

DAFTAR PUSTAKA

- Abiraman, T., Ramanathan, E., Kavitha, G., Rengasamy, R., Balasubramanian, S. 2017. Synthesis of chitosan capped copper oxide nanoleaves using high intensity (30 kHz) ultrasound sonication and their application in antifouling coatings. *Ultrasonics Sonochemistry* 34: 781-791.
- Agarwal, M, Parameswari, R.P., Vasantha, H.R. & Das, D.K. 2012. Dynamic action of carotenoids in cardioprotection and maintenance of cardiac health. *Molecules* 17 (4): 4755–4769.
- Alcântara, M.A., de Lima, A.E.A., Braga, A.L.M., Tonon, R.V., Galdeano, M.C., Mattos, M.C., Brígida, A.I.S., Rosenhaim, R., dos Santos, N.A., Cordeiro, A.M.T.M. 2019. Influence of the emulsion homogenization method on the stability of chia oil microencapsulated by spray drying. *Powder Technology* 354: 877-885.
- Alfionita, K., & Budhiyanti, S.A. 2017. Pengaruh pengemas dan suhu terhadap stabilitas karotenoid nanokapsul *Spirulina platensis* dengan enkapsulan gum arab dan WPC selama penyimpanan. http://etd.repository.ugm.ac.id
- Anandan, S., Keerthiga, M., Vijaya, S., Asiri, A.M., Bogush, V., Krasulyaa, O. 2017. Physicochemical characterization of black seed oil-milk emulsions through ultrasonication. *Ultrasonics Sonochemistry* 38: 766-771.
- Anggraini S. & S.A. Budhiyanti. 2016. Pengaruh rasio fraksi minyak dan air terhadap karakteristik nanokapsul karotenoid dari *A. platensis* dengan enkapsulan gum arab dan konsentrat protein whey. http://etd.repository.ugm.ac.id
- Anwar, S.H. & Kunz, B. 2011. The influence of drying methods on the stabilization of fish oil microencapsules: Comparison of spray granulation, spray drying, and freeze drying. *Journal of Food Engineering* 105(2): 367-378. DOI: doi.org/10.1016/j.jfoodeng.2011.02.047
- Bangu, S.K., Gupta, S., Ashokkumar, M. 2017. Ultrasonic enhancement of lipase-catalysed transesterification for biodiesel synthesis. *Ultrasonic Sonochemistry* 34: 305-309.
- Baissac, L., Buron, C.C., Hallez, L., Berçot, P., Hihn, J.Y., Chantegrel, L., Gosse, G. 2017. Synthesis of sub-micronic and nanometric PMMA particles via emulsion polymerization assisted by ultrasound Process flow sheet and characterization. *Ultrasonic Sonochemistry* 40: 183-192.
- Bationo, F., Savadogo, A., Kabore, D., Ouattara, L., Ouedraogo, H.G., Savadogo, B., & Traore, A. 2015. Storage influence on beta-carotene and alpha-tocopherol contents of solar-dried *Spirulina platensis* (Spirulina). *African Journal of Food Science* 9 (12): 546-554.
- Behbahani, E.S., Ghaedi, M., Abbaspour, M., Rostamizadeh, K. 2017. Optimization and characterization of ultrasound assisted preparation of curcumin-loaded solid lipid nanoparticles: Application of central composite design, thermal analysis and X-ray diffraction. *Ultrasonics Sonochemistry* 38: 271-280.
- Belay, A. 2008. *Spirulina (Arthrospira)* production and quality assurance. In: *Spirulina in Human Nutrition and Health*. (Eds. Gershwin, E. and Belay, A.), CRC press, Taylor & Francis Group, Boca Raton, London, New York, pp. 1-23.
- Bertolini A.C., Siani, A.C., & Grossi, C.R.F. 2001. Stability of Monoterpenes encapsulated in gum arabic by spray drying. *J. Agr. Food. Chem.* 49: 780–785.
- Bouyer, E., Mekhloufi, G., Rosilio, V., Grossiord, J., & Agnely, F. Proteins, polysaccharides, and their complexes used as stabilizers for emulsions: Alternatives to synthetic surfactants in the pharmaceutical field. *International Journal of Pharmaceutics* 436 (1-2): 359–78.

UNIVERSITAS
GADJAH MADA

- Cabrera-Trujillo, M.A., Sotelo-Diaz, L.I., & Quintanilla-Carvajal, M.X. 2016. Effect of amplitude and pulse in low frequency ultrasound on oil/water emulsions. DYNA 83(199): 63-68. DOI: doi.org/10.15446/dyna.v83n199.56192
- Campelo, P.H., Junqueira, L.A., de Resende, J.V., Zacarias, R.D., Fernandes, R.V.B., Botrel, D.A., & Borges, S.V. 2017. Stability of lime essential oil emulsion prepared using biopolymers and ultrasound treatment. International Journal of Food Properties, DOI: 10.1080/10942912.2017.1303707.
- Cárcel, J.A., García-Pérez, J.V., Benedito, J., & Mullet, A. 2012. Food process innovation through new technologies: Use of ultrasound. Journal of Food Engineering 110: 200-207. DOI: doi:10.1016/j.jfoodeng.2011.05.038
- Carneiro, H. C. F., Tonon, R. V., Grossi, C. R. F., & Hubinger, M. D. 2013. Encapsulation efficiency and oxidative stability of flaxseed oil microencapsulated by spray drying using different wall materials. Journal of Food Engineering 115(4): 443-451. DOI: 10.1016/j.jfoodeng.2012.03.033
- Charoen, R., Jangchud, A., Jangchud, K., Harnsilawat, T., Naivikul, O., & McClements, D.J. 2011. Influence of biopolymer emulsifier type on formation and stability of rice bran oil-in-water emulsion: whey protein, gum arabic, and modified starch. Journal of Food Science. 76 (1): 165-72.
- Chegini, C.R. & Ghobadian, B. 2007. Spray dryer parameters for fruit juice drying. World Journal of Agriculture Sciences 3 (2): 230-236.
- Chemat, F., Huma, Z., & Khan, M.K. 2011. Applications of ultrasound in food technology: Processing, preservation and extraction. Ultrasonics Sonochemistry 18: 813-835. DOI: 10.1016/j.ulsonch.2010.11.023
- 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.
- Christwardana, M., Nur, M.M.A., & Hadiyanto. 2013. *Spirulina platensis* : Potensinya sebagai bahan pangan fungsional. Review. Jurnal Teknologi Pangan 2 (1) : 10-17.
- Couvreur, P., Dubernet, C., & Puisieux, F. 1995. Controlled drug delivery with nanoparticles: current possibilities and future trends. European Journal of Pharmaceutics and Biopharmaceutics 41 (10): 2–13.
- Crouter, A. & Briens, L. 2014. The effect of moisture on the flowability of pharmaceutical excipients. American Association of Pharmaceutical Scientist. Pharmaceutical Science Technology 15(1): 65-73. DOI: 10.1208/s12249-013-0036-0.
- del Campo, J.A., Gonzalez, M.G., & Miguel, G.G. 2007. Outdoor cultivation of microalgae for carotenoid production : Current state and perspectives. Appl Microbiology of Biotechnology. 74 (6) :1163.
- Desorby, S.A., F.M. Netto., & T.P. Labuza. 1997. Comparison of spray drying, drum drying, and freeze drying for β -carotene encapsulation and preservation. Journal of Food Science 62 (13): 1158-1162.
- Dietary Reference Intakes. 2001. Dietary Reference Intakes for vitamin a, vitamin k, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc: A Report of the panel on micronutrients. National Academy Press. Washington DC.
- Dutta, D., Chaudhuri, U.R. & Chakraborty, R. 2005. Structure, health, benefits, antioxidant property, processing and storage of carotenoids. African Journal of Biotechnology 4 (13): 1510-1520.

- Dziezak, J.D. 1988. Microencapsulation and encapsulated ingredients. *Food Technology*. 28 (4):138.
- Eggersdorfer, M. & Wyss, A. 2018. Carotenoids in human nutrition and health. *Archives of Biochemistry and Biophysics* 652: 18-26.
- El-Baky, H.H.A., Baz, F.K.E., & El-Baroty, G.S. 2003. Spirulina species as a source of carotenoids and α -tocopherol and its anticarcinoma factors. *Biotechnology* 2(3): 222-240.
- Elisabeth, J., Donald S. & Nuri A. 2003. Mikroenkapsulasi minyak ikan makan merah untuk produk suplemen dan fortifikasi pangan. *Jurnal Penelitian Kelapa Sawit* 11 (3): 143-157.
- Erawati, C.M. 2006. Kendali Stabilitas β -Karotenoid Selama Proses Produksi Tepung Ubi Jalar (*Ipomoea batatas* L.). Sekolah Pasca Sarjana IPB. Bogor. Tesis.
- Estiasih, T. 2003. Peran Natrium Kaseinat dan Fosfolipida dalam Emulsifikasi dan Mikroenkapsulasi Trigliserida Kaya Asam Lemak ω -3. Universitas Gadjah Mada. Disertasi.
- Fajariyanto 1987
- Eun, J.B., Maruf, A., Das, P.R., & Nam, S.H. 2019. A review of encapsulation of carotenoids using spray drying and freeze drying. *Critical Reviews in Food Science and Nutrition*. DOI: 10.1080/10408398.2019.1698511
- Ezhilarasi, P.N., P. Kharthik., N. Channwal., & C. Anandharamakrishnan. 2012. Nanoencapsulation techniques for food bioactive components: A Review. *Review Paper Food Bioprocess Technology* 6: 628-647.
- Fellows, P.J. 2000. Food processing technology, principles and practice. Woodhead Publishing in Food Science and Technology Second Edition. England.
- Frascareli, E.C., Silva, V.M., Tonon, R.V., & Hubinger, M.D. 2012. Food and Bioproducts Processing 90: 413-424. DOI: 10.1016/j.fbp.2011.12.002.
- Friberg S.E. 1990. Food emulsions. New York, NY: Marcel Dekker. 510 pp.
- Gall, V., Runde, M., & Schuchmann, H.P. 2016. Extending applications of high-pressure homogenization by using simultaneous emulsification and mixing (SEM)- An overview. *Process* 4 (46).
- Gardjito, M., Murdiati, A., dan Aini, N. 2006. Mikroenkapsulasi β -karotenoid buah labu kuning dengan enkapsulan whey dan karbohidrat. Universitas Gadjah Mada, Yogyakarta.
- Gaumet, M., Vargas, A., Gurny, R., & Delie, F. 2008. Nanoparticles for drug delivery: The need for precision in reporting particle size parameters. *European Journal of Pharmaceutics and Biopharmaceutics* 69: 1-9. DOI: 10.1016/j.ejpb.2007.08.001.
- Ghannam, M.T. 2005. Water in crude oil emulsion stability investigation. *Petroleum Science and Technology* 23: 649-667.
- Gharibzahedi, S.M.T., Razavi, S.H., & Mousavi, S.M. 2013. Ultrasound-assisted formation of the canthaxanthin emulsions stabilized by arabic and xanthan gums. *Carbohydrate Polymers* 96 (1): 21–30.
- Gharsallaoui, A., R. Gaelle., C. Odile., V. Andree., & S. Remi. 2007. Applications of spray drying in microencapsulation of food ingredients. *Food Research International* 40: 1107-1121.
- Ghosh, S. & Rousseau, D. 2011. Fat crystal and water-in-oil emulsion stability. *Current Opinion in Colloid and Interface Science* 16: 421-431. DOI: 10.1016/j.cocis.2011.06.006
- Ginting, P.M. 2008. Penentuan kadar air inti sawit pada kernel silo menggunakan alat moisture analyzer di PT PTPN III PKS Rambutan Tebing Tinggi. Skripsi. Universitas Sumatera Utara. Sumatera Utara.

UNIVERSITAS
GADJAH MADA

- Gireesh, T., nair, P.P., & Sudhakaran, P.R. 2004. Studies on the bioavailability of the provitamin A carotenoid, β-carotene, using human exfoliated colonic epithelial cells. *British Journal of Nutrition* 92: 241-245. DOI: 10.1079/BJN20041175
- Given, P. S. 2009. Encapsulation of flavors in emulsions for beverages. *Current Opinion in Colloid and Interface Science* 14: 43-47. DOI: 10.1016/j.cocis.2008.01.007.
- Gouin, S. 2004. Microencapsulation: Industrial appraisal of existing technologies and trends. *Trends in Food Science and Technology* 15 (7): 330–347.
- Greiner, R. 2009. Current and projected application of nanotechnology in the food sector. *Journal of Brazilian Society in Food and Nutrition* 34 (1): 243-260.
- Guangwen, T & Suter, P.M. 2011. Vitamin A, nutrition and health values of algae: Spirulina, Chlorella, and Dunaliella. *Journal of Pharmacy and Nutrition Sciences* 1 (2): 2.
- Gutierrez, J.M., Gonzalez, C., Maestro, A., Sole, I., Pey, C.M. & Nolla, J. 2008. Nano-emulsions: new applications and optimization of their preparation. *Curr Opin Colloid Interface Sci* 13:245–251.
- Habib, B., Parvin, M., Huntington, C. & Hasan, R. 2008. A review on culture, production, and use of *Spirulina* as food for humans and feeds for domestic animals and fish. *FAO Fisheries and Aquaculture Circular No. 1034*, p. 33.
- Håkansson, A. & Rayner, M. 2018. General principles of nanoemulsion formation by high-energy mechanical methods. *Nanoemulsions Chapter 5*: 103-139. DOI: 10.1016/B978-0-12-811838-2.00005-9.
- Hanselmann, W. 1996. Influence of continuous whipping process parameters on foam structure and stability. Ph.D. Thesis. ETH Zurich.
- Hapsari, B.W. 2009. Sintesis nanosfer berbasis *ferrofluid* dan *poly lactic acid* (PLA) dengan metode sonifikasi. Skripsi. Institut Pertanian Bogor. Jawa Barat.
- Henrikson, R. 2000. Earth food spirulina. Ronore Enterprises Inc. Hawai.
- Hidayat, R., S.A. Budhiyanti & A. Husni. 2016. Pengaruh suhu spray drying terhadap karakteristik nanokapsul karotenoid dari *Spirulina platensis* dengan enkapsulan gum arab dan konsentrasi protein whey. <http://etd.repository.ugm.ac.id/>
- Higuera-Barraza, O.A., Torres-Arreola, W., Ezquerra-Brauer, J.M., Cinco-Moroyoqui, F.J., Rodriguez-Figueroa, J.C., & Marquez-Rios, E. 2017. Effect of pulsed ultrasound on the physicochemical characteristics and emulsifying properties of squid (*Dosidicus gigas*) mantle proteins. *Ultrasonics Sonochemistry* 38: 829-834.
- Hu, F.Q., Yuan, H., Zhang, H.H., & Fang, M. 2002. Preparation of solid lipid nanoparticles with clobetasol propionate by a novel solvent diffusion method in aqueous system and physicochemical characterization. *International Journal of Pharmaceutical* 239: 121-128.
- Huang, Q., Yu, H. & Ru, Q. 2010. Bioavailability and delivery of nutraceuticals using nanotechnology. *J Food Sci* 75: R50–R57.
- Hung, L. C., Basri, M., Tejo, B. A., Ismail, R., Nang, H. L. L., Hassan, H. A. & May, C. Y. 2011. An improved method for the preparations of nanostructured lipid carriers containing heat-sensitive bioactives. *Colloid Surface B* 87:180–186. DOI: 10.1016/j.colsurfb.2011.05.019.
- Huynh, T.V., Caffin, N., Dykes, G.A., & Bhandari, B. 2008. Optimization of the microencapsulation of lemon myrtle oil using response surface methodology. *Drying Technology: An International Journal* 26 (3): 357-368. DOI: 10.1080/07373930801898182
- Iriawan, N. & Astuti, S.P. 2006. Mengolah data statistik dengan mudah menggunakan Minitab 14. Andi. Yogyakarta.



- Jafari, S.M, Y. H. He & B. Bhandari. 2006. Nano-emulsion production by sonication and microfluidization -A comparison. International Journal of Food Properties 9 3: 475-485.
- Jafari, S.M., Assadpoor, E., He, Y., & Bhandari, B. 2008. Encapsulation efficiency of food flavours and oil during spray drying. Drying Technology 28: 816-835.
- Jayme, M. Dunstan, D., Gee, M. 1999. Zeta potentials of gum Arabic stabilized oil in water emulsions. Food Hydrocolloids 13 (6): 459-465.
- Johnson, E.J. 2002. The role of carotenoids in human health. Nutr. Clin. Care 5 (2): 56-65.
- Johnson, E.J. 2012. A possible role for lutein and zeaxanthin in cognitive function in the elderly. American Journal of Clinical Nutrition 96 (5): 1161S-5S.
- Jyothi, N.V.N., Prasanna, P.M., Sakarkar, S.N., Prabha, K.S., Ramaiah, P.S., & Srawan, G.Y. 2010. Microencapsulation techniques, factor influencing encapsulation efficiency. Journal of Microencapsulation 27(3): 187-197. DOI: 10.3109/02652040903131301.
- Kanafusa, S., Chu, B.S. & Nakajima, M. 2007. Factors affecting droplet size of sodium caseinate-stabilized O/W emulsions containing β -carotene. European Journal of Lipid Science and Technology 109: 1038-1041. DOI: 10.1002/ejlt.200700100.
- Konan, Y. N., Gurny, R., & Allémann, E. 2002. Preparation and Characterization of Sterile and Freeze-Dried Sub-200 nm Nanoparticles. International Journal of Pharmaceutics 233 (12) : 239–252.
- Krasaeko, W., B., H. Bhandari & H. Deeth. 2003. Evaluation of encapsulation techniques of probiotics for yoghurt. Int. Dairy J. 13:3-13
- Kumalasari, A.R & S.A. Budhiyanti. 2016. Pengaruh konsentrasi karotenoid dari *spirulina platensis* terhadap karakteristik nanokapsul dengan enkapsulan konsentrat protein whey dan gum arab. <http://etd.repository.ugm.ac.id/>
- Le, H. D., Le, V.V.M. 2015. Application of ultrasound to microencapsulation of coconut milk fat by spray drying method. Journal of Food Science and Technology 52(4): 2474–2478.
- Letang, C., Piau, M., Verdier, C. & Levebvre, L. 2001. Characterization of wheat-flour-water doughs: a new method using ultrasound. Ultrasonics 39: 133-141. DOI: 10.1016/s0041-624x(00)00058-5.
- Li X, N. Anton, C. Arpagaus, F. Belleteix, & T. F. Vandamme. 2010. Nanoparticles by spray drying using innovative new technology: The buchi nano spray dryer B-90. Université de Strasbourg, Faculté de Pharmacie, Switzerland. P. 1.
- Li X, N. Anton, T.M Chau Ta, M. Zhao, N. Messaddeq, & T. F Vandamme. 2011. Microencapsulation of nanoemulsions: Novel trojan particles for bioactive lipid molecule delivery. International Journal of Nanomedicine. Dovepress. University of Strasbourg. Faculty of Pharmacy. France 1(6): 1314.
- Li, P.H. & Chiang, B.H. 2012. Process optimization and stability of D-limonene-in-water nanoemulsions prepared by ultrasonic emulsification using response surface methodology. Ultrasonics Sonochemistry 19: 192-197. DOI: 10.1016/j.ultsonch.2011.05.017
- Liang, R., Q. Huang, J. Ma, C.F. Shoemaker, & F. Zhong. 2013. Effect of relative humidity on the store stability of spray-dried β -carotene nanoemulsions. Journal of Food Hydrocolloid 33: 225-233.
- Liu, C.H. & Wu, C.T. 2010. Optimization of nanostructured lipid carriers for lutein delivery. Colloids and Surface A: Physicochemical and Engineering Aspects 353: 149-156. DOI: 10.1016/j.colsurfa.2009.11.006
- Loksuwan, J. 2007. Characteristic of microencapsulated β -carotene formed by spray drying with modified starch, native starch and maltodextrin. Food Hydrocolloids 21 (2): 928-935.



- Mani, V., Iyer, M., Dhruv, A., Mani, U., & Sharma, S. 2008. Therapeutic utility *Spirulina*. In: *Spirulina Human Nutrition and Health*. (Eds Gershwin ME. Belay A), CRC Press, Boca Raton, pp.71-100.
- Marinho, R., Horiuchi, L. & Pires, C.A. 2018. Effect of stirring speed on conversion and time to particles stabilization of poly (vinyl chloride) produced by suspension polymerization process at the beginning of reaction. *Brazilian Journal of Chemical Engineering* 35(2): 631-640. DOI: 10.1590/0104-6632.20180352s20160453.
- Maulina, I.D. 2011. Uji Stabilitas Fisik dan Aktivitas Antioksidan Sediaan Krim yang Mengandung Ekstrak Wortel (*Daucus carota* L.). Skripsi. Universitas Indonesia. Jakarta.
- Marquez, A.L., Wagner, J.R. & Palazolo, G.G. 2018. Effects of calcium content and homogenization method on the microstructure, rheology, and stability of emulsions prepared with soybean flour dispersions. *European Journal Lipid Science Technology* 120:1700500.
- McClements, D. J. (2000). Comments on viscosity enhancement and depletion flocculation by polysaccharides. *Food Hydrocolloids* 14(2): 173–177.
- McClements, D.J. & Decker, E.A. 2000. Lipid oxidation in oil-in-water emulsions: impact of molecular environment on chemical reactions in heterogeneous food systems. *Journal of Food Science* 65(8): 1270-1282. DOI: 10.1111/j.1365-2621.2000.tb10596.x.
- McClements, D.J. 2004. Food emulsion principles, practices and techniques. New York: CRC Press.
- McClements, D.J. 2005. Food emulsions: Principles, Practice, and Techniques. Boca Raton, FL: CRC Press.
- McClement, D.J., Decker, E.A., & Weiss, J. 2007. Emulsion-based delivery systems for lipophilic bioactive components. *Journal of Food Science* 72 (8): 109-124.
- McClements, D.J., Decker, E.A., Park, Y. & Weiss, J. 2009. Structural design principles for delivery of bioactive components in nutraceuticals and functional foods. *Crit Rev Food Sci Nutr* 49:577–606
- McClements, D.J. & Rao, J. 2011. Food-grade nanoemulsions: formulation, fabrication, properties, performance, biological fate, and potential toxicity. *Crit Rev Food Sci Nutr* 51:285–330
- McClements, D.J. 2016. Food emulsions: Principles, Practices, and Techniques 3rd Edition. Boca Raton, London: CRC Press.
- Meena, K. S., Bairwa, N. K., & Parashar, B. 2011. Formulation and in vitro evaluation of verapamil hydrochloride loaded microcapsule.
- Meybodi, N.M., Mohammadifar, M.A., & Naseri, A.R. 2014. Effective factors on the stability of oil-in-water emulsion based beverage: a review. *Journal of Food Quality and Hazards Control* 1: 67-71.
- Milani, A., Basirnejad, M., Shahbazi, S., & Bolhassani, A. 2017. Carotenoid: Biochemistry, pharmacology and treatment. *British Journal of Pharmacology* 174: 1290-1324.
- Modarrez-Gheisari, S.M., Gavagsaz-Goachani, R., Malaki, M., Safarpour, P. & Zandi, M. 2019. Ultrasonic nano-emulsification- A review. *Ultrasonics Sonochemistry* 52: 88-105.
- Mohanraj, V.J. & Chen, Y. 2006. Nanoparticles- A review. *Tropical Journal of Pharmaceutical Research* 5(1): 561-573.
- Montgomery, D.C. 2001. Design and analysis of experiments 5th edition. New York: John Wiley and Sons, Inc.



- Muller-Fischer, N., D. Suppiger & E.J. Windhab. 2006. Impact of static pressure and volumetric energy input on the microstructure of food foam whipped in a rotor-stator device. *Journal Food Engineering* 80: 306-316.
- Mun, S. & McClements, D.J. 2006. Influence of interfacial characteristics on Ostwald ripening in hydrocarbon oil-in-water emulsions. *Langmuir* 22: 1551-1554. DOI: 10.1021/la0525751.
- Nakahira, A., Nakamura, S. & Horimoto, M. 2007. Synthesis of modified hydroxyapatite (HAP) substituted with Fe ion for DDS application. Osaka: *IEEE Transactions on Magnetic* 43 (6): 2465-2467.
- Namira, Z.R., Paramita, V., & Kusumayanti, H. 2021. The effect of rotational speed of homogenization on emulsion results obtained using soy lecithin emulsifier. *Journal of Vocational Studies on Applied Research* 3(1): 14-17.
- Ndiha, B. & Limantara, L. 2009. Karotenoid pada bahan makanan. Prosiding Seminar Nasional Biologi, Lingkungan dan Pembelajarannya. FMIPA Universitas Negeri Yogyakarta p. 75-84
- Ngan, C.L., Basri, M., Lye, F.F., Masoumi, H.R.F., Tripathy, M., Karjiban, R.A. & Abdul-Malek, E. 2014. Comparison of process parameter optimization using different designs in nanoemulsion-based formulation for transdermal delivery of fullerene. *International Journal of Nanomedicine* 9: 4375-4386. DOI: 10.2147/IJN.S65689
- Niknam, S.M., Escudero, I., & Benito, J.M. 2020. Formulation and preparation of water-in-oil-in-water emulsions loaded with a phenolic-rich inner aqueous phase by application of high energy emulsification methods. *Foods* 9: 1411-1423. DOI: 10.3390/foods9101411.
- Nugrahani, O.P. 2012. Stabilitas mikrokapsul *Spirulina platensis* selama penyimpanan. Skripsi. Universitas Gadjah Mada. Yogyakarta.
- Obulesu, M, M.R. Dowlatshabad, & P.V. Bramhachari. 2011. Carotenoids and alzheimer's disease: An insight into therapeutic role of retinoids in animal models. *Neurochemical Int.* 59 : 535–541.
- Pahlevi, Y.W., T. Estiasih., E. Saparianti. 2008. Mikroenkapsulasi Ekstrak Karotenoid dari Spora Kapang Oncom Merah (*Neurospora* sp.) dengan Bahan Penyalut Berbasis Protein Menggunakan Metode Pengeringan Semprot. *Jurnal Teknologi Pertanian*. Vol. 9 (2): 31-39.
- Patel, S. & Goyal, A. 2015. Application of natural polymer gum Arabic: A review. *International Journal of Food Properties* 18 (5): 986-998.
- Patrick, L. 2000. Beta carotene: The controversy continues. *Alternative Medicine Review*. Vol. 5 (6): 530-545.
- Peralta-Martinez, M.V., Arriola-Medelin, A., & Manzanares-Papayanopoulos, E., Sánchez-Sánchez, R., Palacios-Lozano, E.M. 2004. Influence of the speed mixing-on viscosity and droplet size of oil in water emulsions. *Petroleum Science and Technology* 22: 1035- 1043. DOI: 10.1081/LFT-120038709.
- Perrier-Cornet, J.M., Marie, P., & Gervais, P. 2005. Comparison of emulsification efficiency of protein-stabilized oil-in-water emulsions using jet, high pressure and colloid mill homogenization. *Journal of Food Engineering* 66 (2): 211-217.
- Peshkovsky, A.S. & Bystryak, S. 2014. Continuous-flow production of a pharmaceutical nanoemulsion by high-amplitude ultrasounds: Process scale-up. *Chemical Engineering and Processing* 82: 132-136. DOI: 10.1016/j.cep.2014.05.007
- Piorkowski, D. & McClements, D.J. 2014. Beverage emulsions: Recent developments in formulation, production, and applications. *Food Hydrocolloids* 42: 5-41. DOI: 10.1016/j.foodhyd.2013.07.009



UNIVERSITAS
GADJAH MADA

- Pirenantyo, P. & Limantara, L. 2008. Pigmen spirulina sebagai senyawa antikanker. *Indonesian Journal of Cancer* 4 (12) : 155-163.
- Pu, J., Bankston, J.D., & Sathivel, S. 2011. Production of microencapsulated crawfish (*Procambarus clarkii*) astaxanthin in oil by spray drying technology. *Drying Technology: An International Journal* 29: 1150-1160. DOI: 10.1080/07373937.2011.573155
- Rajan, R. & Pandit, A.B. 2001. Correlations to predict droplet size in ultrasonic atomization. *Ultrasonics* 39: 235-255.
- Ramisetty, K.A., Pandit, A.B., & Gogate, P.R. 2015. Ultrasound assisted preparation of emulsion of coconut oil in water: understanding the effect of operating parameters and comparison of reactor designs. *Chemical Engineering and Processing: Process Intensification* 88: 70–77.
- Ravi, M., De, S.L., Azharuddin, S., & Paul, S.F.D. 2010. The beneficial effects of spirulina focusing on its immunomodulatory and antioxidant properties. *Nutrition and Dietary Supplements*. Dove Medical Press Ltd. Pp. 73-83.
- Reineccius, G.A. & Yan, C. 2004. Factors controlling the deterioration of spray dried flavourings and unsaturated lipids. *Flavour and Fragrance Journal* 31: 5-21.
- Ricaurte, L., de Jesus, P.M., Anamaria, M., Ximena, Q.M. 2016. Production on high-oleic palm oil nanoemulsions by high-shear homogenization (microfluidization). *Innovative Food Science and Emerging Technologies* 35: 75-85.
- Risch SJ. 1995. Encapsulation and controlled release of food ingredients. American Chemical Society. Washington DC. Chapter 18. Pp. 197-203.
- Rita, I. 2011. Proses emulsifikasi dan analisis biaya produksi minuman emulsi minyak sawit merah. Tesis. Institut Pertanian Bogor. Jawa Barat.
- Rodriguez, J., Martin, M.J., Ruiz, M.A., & Clarez, B. 2016. Current encapsulation strategies for bioactive oils: From alimentary to pharmaceutical perspectives. *Food Research International* 83: 41-59.
- Rosanita, E.N. 2014. Mikroenkapsulasi β -karotenoid *S. platensis* dengan enkapsulan maltodekstrin dan konsentrat protein whey. Skripsi. Universitas Gajah Mada. Yogyakarta.
- Schramm, L.L. 2006. Emulsion, foams, and suspension. Fundamentals and applications. John Wiley & Sons.
- Shahidi, F. & Zhong, Y. 2001. Measurement of antioxidant activity. *Journal of Functional Foods* 18: 757-781. DOI: 10.1016/j.jff.2015.01.047
- Shanmugam, A. & Ashokkumar, M. 2014. Ultrasonic preparation of stable flax seed oil emulsions in dairy systems – Physicochemical characterization. *Food Hydrocolloids* 39: 151–162.
- Shao, P., Shao, J., Jiang, Y., Sun, P. 2016. Influences of *Ulva fasciata* polysaccharide on the rheology and stabilization of cinnamaldehyde emulsion. *Carbohydrate Polymers* 135: 27-34.
- Shen Y., Y. Hu, K. Huang, S. Yin, B. Chen, & S. Yao. 2009. Solid-phase extraction of carotenoids. *Journal of Chromatographic* 1216 : 5763–5768.
- Shen, S. Shao, & M. Guo. 2017. Ultrasound-induced changes in physical and functional properties of whey proteins. *Int. J. Food Sci. Technol.* 52: 381–388.
- Silva, H.D., Cerqueira, M.A., & Vicente, A.A. 2012. Nanoemulsions for food applications: Development and characterization. *Food Bioprocess Technology* 5(3): 854-867. DOI: 10.1007/s11947-011-0683-7



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GADJAH MADA

- Silva, E.K., Azevedo, V.M., Cunha, R.L., Hubinger, M.D., & Meireles, M.A.A. 2016. Ultrasound assisted encapsulation of annatto seed oil - Whey protein isolate versus modified starch. *Food Hydrocolloids* 56: 71–83.
- Silva, H.D., Cerqueira, M.Â., Vicente, A.A. Nanoemulsions for Food Applications: Development and Characterization. *Food and Bioprocess Technology* 5(3): 854-867.
- Sinko, P.J., & Singh, Y. 2006. Mathin's physical pharmacy and pharmaceutical sciences : physical chemical and biopharmaceutical principles in the pharmaceutical sciences. Sixth Edition. Lippincott Williams & Wilkins. Philadelphia.
- Soottitantawat, A., Yoshii, H., Furuta, T., Ohkawara, M. & Linko, P. 2003. Microencapsulation by spray drying: Influence of emulsion size on the retention of volatile compounds. *Food Engineering and Physical Properties* 68 (7): 2256-2262.
- Soottitantawat, A., Bigeard, F., Yoshii, H., Furuta, T., Ohkawara, M. & Linko, P. 2005. Influence of emulsion and powder size on the stability of encapsulated d-limonene by spray drying. *Innovative Food Science and Emerging Technologies* 6: 107-114. DOI: 10.1016/j.ifset.2004.09.003.
- Sotiroudis, T.G. & Sotiroudis, G.T. 2013. Health aspects of Spirulina (*Arthrosphaera*) microalga food supplement. *Journal of the Serbian Chemical Society* 78(3): 395-405. DOI: 10.2298/JSC121020152S
- Susilowati, R. & Januar, H.I. 2014. Variasi Temporal dan Stabilitas Fisik dan Kimia Senyawa Bioaktif Karotenoid Rumput Laut Coklat *Turbinaria decurens*. *JPB Perikanan* 9 (1): 21-28.
- Tadros, T. 2004. Application of rheology for assessment and prediction of the long-term physical stability of emulsions. *Advances in Colloid and Interface Science* 108-09:227–258.
- Taha, A., Ahmed, E., Ismaiel, A., Ashokumar, M., Xu, C., Pan, S., & Hu, H. 2020. Ultrasonic emulsification: An overview on the preparation of different emulsifiers-stabilized emulsions. *Trends in Food Science and Technology* 106: 363-377.
- Taktak, W., Nasri, R., Lopez-Rubio, A., Hamdi, M., Gomez-Mascaraque, L., Amor, N.B., Kabadou, A., Li, S., Nasri, M. & Karra-chaâbouni, M. 2019. Improved antioxidant activity and oxidative stability of spray dried European eel (*Anguilla anguilla*) oil microcapsules: Effect of emulsification process and eel protein isolate concentration. *Materials Science and Engineering* 104: 109867. DOI: 10.1016/j.msec.2019.109867.
- Thevenet, F. 2006. Acaciagum (Gum Arabic). In: imeson A, editor: Food stabilizer, thickerners, and gelling agents. Blackwell Publishing. p. 11-30.
- Tomar, M., Kumar, S.A., & Raj, S.A. 2017. Effect of moisture content of excipient (microcrystalline cellulose) on direct compressible solid dosage forms. *International Journal of Pharmaceutical Sciences and Research* 8 (1): 282-288. DOI: 10.13040/IJPSR.0975-8232.8 (1).282-88
- Tonon, R.V., Pedro, R.B., Grosso, C.R.F., Hubinger, M.D. 2012. Microencapsulation of flaxseed oil by spray drying: Effect of oil load and type of wall material. *Drying Technology* 30 (13): 1419-1501.
- Tontul, I. & Topuz, A. 2013. Mixture design approach in wall material selection and evaluation of ultrasonic emulsification in flaxseed oil microencapsulation. *Drying Technology: An International Journal* 31(12): 1362-1373. DOI: 10.1080/07373937.2013.795964.
- Tontul, I. & Topuz, A. 2015. Microencapsulation of plant oils rich in alpha-linolenic acid: Effect of processing parameters. *Microencapsulation and Microspheres for Food Applications* 253-269. DOI: 10.1016/B978-0-12-800350-3.00011-X.



- Utami, S.S. 2012. Formulasi dan uji penetrasi *in vitro* nanoemulsi, nanoemulsi gel, dan gel kurkumin. Skripsi. Universitas Indonesia. Jakarta.
- Vahidmoghadam, F., Pourahmad, R., Mortazavi, A., Davoodi, D., & Azizinezhad, R. 2019. Characteristics of freeze-dried nanoencapsulated fish oil with whey protein concentrate and gum arabic as wall materials. *Food Science and Technology*. DOI: 10.1590/fst.22618.
- Villamiel, M. & de Jong, P. 2000. Influence of high-intensity ultrasound and heat treatment in continuous flow on fat, proteins, and native enzymes of milk. *Journal of Agricultural and Food Chemistry* 48 (7): 472-478. DOI: 10.1021/jf0006224.
- Vonshak, A. 1997. *Spirulina platensis (Arthrospira): Physiology, cell biology and biotechnology*. Taylor and Francis. London
- Vonshak, A., Chanawongse, L., Bunnag, B. & Tanticharoen, M. 1996. Role of light and photosynthesis on acclimation process of cyanobacterium *Spirulina platensis* to salinity stress. *Journal of Applied Phycology* 8:199-124.
- Wahyu, A.P. & Yanuar, E.K. 2010. Optimasi Proses Ekstraksi Pigmen Karotenoid dari *Spirulina platensis*. Jurusan Teknik Kimia Fakultas Teknik Universitas Diponegoro, Semarang.
- Winarno, 2002. *Kimia Pangan dan Gizi*. PT. Gramedia Pustaka Utama. Jakarta.
- Woo, M.W., A.S Mujumdar, & W.R.W. Daud. 1979. Spray drying technology. ISBN-978-981-08-6270-1. Published in Singapore 1 (12): 3-13.
- Yao, X., Chen, Y., Shu, M., Zhang, K., Gao, Z., Kuang, Y., Fang, Y., Nishinari, K., Philips, G.O., Jiang, F. 2018. Stability and digestibility of one- or bi-layered medium chain triglyceride emulsions with gum Arabic and whey protein isolates by pancreatic lipase *in vitro*. *Food and Function* 9: 1017-1027. DOI: 10.1039/C7FO01719G.
- Yoga, I.B.K.W. 2015. Penentuan konsentrasi optimum kurva standar antioksidan; asam galat, asam askorbat dan Trolox® terhadap radikal bebas DPPH (*2,2-diphenyl-1-picrylhydrazyl*) 0,1 mM. Prosiding Seminar Nasional “Seminar Nasional FMIPA UNDIKSHA V Tahun 2015”. Denpasar, 7 Desember 2015.
- Yuan, Y., Gao, Y., Zhao, J. & Mao, L. 2008. Characterization and stability evaluation of beta carotene nanoemulsions prepared by high pressure homogenization under various emulsifying conditions. *Food Research International* 41 (1): 61-68. DOI: 10.1016/j.foodres.2007.09.006.
- Yudiatyi, E., Sejati, S., Sunarsih, S. & Agustian, R. 2011. Aktivitas antioksidan dan toksisitas ekstrak metanol dan pigmen kasar *Spirulina* sp. *Indonesian Journal of Marine Sciences* 16 (4): 187-192.
- Zhang, Y., Tan, C., Abbas, S., Eric, K., Xia, S., & Zhang, X. 2015. Modified SPI improves the emulsion properties and oxidative stability of fish oil microcapsules. *Food Hydrocolloids* 51: 108-117. DOI: 10.1016/j.foodhyd.2015.05.001.
- Zhou, L., Chen, Y.J., Feng, X., Tang, X. 2019. Effect of high-speed shear homogenization on the emulsifying and structural properties of myofibrillar protein under low-fat condition. *Journal of the Science of Food and Agriculture* 99: 6500-6508.
- Zimmer, J.P. & Hammond, B.R. Jr. 2007. Possible influences of lutein and zeaxanthin on the developing retina. *Clinical Ophthalmology* 1 (1): 25-35.