



DAFTAR PUSTAKA

- [AOAC] Association of Official Analytical. 1990. Official Methods of Analysis of AOAC International (15th ed). AOAC. Virginia.
- Abbasi, S., & Radi, M. (2016). Food grade microemulsion systems: Canola oil/lecithin:n-propanol/water. *Food Chemistry*, 194, 972–979. <https://doi.org/10.1016/j.foodchem.2015.08.078>
- Aditya, N. P., Macedo, A. S., Doktorovova, S., Souto, E. B., Kim, S., Chang, P. S., & Ko, S. (2014). Development and evaluation of lipid nanocarriers for quercetin delivery: A comparative study of solid lipid nanoparticles (SLN), nanostructured lipid carriers (NLC), and lipid nanoemulsions (LNE). *Lwt*, 59(1), 115–121. <https://doi.org/10.1016/j.lwt.2014.04.058>
- Ahmad, A., Rehman, M. U., Wali, A. F., El-Serehy, H. A., Al-Misned, F. A., Maodaa, S. N., Aljawdah, H. M., Mir, T. M., & Ahmad, P. (2020). Box-Behnken Response Surface Design of Polysaccharide Extraction from Rhododendron arboreum and the Evaluation of Its Antioxidant Potential. *Molecules*, 25(17). <https://doi.org/10.3390/molecules25173835>
- Akhtar, N., Rehman, M. U., Khan, H. M. S., Rasool, F., Saeed, T., & Murtaza, G. (2011). Penetration enhancing effect of polysorbate 20 and 80 on the in vitro percutaneous absorption of L-ascorbic acid. *Tropical Journal of Pharmaceutical Research*, 10(3), 281–288. <https://doi.org/10.4314/tjpr.v10i3.1>
- Akyildiz, A., Mertoglu, T. S., & Agcam, E. (2021). Kinetic study for ascorbic acid degradation, hydroxymethylfurfural and furfural formations in Orange juice. *Journal of Food Composition and Analysis*, 102(May), 103996. <https://doi.org/10.1016/j.jfca.2021.103996>
- Al-Maqtari, Q. A., Ghaleb, A. D. S., Mahdi, A. A., Al-Ansi, W., Noman, A. E., Wei, M., Al-Adeeb, A., & Yao, W. (2021). Stabilization of water-in-oil emulsion of *Pulicaria jaubertii* extract by ultrasonication: Fabrication, characterization, and storage stability. *Food Chemistry*, 350, 129-249. <https://doi.org/10.1016/j.foodchem.2021.129249>
- Amiri-Rigi, A., & Abbasi, S. (2016). Microemulsion-based lycopene extraction: Effect of surfactants, co-surfactants and pretreatments. *Food Chemistry*, 197, 1002–1007. <https://doi.org/10.1016/j.foodchem.2015.11.077>
- Anton, N., & Vandamme, T. F. (2011). Nano-emulsions and micro-emulsions: Clarifications of the critical differences. *Pharmaceutical Research*, 28(5), 978–985. <https://doi.org/10.1007/s11095-010-0309-1>
- Arab, F., Alemzadeh, I., & Maghsoudi, V. (2011). Determination of antioxidant



component and activity of rice bran extract. *Scientia Iranica*, 18(6), 1402–1406. <https://doi.org/10.1016/j.scient.2011.09.014>

Ariviani, S., Raharjo, S., & Hastuti, P. (2011). Potensi mikroemulsi β -karoten dalam menghambat fotooksidasi vitamin C sistem aqueous [The Potential Inhibition of B -Carotene Microemulsion on Vitamin C Photooxidation in Aqueous Systems]. *Jurnal Teknologi Dan Industri Pangan*, XXII(1), 33–39.

Asmara, A. P., & Amungkasi, H. K. (2019). Kajian Kinetika Pengaruh Lama Penyimpanan Terhadap Kadar Vitamin C Pada Buah Apel Malang (*Malus Sylvestris*). *Al-Kimia*, 7(2), 1-22. <https://doi.org/10.24252/alkimia.v7i2.8125>

Augustin, M. A., & Hemar, Y. (2009). Nano- and micro-structured assemblies for encapsulation of food ingredients. *Chemical Society Reviews*, 38(4), 902–912. <https://doi.org/10.1039/b801739p>

Azevedo, E. P. de P., dos Santos Alves, E. M., de Souza, J. R. B., de Araújo, K. S., de Santana Khan, S., Alves de Mendonça, C. E., & Maciel, M. I. S. (2021). Fatty acid in raw and heated coconut oil in eleven coconut oil food preparations analysed by gas chromatography. *International Journal of Gastronomy and Food Science*, 24(March). <https://doi.org/10.1016/j.ijgfs.2021.100329>

Babazadeh, A., Ghanbarzadeh, B., & Hamishehkar, H. (2016). Novel nanostructured lipid carriers as a promising food grade delivery system for rutin. *Journal of Functional Foods*, 26, 167–175. <https://doi.org/10.1016/j.jff.2016.07.017>

Bandi, S. P., Kumbhar, Y. S., & Venuganti, V. V. K. (2020). Effect of particle size and surface charge of nanoparticles in penetration through intestinal mucus barrier. *Journal of Nanoparticle Research*, 22(3). <https://doi.org/10.1007/s11051-020-04785-y>

Bodie, A. R., Micciche, A. C., Atungulu, G. G., Rothrock, M. J., & Ricke, S. C. (2019). Current Trends of Rice Milling Byproducts for Agricultural Applications and Alternative Food Production Systems. *Frontiers in Sustainable Food Systems*, 3(47), 1–13. <https://doi.org/10.3389/fsufs.2019.00047>

Butsat, S., & Siriamornpun, S. (2010). Antioxidant capacities and phenolic compounds of the husk, bran and endosperm of Thai rice. *Food Chemistry*, 119(2), 606–613. <https://doi.org/10.1016/j.foodchem.2009.07.001>

Calligaris, S., Comuzzo, P., Bot, F., Lippe, G., Zironi, R., Anese, M., & Nicoli, M. C. (2015). Nanoemulsions as delivery systems of hydrophobic silybin from silymarin extract: Effect of oil type on silybin solubility, invitro bioaccessibility and stability. *Lwt*, 63(1), 77–84.



<https://doi.org/10.1016/j.lwt.2015.03.091>

Capellini, M. C., Giacomini, V., Cuevas, M. S., & Rodrigues, C. E. C. (2017). Rice bran oil extraction using alcoholic solvents: Physicochemical characterization of oil and protein fraction functionality. *Industrial Crops and Products*, 104(June 2016), 133–143.
<https://doi.org/10.1016/j.indcrop.2017.04.017>

Chakraborty, S., Shukla, D., Mishra, B., & Singh, S. (2009). Lipid - An emerging platform for oral delivery of drugs with poor bioavailability. *European Journal of Pharmaceutics and Biopharmaceutics*, 73(1), 1–15.
<https://doi.org/10.1016/j.ejpb.2009.06.001>

Chen, Y., Wang, Y., Jin, J., Jin, Q., Akoh, C. C., & Wang, X. (2022). Formation of dark chocolate fats with improved heat stability and desirable miscibility by blending cocoa butter with mango kernel fat stearin and hard palm-mid fraction. *Lwt*, 156(July 2021), 113066.
<https://doi.org/10.1016/j.lwt.2022.113066>

Cho, Y. H., Kim, S., Bae, E. K., Mok, C. K., & Park, J. (2008). Formulation of a cosurfactant-free O/W microemulsion using nonionic surfactant mixtures. *Journal of Food Science*, 73(3), 115–121. <https://doi.org/10.1111/j.1750-3841.2008.00688.x>

Cravotto, G., Boffa, L., Mantegna, S., Perego, P., Avogadro, M., & Cintas, P. (2008). Improved extraction of vegetable oils under high-intensity ultrasound and/or microwaves. *Ultrasonics Sonochemistry*, 15(5), 898–902.
<https://doi.org/10.1016/j.ultsonch.2007.10.009>

Cuevas, M. S., de Souza, P. T., da Costa Rodrigues, C. E., & Meirelles, A. J. A. (2017). Quantification and Determination of Composition of Steryl Ferulates in Refined Rice Bran Oils Using an UPLC-MS Method. *JAOCs, Journal of the American Oil Chemists' Society*, 94(3), 375–385.
<https://doi.org/10.1007/s11746-017-2955-5>

Davidov-Pardo, G., & McClements, D. J. (2015). Nutraceutical delivery systems: Resveratrol encapsulation in grape seed oil nanoemulsions formed by spontaneous emulsification. *Food Chemistry*, 167, 205–212.
<https://doi.org/10.1016/j.foodchem.2014.06.082>

Dey, S., & Rathod, V. K. (2013). Ultrasound assisted extraction of β-carotene from Spirulina platensis. *Ultrasonics Sonochemistry*, 20(1), 271–276.
<https://doi.org/10.1016/j.ultsonch.2012.05.010>

Dhara, K., & Debiprosad, R. M. (2019). Review on nanomaterials-enabled electrochemical sensors for ascorbic acid detection. *Analytical Biochemistry*, 586(July), 113415. <https://doi.org/10.1016/j.ab.2019.113415>

Dhvavamani, S., Poorna Chandra Rao, Y., & Lokesh, B. R. (2014). Total



antioxidant activity of selected vegetable oils and their influence on total antioxidant values in vivo: A photochemiluminescence based analysis. *Food Chemistry*, 164, 551–555. <https://doi.org/10.1016/j.foodchem.2014.05.064>

Djaeni, M., & Listyadevi, Y. L. (2019). The Ultrasound-Assisted Extraction of Rice Bran Oil with n-Hexane as a Solvent. *Journal of Physics: Conference Series*, 1295(1) 1-7. <https://doi.org/10.1088/1742-6596/1295/1/012027>

Do, L. D., & Sabatini, D. A. (2010). Aqueous extended-surfactant based method for vegetable oil extraction: Proof of concept. *JAOCs, Journal of the American Oil Chemists' Society*, 87(10), 1211–1220. <https://doi.org/10.1007/s11746-010-1603-0>

Domínguez-Martínez, I., Meza-Márquez, O. G., Osorio-Revilla, G., Proal-Nájera, J., & Gallardo-Velázquez, T. (2014). Determination of capsaicin, ascorbic acid, total phenolic compounds and antioxidant activity of *Capsicum annuum* L. var. serrano by mid infrared spectroscopy (Mid-FTIR) and chemometric analysis. *Journal of the Korean Society for Applied Biological Chemistry*, 57(1), 133–142. <https://doi.org/10.1007/s13765-013-4295-y>

Elianarni, D., Raharjo, S., & Supriyadi, S. (2023). Formulation and Characteristics of Red Palm Oil Nanostructured Lipid Carriers Prepared by Microemulsion Method and Its Application in Drinking Yoghurt. *Indonesian Food and Nutrition Progress*, 19(1), 1. <https://doi.org/10.22146/ifnp.70925>

Elmowafy, M., & Al-Sanea, M. M. (2021). Nanostructured lipid carriers (NLCs) as drug delivery platform: Advances in formulation and delivery strategies. *Saudi Pharmaceutical Journal*, 29(9), 999–1012. <https://doi.org/10.1016/j.jsps.2021.07.015>

Esmaeili, H. R., & Gholami, Z. (2011). Scanning electron microscopy of the scale morphology in cyprinid fish, *Rutilus frisii kutum* Kamenskii, 1901 (Actinopterygii: Cyprinidae). *Iranian Journal of Fisheries Sciences*, 10(1), 155–166.

Ezhilarasi, P. N., Karthik, P., Chhanwal, N., & Anandharamakrishnan, C. (2013). Nanoencapsulation Techniques for Food Bioactive Components: A Review. *Food and Bioprocess Technology*, 6(3), 628–647. <https://doi.org/10.1007/s11947-012-0944-0>

Fathi, M., Mozafari, M. R., & Mohebbi, M. (2012). Nanoencapsulation of food ingredients using lipid based delivery systems. *Trends in Food Science and Technology*, 23(1), 13–27. <https://doi.org/10.1016/j.tifs.2011.08.003>

Flanagan, J., & Singh, H. (2006). Microemulsions: A potential delivery system for bioactives in food. *Critical Reviews in Food Science and Nutrition*, 46(3), 221–237. <https://doi.org/10.1080/10408690590956710>

Fraterrigo Garofalo, S., Tommasi, T., & Fino, D. (2021). A short review of green



- extraction technologies for rice bran oil. *Biomass Conversion and Biorefinery*, 11(2), 569–587. <https://doi.org/10.1007/s13399-020-00846-3>
- Gadhav, A. (2014). *Determination of Hydrophilic-Lipophilic Balance Value*. International Journal of Science and Research (IJSR). 3(4), 573–575. <https://www.ijsr.net/archive/v3i4/MDIwMTMxNTMw.pdf>
- Gadhav, A. D., & Waghmare, J. T. (2014). A short review on microemulsion and its application in extraction of vegetable oil. *International Journal of Research in Engineering and Technology*, 03(09), 147–158. <https://doi.org/10.15623/ijret.2014.0309022>
- Garba, U., Singanusong, R., Jiamyangyeun, S., & Thongsook, T. (2017). Extraction and utilisation of rice bran oil. A review. *Rivista Italiana Delle Sostanze Grasse*, 96(3), 161–170.
- Ghorbanzadeh, R., & Rezaei, K. (2017). Optimization of an Aqueous Extraction Process for Pomegranate Seed Oil. *JAOCs, Journal of the American Oil Chemists' Society*, 94(12), 1491–1501. <https://doi.org/10.1007/s11746-017-3045-4>
- Gómez-Estaca, J., Calvo, M. M., Álvarez-Acero, I., Montero, P., & Gómez-Guillén, M. C. (2017). Characterization and storage stability of astaxanthin esters, fatty acid profile and α-tocopherol of lipid extract from shrimp (*L. vannamei*) waste with potential applications as food ingredient. *Food Chemistry*, 216, 37–44. <https://doi.org/10.1016/j.foodchem.2016.08.016>
- Goufo, P., & Trindade, H. (2014). Rice antioxidants: Phenolic acids, flavonoids, anthocyanins, proanthocyanidins, tocopherols, tocotrienols, c-oryzanol, and phytic acid. *Food Science and Nutrition*, 2(2), 75–104. <https://doi.org/10.1002/fsn3.86>
- Grajzer, M., Prescha, A., Korzonek, K., Wojakowska, A., Dziadas, M., Kulma, A., & Grajeda, H. (2015). Characteristics of rose hip (*Rosa canina L.*) cold-pressed oil and its oxidative stability studied by the differential scanning calorimetry method. *Food Chemistry*, 188, 459–466. <https://doi.org/10.1016/j.foodchem.2015.05.034>
- Gu, L., Sun, R., Wang, W., & Xia, Q. (2022). Nanostructured lipid carriers for the encapsulation of phloretin: preparation and in vitro characterization studies. *Chemistry and Physics of Lipids*, 242(October 2021), 105150. <https://doi.org/10.1016/j.chemphyslip.2021.105150>
- Handford, C. E., Dean, M., Henchion, M., Spence, M., Elliott, C. T., & Campbell, K. (2014). Implications of nanotechnology for the agri-food industry: Opportunities, benefits and risks. *Trends in Food Science and Technology*, 40(2), 226–241. <https://doi.org/10.1016/j.tifs.2014.09.007>
- Hartati, S., Marsono, Y., & Santoso, U. (2015). Komposisi Kimia Serta Aktivitas



Antioksidan Ekstrak Hidrofilik Bekatul Beberapa Varietas Padi. *Jurnal Agritech*, 35(1), 35–42.

Henderson, A. J., Ollila, C. A., Kumar, A., Borresen, E. C., Raina, K., Agarwal, R., & Ryan, E. P. (2012). Chemopreventive properties of dietary rice bran: Current status and future prospects. *Advances in Nutrition*, 3(5), 643–653. <https://doi.org/10.3945/an.112.002303>

Huang, W., Dou, H., Wu, H., Sun, Z., Wang, H., & Huang, L. (2017). Preparation and Characterisation of Nobiletin-Loaded Nanostructured Lipid Carriers. *Journal of Nanomaterials*, 2017. 18, 509-516. <https://doi.org/10.1155/2017/2898342>

Iman, N., Rahman, A., & Nurhaeni, D. (2016). Sintesis Surfaktan Metil Ester Sulfonat (MES) dari Metil Laurat [Synthesis of Methyl Ester Sulfonic (MES) from Methyl Laurate]. *Kovalen*, 2(2), 54–66.

Jiao, J., Li, Z. G., Gai, Q. Y., Li, X. J., Wei, F. Y., Fu, Y. J., & Ma, W. (2014). Microwave-assisted aqueous enzymatic extraction of oil from pumpkin seeds and evaluation of its physicochemical properties, fatty acid compositions and antioxidant activities. *Food Chemistry*, 147, 17–24. <https://doi.org/10.1016/j.foodchem.2013.09.079>

Joshi, M., Kaur, R., Kanwar, P., Dhiman, G., Sharma, G., Lata, S., Tilak, K., Gupta, N., & Mishra, T. (2016). To Evaluate Antioxidant Activity of Γ – Oryzanol Extracted From Rice Bran Oil. *International Journal of Life Sciences And Pharma Research*, 6(3), 17–25. http://www.ijlpr.com/admin/php/uploads/281_pdf.pdf

Kang, K. K., Jeon, H., Kim, I. H., & Kim, B. H. (2013). Cocoa butter equivalents prepared by blending fractionated palm stearin and shea stearin. *Food Science and Biotechnology*, 22(2), 347–352. <https://doi.org/10.1007/s10068-013-0087-8>

Khan Chand, U. K. P. (2015). Application of Response Surface Method as an Experimental Design to Optimize Clarification Process Parameters for Sugarcane Juice. *Journal of Food Processing & Technology*, 06(02). 1-6. <https://doi.org/10.4172/2157-7110.1000422>

Khoei, M., & Chekin, F. (2016). The ultrasound-assisted aqueous extraction of rice bran oil. *Food Chemistry*, 194, 503–507. <https://doi.org/10.1016/j.foodchem.2015.08.068>

Khosa, A., Reddi, S., & Saha, R. N. (2018). Nanostructured lipid carriers for site-specific drug delivery. *Biomedicine and Pharmacotherapy*, 103(April), 598–613. <https://doi.org/10.1016/j.biopha.2018.04.055>

Kim, J. I., Lee, J. H., Choi, D. S., Won, B. M., Jung, M. Y., & Park, J. (2009). Kinetic study of the quenching reaction of singlet oxygen by common



synthetic antioxidants (tert-Butylhydroxyanisol, tert-di-Butylhydroxytoluene, and tert-Butylhydroquinone) as compared with α -Tocopherol. *Journal of Food Science*, 74(5) 33-69. <https://doi.org/10.1111/j.1750-3841.2009.01160.x>

Kittithammavong, V., Charoensaeng, A., & Khaodhiar, S. (2021). A normalized HLD (HLDN) tool for optimal salt-concentration prediction of microemulsions. *Applied Sciences (Switzerland)*, 11(19). 1-3. <https://doi.org/10.3390/app11199151>

Krambeck, K., Silva, V., Silva, R., Fernandes, C., Cagide, F., Borges, F., Santos, D., Otero-Espinar, F., Lobo, J. M. S., & Amaral, M. H. (2021). Design and characterization of Nanostructured lipid carriers (NLC) and Nanostructured lipid carrier-based hydrogels containing Passiflora edulis seeds oil. *International Journal of Pharmaceutics*, 600, 1-22. <https://doi.org/10.1016/j.ijpharm.2021.120444>

Krishna, G., A. G., Hemakumar, K. H., & Khatoon, S. (2006). Study on the composition of rice bran oil and its higher free fatty acids value. *JAOCs, Journal of the American Oil Chemists' Society*, 83(2), 117–120. <https://doi.org/10.1007/s11746-006-1183-1>

Kumar, S. S., Chauhan, S. A., & Giridhar, P. (2020). Nanoliposomal encapsulation mediated enhancement of betalain stability: Characterisation, storage stability and antioxidant activity of *Basella rubra* L. fruits for its applications in vegan gummy candies. *Food Chemistry*, 333, 127442. <https://doi.org/10.1016/j.foodchem.2020.127442>

Lade, S., Shah, N., & Burle, S. (2022). Nanostructured Lipid Carriers: A Vital Drug Carrier for Migraine Treatment. *Research Journal of Pharmacy and Technology*, 15(7), 3309–3316. <https://doi.org/10.52711/0974-360X.2022.00554>

Lee, Y. S., Tarté, R., & Acevedo, N. C. (2021). Synergistic effects of starch nanoparticles and chitin nanofibers on the stability of oil-in-water Pickering emulsions. *Food Chemistry*, 363(June) 34-47. <https://doi.org/10.1016/j.foodchem.2021.130301>

Lerma-García, M. J., Herrero-Martínez, J. M., Simó-Alfonso, E. F., Mendonça, C. R. B., & Ramis-Ramos, G. (2009). Composition, industrial processing and applications of rice bran γ -oryzanol. *Food Chemistry*, 115(2), 389–404. <https://doi.org/10.1016/j.foodchem.2009.01.063>

Liao, M., Damayanti, W., Xu, Y., Zhao, Y., Xu, X., Zheng, Y., & Jiao, S. (2020). Hot air-assisted radio frequency heating for stabilization of rice bran: Enzyme activity, phenolic content, antioxidant activity and microstructure. *Lwt*, 131, 109754. <https://doi.org/10.1016/j.lwt.2020.109754>



- Linander, C. B., Bojesen Christensen, R. H., Cleaver, G., & Brockhoff, P. B. (2020). Principal component analysis of d-prime values from sensory discrimination tests using binary paired comparisons. *Food Quality and Preference*, 81(December 2019), 1-20. <https://doi.org/10.1016/j.foodqual.2019.103864>
- 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, W., Wang, J., McClements, D. J., & Zou, L. (2018). Encapsulation of β -carotene-loaded oil droplets in caseinate/alginate microparticles: Enhancement of carotenoid stability and bioaccessibility. *Journal of Functional Foods*, 40(September 2017), 527–535. <https://doi.org/10.1016/j.jff.2017.11.046>
- Liu, Z., Deng, B., Li, S., & Zou, Z. (2018). Optimization of solvent-free microwave assisted extraction of essential oil from *Cinnamomum camphora* leaves. *Industrial Crops and Products*, 124(August), 353–362. <https://doi.org/10.1016/j.indcrop.2018.08.016>
- Luo, X., Cui, J., Zhang, H., Duan, Y., Zhang, D., Cai, M., & Chen, G. (2018). Ultrasound assisted extraction of polyphenolic compounds from red sorghum (*Sorghum bicolor* L.) bran and their biological activities and polyphenolic compositions. *Industrial Crops and Products*, 112(301), 296–304. <https://doi.org/10.1016/j.indcrop.2017.12.019>
- Mas'ud, F., & Pabbenteng, P. (2016). Rasio Bekatul Padi dengan Pelarut pada Ekstraksi Minyak Bekatul Padi. *INTEK: Jurnal Penelitian*, 3(2), 82-92. <https://doi.org/10.31963/intek.v3i2.56>
- McClements, D. J. (2007). Critical review of techniques and methodologies for characterization of emulsion stability. *Critical Reviews in Food Science and Nutrition*, 47(7), 611–649. <https://doi.org/10.1080/10408390701289292>
- McClements, D. J., Bai, L., & Chung, C. (2017). Recent Advances in the Utilization of Natural Emulsifiers to Form and Stabilize Emulsions. *Annual Review of Food Science and Technology*, 8(January), 205–236. <https://doi.org/10.1146/annurev-food-030216-030154>
- McClements, D. J., & Rao, J. (2011). Food-Grade nanoemulsions: Formulation, fabrication, properties, performance, Biological fate, and Potential Toxicity. *Critical Reviews in Food Science and Nutrition*, 51(4), 285–330. <https://doi.org/10.1080/10408398.2011.559558>
- Mello, N. A., Cardoso, L. P., Ribeiro, A. P. B., & Bicas, J. L. (2021). Effect of Limonene on Modulation of Palm Stearin Crystallization. *Food Biophysics*,



16(1). <https://doi.org/10.1007/s11483-020-09640-0>

- Minatel, I. O., Francisqueti, F. V., Corrêa, C. R., & Pereira Lima, G. P. (2016). Antioxidant activity of Y-oryzanol: A complex network of interactions. *International Journal of Molecular Sciences*, 17(8), 1–5. <https://doi.org/10.3390/ijms17081107>
- Mitri, K., Shegokar, R., Gohla, S., Anselmi, C., & Müller, R. H. (2011). Lipid nanocarriers for dermal delivery of lutein: Preparation, characterization, stability and performance. *International Journal of Pharmaceutics*, 414(1–2), 267–275. <https://doi.org/10.1016/j.ijpharm.2011.05.008>
- Montenegro, L., Lai, F., Offerta, A., Sarpietro, M. G., Micicchè, L., Maccioni, A. M., Valenti, D., & Fadda, A. M. (2016). From nanoemulsions to nanostructured lipid carriers: A relevant development in dermal delivery of drugs and cosmetics. *Journal of Drug Delivery Science and Technology*, 32, 100–112. <https://doi.org/10.1016/j.jddst.2015.10.003>
- Morshedi, A. & Akbarian., M. (2014). Application of Response Surface Methodology: Design of Experiments and Optimization: a Mini Review. *Indian Journal of Fundamental and Applied Life Sciences*, 4(2002), 2434–2439.
- Müller, R. H., Radtke, M., & Wissing, S. A. (2002). Solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC) in cosmetic and dermatological preparations. *Advanced Drug Delivery Reviews*, 54(SUPPL.), 131–155. [https://doi.org/10.1016/S0169-409X\(02\)00118-7](https://doi.org/10.1016/S0169-409X(02)00118-7)
- Myers, D. (2006) Surfactant Science. 3rd ed. Hoboken, N. J.: John Wiley & Sons, Inc.
- Nagao, A., Kotake-Nara, E., & Hase, M. (2013). Effects of fats and oils on the bioaccessibility of carotenoids and vitamin e in vegetables. *Bioscience, Biotechnology and Biochemistry*, 77(5), 1055–1060. <https://doi.org/10.1271/bbb.130025>
- Naksuk, A., Sabatini, D. A., & Tongcumpou, C. (2009). Microemulsion-based palm kernel oil extraction using mixed surfactant solutions. *Industrial Crops and Products*, 30(2), 194–198. <https://doi.org/10.1016/j.indcrop.2009.03.008>
- Nie, R., Zhang, Y., Zhang, H., Jin, Q., Wu, G., & Wang, X. (2020). Effect of different processing methods on physicochemical properties, chemical compositions and in vitro antioxidant activities of *Paeonia lactiflora* Pall seed oils. *Food Chemistry*, 332, 127408. <https://doi.org/10.1016/j.foodchem.2020.127408>
- Nurhasanah, S., Wulandari, N., Munarso, S. J., & Hariyadi, P. (2018). Stabilitas Oksidasi Lipida Terstruktur Berbasis Minyak Kelapa dan Minyak Kelapa Sawit [Oxidative Stability of Structured Lipid Based on Coconut Oil and



Palm Oil]. *Buletin Palma*, 18(2), 53.
<https://doi.org/10.21082/bp.v18n2.2017.53-62>

Ouchi, A., Aizawa, K., Iwasaki, Y., Inakuma, T., Terao, J., Nagaoka, S. I., & Mukai, K. (2010). Kinetic study of the quenching reaction of singlet oxygen by carotenoids and food extracts in solution. development of a singlet oxygen absorption capacity (SOAC) assay method. *Journal of Agricultural and Food Chemistry*, 58(18), 9967–9978. <https://doi.org/10.1021/jf101947a>

Pan, Y., Tikekar, R. V., & Nitin, N. (2016). Distribution of a model bioactive within solid lipid nanoparticles and nanostructured lipid carriers influences its loading efficiency and oxidative stability. *International Journal of Pharmaceutics*, 511(1), 322–330.
<https://doi.org/10.1016/j.ijpharm.2016.07.019>

Papaioannou, E. H., & Karabelas, A. J. (2012). Lycopene recovery from tomato peel under mild conditions assisted by enzymatic pre-treatment and non-ionic surfactants. *Acta Biochimica Polonica*, 59(1), 71–74.
https://doi.org/10.18388/abp.2012_2174

Pardeike, J., Hommoss, A., & Müller, R. H. (2009). Lipid nanoparticles (SLN, NLC) in cosmetic and pharmaceutical dermal products. *International Journal of Pharmaceutics*, 366(1–2), 170–184.
<https://doi.org/10.1016/j.ijpharm.2008.10.003>

Park, S. H., Jo, Y. J., Chun, J. Y., Hong, G. P., Davaatseren, M., & Choi, M. J. (2015). Effect of Frozen Storage Temperature on the Quality of Premium Ice Cream. *Korean Journal for Food Science of Animal Resources*, 35(6), 793–799. <https://doi.org/10.5851/kosfa.2015.35.6.793>

Pastor, M., Moreno-Sastre, M., Esquibal, A., Sans, E., Viñas, M., Bachiller, D., Asensio, V. J., Del Pozo, Á., Gainza, E., & Pedraz, J. L. (2014). Sodium colistimethate loaded lipid nanocarriers for the treatment of *Pseudomonas aeruginosa* infections associated with cystic fibrosis. *International Journal of Pharmaceutics*, 477(1–2), 485–494.
<https://doi.org/10.1016/j.ijpharm.2014.10.048>

Patel, M. (2014). Gamma-Oryzanol from rice bran oil-A review. *Journal of Scientific & Industrial Research*, 63(July 2004), 569–578.

Patidar, A., Thakur, D. S., Kumar, P., & Verma, J. (2010). A review on novel lipid based nanocarriers. *International Journal of Pharmacy and Pharmaceutical Sciences*, 2(4), 30–35.

Pestana, V. R., Zambiazi, R. C., Mendonça, C. R. B., Bruscatto, M. H., Lerma-García, M. J., & Ramis-Ramos, G. (2008). Quality changes and tocopherols and γ -Orizanol concentrations in rice bran oil during the refining process. *JAOCs, Journal of the American Oil Chemists' Society*, 85(11), 1013–1019.



<https://doi.org/10.1007/s11746-008-1300-4>

Pimentel-Moral, S., Borrás-Linares, I., Lozano-Sánchez, J., Arráez-Román, D., Martínez-Férez, A., & Segura-Carretero, A. (2018). Microwave-assisted extraction for *Hibiscus sabdariffa* bioactive compounds. *Journal of Pharmaceutical and Biomedical Analysis*, 156, 313–322. <https://doi.org/10.1016/j.jpba.2018.04.050>

Piorkowski, D. T., & McClements, D. J. (2014). Beverage emulsions: Recent developments in formulation, production, and applications. *Food Hydrocolloids*, 42, 5–41. <https://doi.org/10.1016/j.foodhyd.2013.07.009>

Priya, R. T. S., Nelson, E. A. R. L., Ravichandran, K., & Antony, U. (2019). Nutritional and functional properties of coloured rice varieties of South India: A review. *Journal of Ethnic Foods*, 6(1), 1–11. <https://doi.org/10.1186/s42779-019-0017-3>

Punia, S., Kumar, M., Siroha, A. K., & Purewal, S. S. (2021). Rice Bran Oil: Emerging Trends in Extraction, Health Benefit, and Its Industrial Application. *Rice Science*, 28(3), 217–232. <https://doi.org/10.1016/j.rsci.2021.04.002>

Ramly, N. H., Zakaria, R., & Naim, M. N. (2016). Characterisation of crude palm oil O/W emulsion produced with Tween 80 and potential in residual oil recovery of palm pressed mesocarp fibre. *IOP Conference Series: Earth and Environmental Science*, 36(1), 12–33. <https://doi.org/10.1088/1755-1315/36/1/012033>

Raza, K., Singh, B., Lohan, S., Sharma, G., Negi, P., Yachha, Y., & Katare, O. P. (2013). Nano-lipoidal carriers of tretinoin with enhanced percutaneous absorption, photostability, biocompatibility and anti-psoriatic activity. *International Journal of Pharmaceutics*, 456(1), 65–72. <https://doi.org/10.1016/j.ijpharm.2013.08.019>

Ribeiro, A. P. B., Basso, R. C., & Kieckbusch, T. G. (2013). Effect of the addition of hardfats on the physical properties of cocoa butter. *European Journal of Lipid Science and Technology*, 115(3), 301–312. <https://doi.org/10.1002/ejlt.201200170>

Rohmah, M., Raharjo, S., Hidayat, C., & Martien, R. (2019). Formulasi dan Stabilitas Nanostructured Lipid Carrier dari Campuran Fraksi Stearin dan Olein Minyak Kelapa Sawit. *Jurnal Aplikasi Teknologi Pangan*, 8(1), 23–30. <https://doi.org/10.17728/jatp.3722>

Rosen, M. J., & Kunjappu, J. T. (2012). Characteristic features and uses of commercially available surfactants. In *Surfactant and interfacial phenomena* (4th ed., p. 8).

Sahini, M. G., & Mutegoa, E. (2023). Extraction, phytochemistry, nutritional, and



- therapeutic potentials of rice bran oil: A review. *Phytomedicine Plus*, 3(2), 100453. <https://doi.org/10.1016/j.phyplu.2023.100453>
- Sakellari, G. I., Zafeiri, I., Batchelor, H., & Spyropoulos, F. (2021). Formulation design, production and characterisation of solid lipid nanoparticles (SLN) and nanostructured lipid carriers (NLC) for the encapsulation of a model hydrophobic active. *Food Hydrocolloids for Health*, 1, 100024. <https://doi.org/10.1016/j.fhfh.2021.100024>
- Salvi, V. R., & Pawar, P. (2019). Nanostructured lipid carriers (NLC) system: A novel drug targeting carrier. *Journal of Drug Delivery Science and Technology*, 51(990), 255–267. <https://doi.org/10.1016/j.jddst.2019.02.017>
- Sari, Y. P., Raharjo, S., Santoso, U., & Supriyadi. (2020). Bran Oil Prepared By Emulsion Phase Inversion. *Food Research*, 4(4), 1024–1029.
- Satirawaty, A., Pauzan, M., Bainun, N., Ismail, B., Syafiqah, N., Binti, A., & Zulkefli, M. (2013). *Microemulsion-Based Palm Kernel and Peanut Oil Extraction using Nonionic Surfactant Brij 30 Solution*. Malaysian Journal of Chemistry. 15(1), 6–12. <http://dx.doi.org/10.1016/j.indcrop.2009.03.008>
- Selvamuthukumar, S., & Velmurugan, R. (2012). Nanostructured Lipid Carriers: A potential drug carrier for cancer chemotherapy. *Lipids in Health and Disease*, 11(1), 1–15. <https://doi.org/10.1186/1476-511X-11-159>
- Sonoda, T., Takata, Y., Ueno, S., & Sato, K. (2004). DSC and synchrotron-radiation X-ray diffraction studies on crystallization and polymorphic behavior of palm stearin in bulk and oil-in-water emulsion states. *JAOCs, Journal of the American Oil Chemists' Society*, 81(4), 365–373. <https://doi.org/10.1007/s11746-004-0908-5>
- Sousa, S. C., Fragoso, S. P., Penna, C. R. A., Arcanjo, N. M. O., Silva, F. A. P., Ferreira, V. C. S., Barreto, M. D. S., & Araújo, I. B. S. (2017). Quality parameters of frankfurter-type sausages with partial replacement of fat by hydrolyzed collagen. *Lwt*, 76, 320–325. <https://doi.org/10.1016/j.lwt.2016.06.034>
- Speranza, P., Ribeiro, A. P. B., & Macedo, G. A. (2015). Lipase catalyzed interesterification of Amazonian patauá oil and palm stearin for preparation of specific-structured oils. *Journal of Food Science and Technology*, 52(12), 8268–8275. <https://doi.org/10.1007/s13197-015-1943-8>
- Suhendra, L., Raharjo, S., Hastuti, P., & Hidayat, C. (2012). Formulasi Dan Stabilitas Mikroemulsi O/W Sebagai Pembawa Fucoxanthin. *Agritech*, 32(03), 230–239.
- Sun, X., Zhang, L., Yan, J., Song, F., Tian, S., & Xie, J. (2021). Effects of enzymatic free fatty acid reduction process on the composition and phytochemicals of rice bran oil. *Food Chemistry*, 337(August 2020), 127–



157. <https://doi.org/10.1016/j.foodchem.2020.127757>

- Surlehan, H. F., Noor Azman, N. A., Zakaria, R., & Mohd Amin, N. A. (2019). Extraction of oil from passion fruit seeds using surfactant-assisted aqueous extraction. *Food Research*, 3(4), 348–356. [https://doi.org/10.26656/fr.2017.3\(4\).146](https://doi.org/10.26656/fr.2017.3(4).146)
- Susanti, A. D., Ardiana, D., P, Gumelar, G., & Bening, G, Y. (2012). Polaritas Pelarut sebagai Pertimbangan dalam Pemilihan Pelarut untuk Ekstraksi Minyak Bekatul dari Bekatul Varietas Ketan (*Oriza Sativa Glatinosa*). *Symposium Nasional RAPI XI FT UMS*, 8–14. https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/3847/Paper_TK.02.pdf?sequence=1
- Swasono, A. W. P., Sianturi, P. D. E., & Masyithah, Z. (2012). Sintesis Surfaktan Alkil Poliglikosida Pari Plukosa Dan Dodekanol Dengan Katalis Asam. *Jurnal Teknik Kimia USU*, 1(1), 5–9.
- Tamjidi, F., Shahedi, M., Varshosaz, J., & Nasirpour, A. (2013). Nanostructured lipid carriers (NLC): A potential delivery system for bioactive food molecules. *Innovative Food Science and Emerging Technologies*, 19, 29–43. <https://doi.org/10.1016/j.ifset.2013.03.002>
- Tang, T. S., Pantzaris, T. P., & Malaysia, L. M. S. (2009). *Pocket Book of Palm Oil Uses*. Malaysian Palm Oil Board. <https://books.google.co.id/books?id=PTR8nQEACAAJ>
- Thomsen, B. R., Haugsgjerd, B. O., Griinari, M., Lu, H. F. S., Bruheim, I., Vogt, G., Oterhals, Å., & Jacobsen, C. (2013). Investigation of oxidative degradation and non-enzymatic browning reactions in krill and fish oils. *European Journal of Lipid Science and Technology*, 115(12), 1357–1366. <https://doi.org/10.1002/ejlt.201300141>
- Trevisan, C., Torgerson, P. R., & Robertson, L. J. (2019). Foodborne Parasites in Europe: Present Status and Future Trends. *Trends in Parasitology*, 35(9), 695–703. <https://doi.org/10.1016/j.pt.2019.07.002>
- Verstringe, S., Danthine, S., Blecker, C., & Dewettinck, K. (2014). Influence of a commercial monoacylglycerol on the crystallization mechanism of palm oil as compared to its pure constituents. *Food Research International*, 62, 694–700. <https://doi.org/10.1016/j.foodres.2014.04.049>
- Wang, N., Cui, X., Duan, Y., Yang, S., Wang, P., Saleh, A. S. M., & Xiao, Z. (2021). Potential health benefits and food applications of rice bran protein: research advances and challenges. *Food Reviews International*, 1–24. <https://doi.org/10.1080/87559129.2021.2013253>
- Wang, W., Chen, L., Huang, X., & Shao, A. (2017). Preparation and Characterization of Minoxidil Loaded Nanostructured Lipid Carriers. *AAPS*



PharmSciTech, 18(2), 509–516. <https://doi.org/10.1208/s12249-016-0519-x>

- Wang, Y., Zhao, L., Zhang, R., Yang, X., Sun, Y., Shi, L., & Xue, P. (2020). Optimization of ultrasound-assisted extraction by response surface methodology, antioxidant capacity, and tyrosinase inhibitory activity of anthocyanins from red rice bran. *Food Science and Nutrition*, 8(2), 921–932. <https://doi.org/10.1002/fsn3.1371>
- Xing, Q., Song, J., You, X., Xu, D., Wang, K., Song, J., Guo, Q., Li, P., Wu, C., & Hu, H. (2016). Microemulsions containing long-chain oil ethyl oleate improve the oral bioavailability of piroxicam by increasing drug solubility and lymphatic transportation simultaneously. *International Journal of Pharmaceutics*, 511(2), 709–718. <https://doi.org/10.1016/j.ijpharm.2016.07.061>
- Xu, D., Hao, J., Wang, Z., Liang, D., Wang, J., Ma, Y., & Zhang, M. (2021). Physicochemical properties, fatty acid compositions, bioactive compounds, antioxidant activity and thermal behavior of rice bran oil obtained with aqueous enzymatic extraction. *Lwt*, 149(11), 111817. <https://doi.org/10.1016/j.lwt.2021.111817>
- Yadav, N., Khatak, S., & Singh Sara, U. V. (2013). Solid lipid nanoparticles- A review. *International Journal of Applied Pharmaceutics*, 5(2), 8–18. <https://doi.org/10.9790/3013-26103444>
- Yang, R., Zhang, L., Li, P., Yu, L., Mao, J., Wang, X., & Zhang, Q. (2018). A review of chemical composition and nutritional properties of minor vegetable oils in China. *Trends in Food Science and Technology*, 74, 26–32. <https://doi.org/10.1016/j.tifs.2018.01.013>
- Yang, Y., Marshall-Breton, C., Leser, M. E., Sher, A. A., & McClements, D. J. (2012). Fabrication of ultrafine edible emulsions: Comparison of high-energy and low-energy homogenization methods. *Food Hydrocolloids*, 29(2), 398–406. <https://doi.org/10.1016/j.foodhyd.2012.04.009>
- Zhong, J., Liu, X., Wang, Y., Qin, X., & Li, Z. (2017). γ -Oryzanol nanoemulsions produced by a low-energy emulsification method: An evaluation of process parameters and physicochemical stability. *Food and Function*, 8(6), 2202–2211. <https://doi.org/10.1039/c7fo00023e>
- Zhong, J., Yang, R., Cao, X., Liu, X., & Qin, X. (2018). Improved Physicochemical Properties of Yogurt Fortified with Fish Oil/ γ -Oryzanol by Nanoemulsion Technology. *Molecules*, 23(1), 1–11. <https://doi.org/10.3390/molecules23010056>
- Zhu, J., Zhuang, P., Luan, L., Sun, Q., & Cao, F. (2015). Preparation and characterization of novel nanocarriers containing krill oil for food application. *Journal of Functional Foods*, 19, 902–912.



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Universitas Gadjah Mada, 2024 | Diunduh dari <http://etd.repository.ugm.ac.id/>

<https://doi.org/10.1016/j.jff.2015.06.017>