsdorf, M., Engelrud, U., & Xu, X. (2005). Enzymatic production of monoacylglycerols containing polyunsaturated fatty acids through an efficient glycerolysis system. *Journal of Agricultural and Food Chemistry*, 53(5), 1475–1481. <https://doi.org/10.1021/jf048405g>
- Yee, M. M. (2011). Preparation of An Effective Antimicrobial Agent from Virgin Coconut Oil. *Dragon University Research Journal*, 3, 107–113.
- Yeh, Y. C., & Gulari, E. (1998). Enzymatic glyceride synthesis in a foam reactor. *JAACS, Journal of the American Oil Chemists' Society*, 75(5), 643–650. <https://doi.org/10.1007/s11746-998-0078-8>
- Yoon, B. K., Jackman, J. A., Kim, M. C., & Cho, N. J. (2015). Spectrum of membrane morphological responses to antibacterial fatty acids and related surfactants. *Langmuir*, 31(37), 10223–10232. <https://doi.org/10.1021/acs.langmuir.5b02088>
- Yoon, B. K., Jackman, J. A., Park, S., Mokrzecka, N., & Cho, N. J. (2019).

- Characterizing the membrane-disruptive behavior of dodecylglycerol using supported lipid bilayers [Research-article]. *Langmuir*, 35(9), 3568–3575. <https://doi.org/10.1021/acs.langmuir.9b00244>
- Yoon, B. K., Jackman, J. A., Valle-González, E. R., & Cho, N. J. (2018). Antibacterial free fatty acids and monoglycerides: Biological activities, experimental testing, and therapeutic applications. *International Journal of Molecular Sciences*, 19(4), 1114. <https://doi.org/10.3390/ijms19041114>
- Yu, D., Jiang, Q., Xu, Y., & Xia, W. (2017). The shelf life extension of refrigerated grass carp (*Ctenopharyngodon idellus*) fillets by chitosan coating combined with glycerol monolaurate. *International Journal of Biological Macromolecules*, 101, 448–454. <https://doi.org/10.1016/j.ijbiomac.2017.03.038>
- Yue, H., Luo, R. M., Qin, X., He, S., Yang, B., Liao, S., Wang, W., & Wang, Y. (2021). Synthesis of partial glycerides rich in α -linolenic acid efficiently from silkworm pupa oil with immobilized lipase MAS1-H108A. *Food Sci. Technol, Campinas*, 2061, 1–6.
- Yusoff, M. S. A. (2012). Applications of palm oil. *Palm Oil Trade Fair and Seminar (POTS) Philippines 2012*. <http://www.mpoc.org.my/upload/P5-Food-Applications-in-Palm-Oil.pdf>
- Zakwan, Julianti, E., & Lubis, Z. (2017). Production mono-diglyceride (MDG) from refined deodorized palm oil (RBDPO) by enzymatic process. *International Food Research Journal*, 24(1), 56–59.
- Zha, B., Chen, Z., Wang, L., Wang, R., Chen, Z., & Zheng, L. (2014). Production of glycerol monolaurate-enriched monoacylglycerols by lipase-catalyzed glycerolysis from coconut oil. *European Journal of Lipid Science and Technology*, 116(3), 328–335. <https://doi.org/10.1002/ejlt.201300243>
- Zhang, Hui, Cui, Y., Zhu, S., Feng, F., & Zheng, X. (2010). Characterization and antimicrobial activity of a pharmaceutical microemulsion. *International Journal of Pharmaceutics*, 395(1–2), 154–160. <https://doi.org/10.1016/j.ijpharm.2010.05.022>
- Zhang, Hui, Feng, F., Li, J., Zhan, X., Wei, H., Li, H., Wang, H., & Zheng, X. (2008). Formulation of food-grade microemulsions with glycerol monolaurate: Effects of short-chain alcohols, polyols, salts and nonionic surfactants. *European Food Research and Technology*, 226(3), 613–619. <https://doi.org/10.1007/s00217-007-0606-z>
- Zhang, Hui, Wei, H., Cui, Y., Zhao, G., & Feng, F. (2009). Antibacterial interactions of monolaurin with commonly used antimicrobials and food components. *Journal of Food Science*, 74(7). <https://doi.org/10.1111/j.1750-3841.2009.01300.x>
- Zhang, Huijun, Zhao, H., Zhang, Y., Shen, Y., Su, H., Jin, J., Jin, Q., & Wang, X. (2018). Characterization of Positional Distribution of Fatty Acids and Triacylglycerol Molecular Compositions of Marine Fish Oils Rich in Omega-3 Polyunsaturated Fatty Acids. *BioMed Research International*, 2018.

- <https://doi.org/10.1155/2018/3529682>
- Zhang, S., Xiong, J., Lou, W., Ning, Z., Zhang, D., & Yang, J. (2018). The key lethal effect existed in the antibacterial behavior of short, medium, and long chain fatty acid monoglycerides on *Escherichia coli*. *BioRxiv*. <https://doi.org/10.1101/339309>
- Zhang, Xi, Song, F., Taxipalati, M., Wei, W., Feng, F., & Chen, C. S. (2014). Comparative study of surface-active properties and antimicrobial activities of disaccharide monoesters. *PLoS ONE*, 9(12), 1–19. <https://doi.org/10.1371/journal.pone.0114845>
- Zhang, Xia, Li, L., Xie, H., Liang, Z., Su, J., Liu, G., & Li, B. (2014). Effect of Temperature on the crystalline form and fat crystal network of two model palm oil-based shortenings during storage. *Food and Bioprocess Technology*, 7(3), 887–900. <https://doi.org/10.1007/s11947-013-1078-8>
- Zhao, M., Cai, H., Jiang, Z., Li, Y., Zhong, H., Zhang, H., & Feng, F. (2019). Glycerol-monolaurate-mediated attenuation of metabolic syndrome is associated with the modulation of gut microbiota in high-fat-diet-fed mice. *Molecular Nutrition and Food Research*, 63(18), 1–12. <https://doi.org/10.1002/mnfr.201801417>
- Zhao, M., Jiang, Z., Cai, H., Li, Y., Mo, Q., Deng, L., Zhong, H., Liu, T., Zhang, H., Kang, J. X., & Feng, F. (2020). Modulation of the gut microbiota during high-dose glycerol monolaurate-mediated amelioration of obesity in mice fed a high-fat diet. *MBio*, 11(2), e00190-20. <https://doi.org/https://doi.org/10.1128/mBio.00190-20>. Invited
- Zhao, Y., Liu, J., Deng, L., Wang, F., & Tan, T. (2011). Optimization of *Candida sp.* 99-125 lipase catalyzed esterification for synthesis of monoglyceride and diglyceride in solvent-free system. *Journal of Molecular Catalysis B: Enzymatic*, 72(3–4), 157–162. <https://doi.org/10.1016/j.molcatb.2011.05.014>
- Zheling, Z., Dongman, W., Chao, P., & Chunyan, L. (2010). *Method for preparing monolaurin* (Patent No. CN101747997A). <https://patents.google.com/patent/CN101747997A/en>
- Zhong, N., Li, L., Xu, X., Cheong, L., Li, B., Hu, S., & Zhao, X. (2009). An efficient binary solvent mixture for monoacylglycerol synthesis by enzymatic glycerolysis. *JAACS, Journal of the American Oil Chemists' Society*, 86(8), 783–789. <https://doi.org/10.1007/s11746-009-1402-7>
- Zhong, N., Li, L., Xu, X., Cheong, L. Z., Xu, Z., & Li, B. (2013). High yield of monoacylglycerols production through low-temperature chemical and enzymatic glycerolysis. *European Journal of Lipid Science and Technology*, 115(6), 684–690. <https://doi.org/10.1002/ejlt.201200377>
- Zhong, N., Li, L., Xu, X., Cheong, L. Z., Zhao, X., & Li, B. (2010). Production of diacylglycerols through low-temperature chemical glycerolysis. *Food Chemistry*, 122(1), 228–232. <https://doi.org/10.1016/j.foodchem.2010.02.067>
- Zitianwang, Dai, L., Liu, D., Liu, H., & Du, W. (2020). Kinetics and mechanism of

solvent influence on the lipase-catalyzed 1,3-diolein synthesis. *ACS Omega*, 5(38), 24708–24716. <https://doi.org/10.1021/acsomega.0c03284>