

## DAFTAR PUSTAKA

- [AOAC] Association of Official Analytical. (1990). *Official Methods of Analysis of AOAC International* (15th edn). AOAC, Virginia.
- Abramsson-Zetterberg, L., and Ilbäck, N. G. (2013). The synthetic food colouring agent allura red AC (E129) is not genotoxic in a flow cytometry-based micronucleus assay in vivo. *Food and Chemical Toxicology*, 59: 86–89. <https://doi.org/10.1016/j.fct.2013.05.047>.
- Ačkar, D., Babić, J., Jozinović, A., Miličević, B., Jokić, S., Miličević, R., Rajič, M., and Šubarić, D. (2015). Starch modification by organic acids and their derivatives: A review. *Molecules*, 20(10): 19554–19570. <https://doi.org/10.3390/molecules201019554>.
- Ahmed, J., Shivhare, U. S., and Singh, G. D. (2000). Chlorophyll and color of green chilli puree as affected by mesh size and temperature. *International Journal of Food Properties*, 3(2): 305–315. <https://doi.org/10.1080/10942910009524636>.
- Akdeniz, B., Sumnu, G., and Sahin, S. (2017). The effects of maltodextrin and gum arabic on encapsulation of onion skin phenolic compounds. *Chemical Engineering Transactions*, 57: 1891–1896. <https://doi.org/10.3303/CET1757316>
- Alsuhendra, Muchtadi, D., Saastradipradja, D., and Wresdiyati, T. (2003). Antihypercholesterolaemic activity of “zincophyllin.” *Jurnal Teknologi dan Industri Pangan*, XIV(2): 129–135. <https://jai.ipb.ac.id/index.php/jtip/article/view/743>.
- Amrani-Allalou, H., Boulekbache-Makhlouf, L., Mapelli-Brahm, P., Sait, S., Tenore, G. C., Benmezziane, A., Kadri, N., Madani, K., and Martinez, A. J. M. (2019). Antioxidant activity, carotenoids, chlorophylls and mineral composition from leaves of *Pallenis spinosa*: an Algerian medicinal plant. *DEGRUYTER. Journal of Complementary and Integrative Medicine*, 20170081:1–9. <https://doi.org/10.1515/jcim-2017-0081>.
- An, S., Lee, E., and Choe, E. (2011). Effects of solubility characteristics of sensitizer and pH on the photooxidation of oil in tuna oil-added acidic O/W emulsions. *Food Chemistry*, 128(2): 358–363. <https://doi.org/10.1016/j.foodchem.2011.03.034>.
- Anonim. 1980. The HLB System: a time-saving guide to emulsifier selection. ICI Americas Inc. Delaware.
- Anandharamakrishnan, C. (2014). *Techniques for Nanoencapsulation of Food Ingredients*. <https://doi.org/10.1007/978-1-4614-9387-7>.
- Andarwulan, N., Batari, R., Sandrasari, D. A., Bolling, B., and Wijaya, H. (2010). Flavonoid content and antioxidant activity of vegetables from Indonesia. *Food Chemistry*, 121(4): 1231–1235. <https://doi.org/10.1016/j.foodchem>.

[2010.01.033.](#)

- Andarwulan, N., and Faradilla, R. H. F. (2012). *Pewarna Alami Untuk Pangan*. Penerbit Seafast. IPB, Bogor. <http://seafast.ipb.ac.id/tpc-project/pewarna-alami-untuk-pangan/>.
- Andrew, A., Amin, M., and Duran, A. (2015). Apoptosis in mice liver cells caused by formalin –containing food : normalization of HSP70 overexpression by chlorophyllin. *Procedia Chemistry*, 14, 27–35. <https://doi.org/10.1016/j.proche.2015.03.006>.
- Anonim. (2008). Hunter L, a, b Color Scale. *Application Note*, 8(9), 1–4. <https://doi.org/10.1128/AEM.02997-13>.
- Anonim. (2013). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 75 Tahun 2013 Tentang Angka Kecukupan Gizi yang Dianjurkan Bagi Bangsa Indonesia*. Kementerian Kesehatan RI. <https://peraturan.bpk.go.id/Home/Details/139226/permenkes-no-75-tahun-2013>.
- Anonim. (2015). Scientific opinion on re-evaluation of copper complexes of chlorophylls (E141 (i)) and chlorophyllins (E141 (ii)) as food additives. *EFSA Journal*, 13(6): 1–60. <https://doi.org/10.2903/j.efsa.2015.4151>.
- Anonim. (2018a). Magnesium - Mg Chemical properties of magnesium - Health effects of magnesium - Environmental effects of magnesium. <https://www.Lenntech.Com/Periodic/Elements/Mg.Htm>.
- Anonim. (2018b). Zinc. US National Library of Medicine. <https://pubchem.ncbi.nlm.nih.gov/>.
- Aparicio-Ruiz, R., Riedl, K. M., and Schwartz, S. J. (2011). Identification and quantification of metallo a chlorophyll complexes in bright green table olives by high-performance liquid chromatography a mass spectrometry quadrupole/time-of-flight. *Journal of Agricultural and Food Chemistry*, 59: 11100–11108. <https://doi.org/dx.doi.org/10.1021/jf201643s>.
- Arar, E. J. (1997). Method 446.0 In vitro determination of chlorophylls a, b, c 1c and pheopigments in marine and freshwater algae by visible spectrophotometry. In *446.0-1 EPA*. Revision 1.2 September 1997, National Exposure Research Laboratory Office of Research and Development, U.S. Environmental Protection Agency, Ohio.
- Arivazhagan, P., Juliet, P., and Panneerselvam, C. (2000). Effect of DL- $\alpha$ -lipoic acid on the status of lipid peroxidation and lipids in aged rats. *Pharmacological Research*, 41(3): 299–303. <https://doi.org/10.1093/gerona/58.9.b788>.
- Arnold, L. E., Lofthouse, N., and Hurt, E. (2012). Artificial food colors and attention-deficit/hyperactivity symptoms: Conclusions to dye for. *Neurotherapeutics*, 9(3): 599–609. <https://doi.org/10.1007/s13311-012-0133-x>.
- Arnon, D. L. (1949). Copper enzymes in isolated chloroplast polyphenoloxidase in

- Beta vulgaris*. *Plant Physiology*, 24(1): 1–15. <http://www.plantphysiol.org/content/24/1/1>.
- Aryanti, N., Nafiunisa, A., and Willis, F. M. (2016). Ekstraksi dan karakterisasi klorofil dari daun suji (*Pleomele Angustifolia*) sebagai pewarna pangan alami. *Jurnal Aplikasi Teknologi Pangan*, 5(4): 129–135. <https://doi.org/10.17728/jatp.183>.
- Ashish, B., Neeti, K., and Himanshu, K. (2013). Copper toxicity : A comprehensive study. *Research Journal of Recent Sciences*, 2(ISC-2012): 58–67. <http://www.isca.in/>
- Bai, L., Huan, S., Gu, J., and McClements, D. (2016). Fabrication of oil-in-water nanoemulsions by dual-channel microfluidization using natural emulsifiers: Saponins, phospholipids, proteins, and polysaccharides. *Food Hydrocolloids*, 61: 703–711. <https://doi.org/10.1016/j.foodhyd.2016.06.035>.
- Bastaki, M., Farrell, T., Bhusari, S., Pant, K., and Kulkarni, R. (2017). Lack of genotoxicity in vivo for food color additive Allura Red AC. *Food and Chemical Toxicology*, 105: 308–314. <https://doi.org/10.1016/j.fct.2017.04.037>.
- Bechaieb, R., Fredj, A. B., Akacha, A. B., and Gérard, H. (2016). Interactions of copper(II) and zinc(II) with chlorophyll: Insights from density functional theory studies. *New Journal of Chemistry*, 40(5): 4543–4549. <https://doi.org/10.1039/c5nj03244j>.
- Belova, E. V., Mamontov, M. N., and Uspenskaya, I. A. (2016). A sodium chloride-zinc chloride-water system: Solubility of solids and density of liquid in wide range of temperatures. *Journal of Chemical and Engineering Data*, 61(7): 2426–2432. <https://doi.org/10.1021/acs.jced.6b00048>.
- Benjakul, S., Kittiphattanabawon, P., Sumpavapol, P., and Maqsood, S. (2014). Antioxidant activities of lead (*Leucaena leucocephala*) seed as affected by extraction solvent, prior dechlorophyllisation and drying methods. *Journal of Food Science and Technology*, 51: 3026–3037. <https://doi.org/10.1007/s13197-012-0846-1>.
- Benzie, I. F. F., and Devaki, M. (2018). The ferric reducing/antioxidant power (FRAP) assay for non-enzymatic antioxidant capacity : concepts, procedures, limitations and applications. In R. Apak, E. Capanoglu, and F. Shahidi (Eds.), *Measurement of Antioxidant Activity and Capacity: Recent Trends and Applications*, pp. 77–106. John Wiley and Son, Hongkong. <https://doi.org/10.1002/9781119135388.ch5>.
- Bobbio, P. A., and Guedes, M. C. (1990). Stability of copper and magnesium chlorophylls. *Food Chemistry*, 36(3): 165–168. [https://doi.org/10.1016/0308-8146\(90\)90051-5](https://doi.org/10.1016/0308-8146(90)90051-5).
- Bodmeier, R., and Chen, H. (1989). Preparation and characterization of microspheres containing the anti-inflammatory agents indomethacin, ibuprofen, and ketoprofen. *Journal of Controlled Release*, 10: 167–175.

[https://doi.org/10.1016/0168-3659\(89\)90059-X](https://doi.org/10.1016/0168-3659(89)90059-X).

- Bohn, T., Walczyk, T., Leisibach, S., and Hurrell, R. F. (2004). Chlorophyll-bound magnesium in commonly consumed vegetables and fruits: Relevance to magnesium nutrition. *Journal of Food Science*, 69(9): 347–350. <https://doi.org/10.1111/j.1365-2621.2004.tb09947.x>.
- Bowman, D. C. (2006). A colorful look at the chelate effect. *Journal of Chemical Education*, 83(8): 1158–1160. <https://doi.org/10.1021/ed083p1158>.
- Brecht, H. (2018). Phytopharmaceuticals, Traditional Chinese Medicine, Natural Cosmetics. [info@fritsch.de](mailto:info@fritsch.de). [www.fritsch.de](http://www.fritsch.de)
- Breemen, R. B., Canjura, F. L., and Schwartz, S. J. (1991). Identification of chlorophyll derivatives by mass spectrometry. *Journal of Agricultural and Food Chemistry*, 39: 1452–1456. [https://doi.org/0021-8561/91/1439-1452\\$02.50/0](https://doi.org/0021-8561/91/1439-1452$02.50/0).
- Brewer, G. J. (2007). A brand new mechanism for copper toxicity. *Journal of Hepatology*, 47: 621–622. <https://doi.org/10.1016/j.jhep.2007.07.001>.
- Bruckner, M., Bade, M., and Kunz, B. (2007). Investigations into the stabilization of a volatile aroma compound using a combined emulsification and spray drying process. *European Food Research and Technology*, 226: 137–146. <https://doi.org/10.1007/s00217-006-0518-3>.
- Buckle, K., and Edwards, R. A. (1970). Chlorophyll, colour and pH changes in HTST processed green pea puree. *Journal of Food Technology*, 5: 173–186. <https://doi.org/10.1111/j.1365-2621.1970.tb01555.x>.
- Cahyana, A. H., Shuto, Y., and Kinoshita, Y. (1993). Antioxidative activity of porphyrin derivatives. *Bioscience, Biotechnology and Biochemistry*, 57(4): 680–681. <https://doi.org/10.1271/bbb.57.680>.
- Canjura, F. L., and Schwartz, S. J. (1991). Separation of chlorophyll compounds and their polar derivatives by High-Performance Liquid Chromatography. *Journal of Agricultural and Food Chemistry*, 39(6): 1102–1105. <https://doi.org/10.1021/jf00006a020>.
- Canjura, F. L., Schwartz, S. J., and Nunes, R.V. (1991). Degradation kinetic of chlorophyll and chlorophyllides. *Journal of Food Science*, 56(6): 1639–1643.
- Canjura, F. L., Watkins, R. H., and Schwartz, S. J. (1999). Color improvement and metallo-chlorophyll complexes in continuous flow aseptically processed peas. *Journal of Food Science*, 64(6): 987–990. <https://doi.org/10.1111/j.1365-2621.1999.tb12265.x>.
- Carocho, M., Barreiro, M. F., Morales, P., and Ferreira, I. C. F. R. (2014). Adding molecules to food, pros and cons: A review on synthetic and natural food additives. *Comprehensive Reviews in Food Science and Food Safety*, 13(4): 377–399. <https://doi.org/10.1111/1541-4337.12065>.
- Cervantes-paz, B., Yahia, E. M., Ornelas-paz, J. D. J., Victoria-campos, C. I.,

- Ibarra-junquera, V., Pérez-martínez, J. D., and Escalante-Minakata, P. (2014). Antioxidant activity and content of chlorophylls and carotenoids in raw and heat-processed Jalapeño peppers at intermediate stages of ripening. *Food Chemistry*, 146, 188–196. <https://doi.org/10.1016/j.foodchem.2013.09.060>.
- Cheetangdee, V., and Chaiseri, S. (2006). Free amino acid and reducing sugar composition of pandan (*Pandanus amaryllifolius*) leaves. *Kasetsart J*, 40, 67–74. <http://www.thaiscience.info/Journals/Article/TKJN/10471400.pdf>.
- Chen, F., Liang, L., Zhang, Z., Deng, Z., Decker, E. A., and McClements, D. J. (2017). Inhibition of lipid oxidation in nanoemulsions and filled microgels fortified with omega-3 fatty acids using casein as a natural antioxidant. *Food Hydrocolloids*, 63: 240–248. <https://doi.org/10.1016/j.foodhyd.2016.09.001>.
- Cheng, K. L., Ueno, K., and Imamura, T. (1992). *CRC Handbook of Organic Analytical Reagents* (2nd Edn). CRC Press, Boca raton.
- Cherrak, S. A., Mokhtari-soulmane, N., Berroukeche, F., Merzouk, H., Elhabiri, M., Bensenane, B., Cherbonnel, A., Merzouk, H., and Elhabiri, M. (2016). In vitro antioxidant versus metal ion chelating properties of flavonoids: A structure-activity investigation. *PLoS ONE*, 11(10): 1–21. <https://doi.org/10.1371/journal.pone.0165575>.
- Comunian, T. A., Monterrey-Quintero, E. S., Thomazini, M., Balieiro, J. C. C., Piccone, P., Pittia, P., and Favaro-Trindade, C. S. (2011). Assessment of production efficiency, physicochemical properties and storage stability of spray-dried chlorophyllide, a natural food colourant, using gum Arabic, maltodextrin and soy protein isolate-based carrier systems. *International Journal of Food Science and Technology*, 46(6): 1259–1265. <https://doi.org/10.1111/j.1365-2621.2011.02617.x>.
- Cortez, R., Luna-Vital, D. A., Margulis, D., and de Mejia, E. G. (2017). Natural pigments: Stabilization methods of anthocyanins for food applications. *Comprehensive Reviews in Food Science and Food Safety*, 16(1): 180–198. <https://doi.org/10.1111/1541-4337.12244>.
- Cova, T. F. G. G., Cruz, S. M. A., Valente, A. J. M., Abreu, P. E., Marques, J. M. C., and Pais, A. A. C. (2018). Aggregation of Cyclodextrins: Fundamental Issues and Applications. In: Arora, P. and Dhingra, N. (Eds). *Cyclodextrin - A Versatile Ingredient*. IntechOpen, London. <https://doi.org/10.5772/intechopen.73532>.
- Dameron, C. T., and Harrison, M. D. (1998). Mechanisms for protection against copper toxicity. *American Journal of Clinical Nutrition*, 67(Suppl): 1091S–1097S. <https://doi.org/10.1093/ajcn/67.5.1091s>.
- Del Valle, E. M. M. (2004). Cyclodextrins and their uses: A review. *Process Biochemistry*, 39(9): 1033–1046. [https://doi.org/10.1016/S0032-9592\(03\)00258-9](https://doi.org/10.1016/S0032-9592(03)00258-9).
- Delgado-Vargas, F., Jiménez, A. R., Paredes-López, O., and Francis, F. J. (2000).



- Natural pigments: Carotenoids, anthocyanins, and betalains - Characteristics, biosynthesis, processing, and stability. In *Critical Reviews in Food Science and Nutrition*, Vol. 40(3). <https://doi.org/10.1080/10408690091189257>
- Delgado-Vargas, F., and Paredes-López, O. (2003). *Natural Colorants for Food and Nutraceutical Uses*. CRC Press, Boca raton. <https://www.researchgate.net/deref/http%3A%2F%2F148.201.96.14%2Fdc%2Fver.aspx%3Fns%3D000184649>.
- Deveci, M., and Uzun, E. (2011). Determination of phenolic compounds and chlorophyll content of Spinach (*Spinacia oleracea* L.) at different growth stages. *Asian Journal of Chemistry*, 23(8): 3739–3743. [www.asianjournalofchemistry.co.in](http://www.asianjournalofchemistry.co.in).
- Dewanto, V., Wu, X., Adom, K. K., and Liu, R. H. (2002). Thermal processing enhances the nutritional value of tomatoes by increasing total antioxidant activity. *Journal of Agricultural and Food Chemistry*, 50: 3010–3014. <https://doi.org/10.1021/jf0115589>.
- Endo, Y. (1985a). Antioxidant effects of chlorophyll and pheophytin on the autoxidation of oils in the dark. I. Comparison of the inhibitory effects. *Journal of American Oil Chemist Society* 62(9): 1375–1376.
- Endo, Y., Usuki, R., and Kaneda, T. (1985b). Antioxidant effects of chlorophyll and pheophytin on the autoxidation of oils in the dark. II. The Mechanism of antioxidative action of chlorophyll. *Journal of American Oil Chemists' Society*, 62(9): 1387–1390. <https://doi.org/10.1007/BF02545965>.
- Fabrowska, J., Messyasz, B., Szyling, J., Walkowiak, J., and Łeska, B. (2018). Isolation of chlorophylls and carotenoids from freshwater algae using different extraction methods. *Phycological Research*, 66(1): 52–57. <https://doi.org/10.1111/pre.12191>.
- Fang, M. C. (2013). *Synthesis and stabilization of selected heterocyclic aroma compounds*. University of Illinois at Urbana-Champaign, Illinois. <https://www.ideals.illinois.edu/bitstream/handle/2142/44304/>.
- Fathi, M., Martín, A., and McClements, D. J. (2014). Nanoencapsulation of food ingredients using carbohydrate based delivery systems. *Trends in Food Science and Technology*, 39(1), 18–39. <https://doi.org/10.1016/j.tifs.2014.06.007>.
- FDA (Food Drug Administration). (2016). *GRAS Notice for Alpha-Cyclodextrin*, Issue 678: 3–44. <http://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/NoticeInventory/default.htm>.
- Feingold, B. F. (1976). Hyperkinesis and learning disabilities linked to artificial food flavors and colors. *Journal of Learning Disabilities*, 9(9): 551-559. Downloaded from [ldx.sagepub.com](http://ldx.sagepub.com) at Pennsylvania State University [May 8, 2016].
- Femat-Castañeda, C., Chávez-Rodríguez, A., Chávez-Rodríguez, A. M., Flores-

- Martínez, H., Fariás-Cervantes, V. S., and Andrade-González, I. (2019). Effect of agave fructans and maltodextrin on  $\text{Zn}^{2+}$  chlorophyll microencapsulation by spray drying. *Journal of Food Quality*, 2019:1–9. <https://doi.org/10.1155/2019/6312584>.
- Fernandes, A. S., Nogara, G. P., Menezes, C. R., Cichoski, A. J., Mercadante, A. Z., Jacob-Lopes, E., and Zepka, L. Q. (2017). Identification of chlorophyll molecules with peroxy radical scavenger capacity in microalgae *Phormidium autumnale* using ultrasound-assisted extraction. *Food Research International*, 99: 1036–1041. <https://doi.org/10.1016/j.foodres.2016.11.011>.
- Ferruzzi, M. G., Böhm, V., Courtney, P. D., and Schwartz, S. J. (2002). Antioxidant and antimutagenic activity of dietary chlorophyll derivatives determined by radical scavenging and bacterial reverse mutagenesis assays. *Journal of Food Science*, 67(7): 2589–2595. <https://doi.org/10.1111/j.1365-2621.2002.tb08782.x>.
- Gharsallaoui, A., Roudaut, G., Chambin, O., Voilley, A., and Saurel, R. (2007). Applications of spray-drying in microencapsulation of food ingredients: An overview. *Food Research International*, 40(9): 1107–1121. <https://doi.org/10.1016/j.foodres.2007.07.004>.
- Gil, M. I., Tudela, J. A., Martínez-Sánchez, A., and Luna, M. C. (2012). Harvest maturity indicators of leafy vegetables. *Stewart Postharvest Review*, 8(1): 1–9. <https://doi.org/10.2212/spr.2012.1.2>.
- Goodwin, F.E. (2017). Zinc compounds. 5th edn. Volumes 1. In *Kirk-Othmer Encyclopedia of Chemical Technology*. John Wiley and Son, Inc, New Jersey. <http://dx.doi.org/10.1002/0471238961.2609140307151504.a02.pub3>
- Goswami, T. K. (2017). Recent trends of application of cryogenics in food processing and preservation. *Journal of Food and Population Health*, 1(3:27): 1–4. <http://www.imedpub.com/food-nutrition-and-population-health/>.
- Gouin, S. (2004). Microencapsulation : industrial appraisal of existing technologies and trends. *Trends in Food Science and Technology*, 15: 330–347. <https://doi.org/10.1016/j.tifs.2003.10.005>.
- Griffiths, J. C. (2005). Coloring foods and beverages. *Food Technology*, 59(5): 38–44. [https://www.ift.org/~media/Food%20Technology/pdf/2005/05/0505feat\\_coloringfoods.pdf](https://www.ift.org/~media/Food%20Technology/pdf/2005/05/0505feat_coloringfoods.pdf)
- Gutteridge, J. M. C. (1995). Lipid peroxidation and antioxidants as biomarkers of tissue damage. *Clinical Chemistry*, 41(12): 1819–1828. <https://pubmed.ncbi.nlm.nih.gov/7497639/>.
- Gutteridge, J. M. C., and Halliwell, B. (2000). Free radicals and antioxidants in the year 2000. A historical look to the future. *Annals of The New York Academic Sciences*, 899: 136–147. <https://doi.org/10.1111/j.1749-6632.2000.tb06182.x>.

- Hagerthey, S. E., William Louda, J., and Mongkronsri, P. (2006). Evaluation of pigment extraction methods and a recommended protocol for periphyton chlorophyll a determination and chemotaxonomic assessment. *Journal of Phycology*, 42(5): 1125–1136. <https://doi.org/10.1111/j.1529-8817.2006.00257.x>.
- Halliwell, B. (2006). Reactive species and antioxidants. redox biology is a fundamental theme of aerobic life. *Plant Physiology*, 141(June): 312–322. <https://doi.org/10.1104/pp.106.077073.312>.
- Halliwell, B. (2012). Free radicals and antioxidants: updating a personal view. *Nutrition Reviews*, 70(5): 257–265. <https://doi.org/10.1111/j.1753-4887.2012.00476.x>.
- Hargreaves, T. (2003). *Chemical formulation : An overview of surfactant-based preparations used in everyday life*. The Royal Society of Chemistry, Cambridge.
- Hendry, G. A. F. (1996). Chlorophylls and chlorophyll derivatives. In E. Hendry, G. A and J. D. Houghton (Eds.), *Natural Food Colorants*, 2nd Edn, pp: 131–156. Springer Science Business Media, London. <https://doi.org/10.1073/pnas.0703993104>
- Heyne, K. (1987). *Tumbuhan Berguna Indonesia*. Badan Litbang Kehutanan RI. Jakarta.
- Hojnik, M., Skerget, M., and Knez, Z. (2007). Isolation of chlorophylls from stinging nettle (*Urtica dioica* L.). *Separation and Purification Technology*, 57: 37–46. <https://doi.org/10.1016/j.seppur.2007.02.018>.
- Honma, M. (2015). Evaluation of the in vivo genotoxicity of Allura Red AC (Food Red No. 40). *Food and Chemical Toxicology*, 84: 270–275. <https://doi.org/10.1016/j.fct.2015.09.007>.
- Hoshina, C., Tomita, K., and Shioi, Y. (1998). Antioxidant activity of chlorophylls: Its structure-activity relationship. In G. Garab (Ed.), *Photosynthesis: Mechanisms and Effects*, Issue IV, pp: 3281–3284. Kluwer Academic Publishers, Budapest. [https://link.springer.com/chapter/10.1007/978-94-011-3953-3\\_766](https://link.springer.com/chapter/10.1007/978-94-011-3953-3_766).
- Hsu, C., Chao, P., Hu, S., and Yang, C. (2013). The Antioxidant and free radical scavenging activities of chlorophylls and pheophytins. *Food Science and Nutrition*, 4: 1–8. DOI:10.4236/fns.2013.48A001.
- Hu, H., Liu, W., Shi, J., Huang, Z., Zhang, Y., Huang, A., Yang, M., Qin, X., and Shen, F. (2016). Structure and functional properties of octenyl succinic anhydride modified starch prepared by a non-conventional technology. *Starch/Staerke*, 68(1–2): 151–159. <https://doi.org/10.1002/star.201500195>.
- Hu, X., Tanaka, A., and Tanaka, R. (2013). Simple extraction methods that prevent the artifactual conversion of chlorophyll to chlorophyllide during pigment isolation from leaf samples. *Plant Methods*, 9(1): 1–13.



<https://doi.org/10.1186/1746-4811-9-19>.

- Huang, S.W., Hopla, A., Schwarz, K., Frankel, E.N., and German, J.B. (1996). Antioxidant activity of  $\alpha$ -tocopherol and trolox in different lipid substrates: Bulk oils vs oil-in-water emulsion. *Journal of Agricultural Food Chemistry*, 44: 444-452. DOI: 0021-8561/96/1444-0444\$12.00/0
- Hughes, J. T., and Navrotsky, A. (2011). Enthalpy of formation of zinc acetate dihydrate. *Journal of Chemical Thermodynamics*, 43(6): 980-982. <https://doi.org/10.1016/j.jct.2011.02.004>.
- Humphrey, A. M. (2004). Chlorophyll as a color and functional ingredient. *Journal of Food Science*, 69(5): 422-425. <https://doi.org/10.1111/j.1365-2621.2004.tb10710.x>.
- Hutchings, J. B. (1994). *Food Colour and Appearance*. Springer Science Business Media, Bedford. <https://doi.org/10.1007/978-1-4615-2373-4>.
- IACM (International Association of Color Manufacturers). (2018). *Chlorophylls and Chlorophyllins, Copper Complexes*, Issue 75815, pp: 5-6. <https://doi.org/10.2903/j.efsa.2015.4151>.
- IBM. (2011). *IBM SPSS Statistics 20 Command Syntax Reference*, 20th Edn. IBM Corporation.
- Institute of Food Technologists. (2016). Coloring Foods and Beverages. <http://s36.a2zinc.net/clients/IFT/IFT16/Public/eventmap.aspx?shmode=E>. [20 Juli 2016].
- Irving, H., and Williams, R. J. P. 1953. The stability of transition metal complexes. *Journal of the Chemical Society*. pp:3192-3210. Doi:10.1039/jr9530003192.
- Jafari, S. (2017). *Nanoencapsulation of Food Bioactive Ingredients*. Elsevier Inc, London.
- Jeffrey, S. W. (1968). Quantitative thin-layer chromatography of chlorophylls and carotenoids from marine algae. *Biochimica et Biophysica Acta*, 162: 271-285. [https://doi.org/10.1016/0005-2728\(68\)90109-6](https://doi.org/10.1016/0005-2728(68)90109-6).
- Jeyakumari, A., Zynudheen, A. A., and Parvathy, U. (2016). Microencapsulation of bioactive food ingredients and controlled release - A review. *MOJ Food Processing and Technology*, 2(6): 214-224. <https://doi.org/10.15406/mojfpt.2016.02.00059>.
- Jin, Y., Li, J. Z., and Nik, A. M. (2018). Starch-based microencapsulation. In M. Sjöö and L. Nilsson (Eds.), *Starch in Food*, 2nd Edn, pp: 661-690. Elsevier Ltd, London. <https://doi.org/10.1016/B978-0-08-100868-3.00017-2>.
- Jones, I. D., White, R. C., Gibbs, E., Butler, L. S., and Nelson, L. A. (1977). Experimental formation of zinc and copper complexes of chlorophyll derivatives in vegetable tissue by thermal processing. *Journal of Agricultural and Food Chemistry*, 25(1): 149-153. <https://doi.org/10.1021/jf60209a030>.
- Kamble, P., Girl, S. P., Mane, R. S., and Tiwana, A. (2016). Estimation of

- chlorophyll content in young and adult leaves of some selected plants. *Universal Journal of Environmental Research and Technology*, 5(6): 306–310. <http://www.environmentaljournal.org/>.
- Kang, Y., Lee, Y., Kim, Y. J., and Chang, Y. H. (2019). Characterization and storage stability of chlorophylls microencapsulated in different combination of gum Arabic and maltodextrin. *Food Chemistry*, 272(March 2018): 337–346. <https://doi.org/10.1016/j.foodchem.2018.08.063>.
- Kang, Y. R., Park, J., Jung, S. K., and Chang, Y. H. (2018). Synthesis, characterization, and functional properties of chlorophylls, pheophytins, and Zn-pheophytins. *Food Chemistry*, 245(May 2017): 943–950. <https://doi.org/10.1016/j.foodchem.2017.11.079>.
- Karp, G. (2010). *Cell and Molecular Biology, Concepts and Experiments*, 6th edn. John Willey and Son, New Jersey.
- Karamać, M. (2009). Chelation of Cu(II), Zn(II), and Fe(II) by tannin constituents of selected edible nuts. *International Journal of Molecular Sciences*, 10(12): 5485–5497. <https://doi.org/10.3390/ijms10125485>.
- Khandaker, M. M., Boyce, A. N., Osman, N., and Hossain, A. B. M. S. (2012). Physiochemical and phytochemical properties of wax apple (*Syzygium samarangense* [Blume] Merrill and L. M. Perry var. Jambu Madu) as affected by growth regulator application. *The Scientific World Journal*, 2012: 1–13. <https://doi.org/10.1100/2012/728613>.
- Kim, N., and Choe, E. (2013). Contribution of minor compounds to the singlet oxygen-related photooxidation of olive and perilla oil blend. *Food Science and Biotechnology*, 22(2): 315–321. <https://doi.org/10.1007/s10068-013-0083-z>.
- Kim, T. S., Decker, E. A., and Lee, J. (2012). Effects of chlorophyll photosensitisation on the oxidative stability in oil-in-water emulsions. *Food Chemistry*, 133(4), 1449–1455. <https://doi.org/10.1016/j.foodchem.2012.02.033>.
- King, A. H. (1995). Encapsulation of food ingredients: A review of available technology, focussing on hydrocolloids. *Encapsulation and Controlled Release of Food Ingredients*, ACS Symposium Series, Vol. 590, pp: 26–39. American Chemical Society. DOI: 10.1021/bk-1995-0590.ch003.
- Klinjapo, R., and Krasaekoopt, W. (2018). Microencapsulation of Color and Flavor in Confectionery Products. In: *Natural and Artificial Flavoring Agents and Food Dyes*. <http://refhub.elsevier.com/B978-0-12-811518-3.00014-4/ref0400>.
- Kobayashi, M., Ohashi, S., Iwamoto, K., Shiraiwa, Y., Kato, Y., and Watanabe, T. (2007). Redox potential of chlorophyll d in vitro. *Biochimica et Biophysica Acta*, 1767: 596–602. <https://doi.org/10.1016/j.bbabi.2007.02.015>.
- Koca, N., Karadeniz, F., and Burdurlu, H. S. (2007). Effect of pH on chlorophyll

- degradation and colour loss in blanched green peas. *Food Chemistry*, 100(2): 609–615. <https://doi.org/10.1016/j.foodchem.2005.09.079>.
- Krishnaswamy, K., Orsat, V., and Thangavel, K. (2012). Synthesis and characterization of nano-encapsulated catechin by molecular inclusion with beta-cyclodextrin. *Journal of Food Engineering*, 111(2): 255–264. <https://doi.org/10.1016/j.jfoodeng.2012.02.024>.
- Kubatsch, A., Grüneberg, H., and Ulrichs, C. (2007). The effect of low light intensity and temperature on growth of *Schefflera arboricola* in interior landscapes. *HortScience*, 42(1): 65–67. <https://doi.org/10.21273/HORTSCI.42.1.65>.
- Kurkov, S. V., and Loftsson, T. (2013). Cyclodextrins. *International Journal of Pharmaceutics*, 453(1): 167–180. <https://doi.org/10.1016/j.ijpharm.2012.06.055>.
- Kusmita, L., Puspitaningrum, I., and Limantara, L. (2015). Identification, isolation and antioxidant activity of pheophytin from green Tea (*Camellia sinensis* (L.) Kuntze). *Procedia Chemistry*, 14: 232–238. <https://doi.org/10.1016/j.proche.2015.03.033>.
- LaBorde, L. F., and von Elbe, J. H. (1994a). Chlorophyll degradation and zinc complex formation with chlorophyll derivatives in heated green vegetables. *Journal of Agricultural and Food Chemistry*, 42(5): 1100–1103. <https://doi.org/10.1021/jf00041a010>.
- LaBorde, L. F., and Von Elbe, J. H. (1994b). Effect of solutes on zinc complex formation in heated green vegetables. *Journal of Agricultural and Food Chemistry*, 42(5): 1096–1099. <https://doi.org/10.1021/jf00041a009>.
- Lachowicz, S., Oszmiański, J., and Wiśniewski, R. (2018). Determination of triterpenoids, carotenoids, chlorophylls, and antioxidant capacity in *Allium ursinum* L. at different times of harvesting and anatomical parts. *European Food Research and Technology*, 244: 1269–1280. <https://doi.org/10.1007/s00217-018-3042-3>.
- Lakshmi, C. (2014). Food coloring: The natural way. *Research Journal of Chemical Sciences*, 4(2): 2231–2606. <http://www.isca.in/>.
- Lanfer-Marquez, U. M., Barros, R. M. C., and Sinnecker, P. (2005). Antioxidant activity of chlorophylls and their derivatives. *Food Research International*, 38: 885–891. <https://doi.org/10.1016/j.foodres.2005.02.012>.
- Lehto, S., Buchweitz, M., Klimm, A., Straßburger, R., Bechtold, C., and Ulberth, F. (2017). Comparison of food colour regulations in the EU and the US: a review of current provisions. *Food Additives and Contaminants - Part A Chemistry, Analysis, Control, Exposure and Risk Assessment*, 34(3): 335–355. <https://doi.org/10.1080/19440049.2016.1274431>.
- Leopoldini, M., Russo, N., and Toscano, M. (2011). The molecular basis of working mechanism of natural polyphenolic antioxidants. *Food Chemistry*, 125(2):

- 288–306. <https://doi.org/10.1016/j.foodchem.2010.08.012>.
- Li, S., Ge, S., Huang, Z., Wang, Q., Zhao, H., and Pan, H. (1991). Cryogenic grinding technology for traditional Chinese herbal medicine. *Cryogenics*, 31: 136–137. [https://doi.org/10.1016/0011-2275\(91\)90260-4](https://doi.org/10.1016/0011-2275(91)90260-4).
- Li, Y., He, N., Hou, J., Xu, L., Liu, C., Zhang, J., Wang, Q., Zhang, X., and Wu, X. (2018). Factors influencing leaf chlorophyll content in natural forests at the biome scale. *Frontiers in Ecology and Evolution*, 6(JUN): 1–10. <https://doi.org/10.3389/fevo.2018.00064>.
- Liew, P. S. (2012). *Pandanus amaryllifolius* – The only Pandanus with fragrant leaves. <http://Blogs.Reading.Ac.Uk/Tropical-Biodiversity/Files/2012/12/>. [23 Desember 2017].
- Liu, H., Zeng, F., Wang, Q., Ou, S., Tan, L., and Gu, F. (2013). The effect of cryogenic grinding and hammer milling on the flavour quality of ground pepper (*Piper nigrum* L.). *Food Chemistry*, 141(4): 3402–3408. <https://doi.org/10.1016/j.foodchem.2013.06.052>.
- Loh, S. K., Man, Y. B. C., Tan, C. P., Osman, A., and Hamid, N. S. A. (2005). Process optimisation of encapsulated pandan (*Pandanus amaryllifolius*) powder using spray-drying method. *Journal of Science of Food and Agriculture*, 85: 1999–2004. <https://doi.org/10.1002/jsfa.2169>.
- Lubis, I. H. (2009). *Pengaruh lama dan suhu pengeringan terhadap mutu tepung pandan*. Universitas Sumatera Utara, Medan. <http://repository.usu.ac.id/handle/123456789/7529>
- Macías-Sánchez, M. D., Mantell, C., Rodríguez, M., Martínez de la Ossa, E., Lubián, L. M., and Montero, O. (2009). Comparison of supercritical fluid and ultrasound-assisted extraction of carotenoids and chlorophyll a from *Dunaliella salina*. *Talanta*, 77(3): 948–952. <https://doi.org/10.1016/j.talanta.2008.07.032>.
- Manolopoulou, E., and Varzakas, T. (2016). Effect Of temperature in color changes of green vegetables. *Current Research in Nutrition and Food Science Journal*, 4(SI.2): 10–17. <https://doi.org/10.12944/CRNFSJ.4.Special-Issue-October.02>.
- Maqsood, S., and Benjakul, S. (2010). Comparative studies of four different phenolic compounds on in vitro antioxidative activity and the preventive effect on lipid oxidation of fish oil emulsion and fish mince. *Food Chemistry*, 119(1): 123–132. <https://doi.org/10.1016/j.foodchem.2009.06.004>.
- Maramis, A.A., Amin, M., Sumarno, and Corebima, A.D. (2015). Apoptosis in mice liver cells caused by formalin-containing food: Normalization of HSP70 overexpression by chlorophyllin. *Procedia Chemistry*, 14: 27 – 35.
- Margaretta, S., Handayani, S. D., Indrawati, N., dan Hindarso, H. (2011). Ekstraksi senyawa phenolic *Pandanus Amaryllifolius* Roxb. sebagai antioksidan alami. *Widya Teknik*, 10(1): 21–30. <https://doi.org/10.33508/wt.v10i1.157>.

- Marques, H. M. C. (2010). A review on cyclodextrin encapsulation of essential oils and volatiles. *Flavour and Fragrance Journal*, 25(5): 313–326. <https://doi.org/10.1002/ffj.2019>.
- Marquez, U, M, L. and Borrmann, D. (2009). Chlorophylls. In: Bechtold, T. and Mussak, R. (eds). *Handbook of Natural Colorants*.: John Wiley and Son, Ltd, West Sussex, UK.
- Mason, W, R. (2009). Starch use in foods. In: BeMiller, J. and Whistler, R. (eds) *Starch: Chemistry and Technology*. 3<sup>rd</sup> edn.: Elsevier Inc, New York
- Mataliana, N. G. A., Yudhari, I. D. A. S., and Dewi, I. A. L. (2015). Keragaan usahatani pandan wangi (*Pandanus amaryllifolius* roxb) di Subak Tegenungan Desa Kemenuh Kecamatan Sukawati Kabupaten Gianyar. *E-Jurnal Agribisnis Dan Agrowisata*, 4(1): 1–9. <https://ojs.unud.ac.id/index.php/JAA/article/view/17382>.
- Mathew, S., and Abraham, T. E. (2006). In vitro antioxidant activity and scavenging effects of *Cinnamomum verum* leaf extract assayed by different methodologies. *Food and Chemical Toxicology*, 44(2): 198–206. <https://doi.org/10.1016/j.fct.2005.06.013>
- Matile, P., Hortensteiner, S., Thomas, H., and Krautler, B. (1996). Chlorophyll breakdown in senescent leaves. *Plant Physiology*, 112: 1403–1409. <https://doi.org/10.1104/pp.112.4.1403>.
- Matos, M., Marefati, A., Gutiérrez, G., Wahlgren, M., and Rayner, M. (2016). Comparative emulsifying properties of octenyl succinic anhydride (OSA)-modified starch: Granular form vs dissolved state. *PLoS ONE*, 11(8): 1–16. <https://doi.org/10.1371/journal.pone.0160140>.
- Memisoglu, E., Bochot, A., Sen, A., Charon, D., Duchene, D., and Hincal, A. A. (2002). Amphiphilic b-cyclodextrins modified on the primary face: synthesis, characterization, and evaluation of their potential as novel excipients in the preparation of nanocapsules. *Journal of Pharmaceutical Sciences*, 91(5): 1214–1224. <https://doi.org/10.1002/jps.10105>.
- Mendenhall, W., and Sincich, T. (2016). *Statistics For Engineering and The Sciences*. 6<sup>th</sup> edn. Prentice Hall, New Jersey.
- Miazeck, K., and Ledakowicz, S. (2013). Chlorophyll extraction from leaves, needles and microalgae: A kinetic approach. *International Journal of Agricultural and Biological Engineering*, 6(2): 107–115. <https://doi.org/10.3965/j.ijabe.20130602.00>.
- Mikkelsen, H., Larsen, J. C., and Tarding, F. (1978). Hypersensitivity reactions to food colours with special reference to the natural colour annatto extract (Butter Colour). *Toxicological Aspects of Food Safety Arch. Toxicol*, 143(1): 141–143. [https://doi.org/10.1007/978-3-642-66896-8\\_16](https://doi.org/10.1007/978-3-642-66896-8_16).
- Milenković, S. M., Zvezdanović, J. B., and Anđelković, T. D. (2012). The identification of chlorophyll and its derivatis in the pigment mixtures : HPLC-



- chromatography, visible and mass spectrofotometry studies. *Advanced Technologies*, 1(1): 16–24. <http://www.tf.ni.ac.rs/images/casopisi/vollsveska1/c2.pdf>.
- Moyano, M. J., Heredia, F. J., and Meléndez-Martínez, A. J. (2010). The color of olive oils: The pigments and their likely health benefits and visual and instrumental methods of analysis. *Comprehensive Reviews in Food Science and Food Safety*, 9(3): 278–291. <https://doi.org/10.1111/j.1541-4337.2010.00109.x>.
- Natisri, S., Mahattanatawee, K., and Thaiudom, S. 2014. Improving the flavor of soy ice cream by adding lemongrass or pandan leaf extracts or Pandan Leaf Extracts. *CMUJ NS Special Issue on Food and Applied Bioscience*, 113(1):469-482. Doi: 10.12982/cmujns.2014.0050.
- NCBI (National Center for Biotechnology Information). (2021). PubChem Compound Summary for CID 5727, Zinc chloride. Retrieved June 21, 2021 from <https://pubchem.ncbi.nlm.nih.gov/compound/Zinc-chloride>.
- Nesterenko, A., Alric, I., Silvestre, F., and Durrieu, V. (2013). Vegetable proteins in microencapsulation: A review of recent interventions and their effectiveness. *Industrial Crops and Products*, 42: 469–479. <https://doi.org/10.1016/j.indcrop.2012.06.035>.
- Ngamwonglumlert, L., Devahastin, S., and Chiewchan, N. (2015). Natural colorants : Pigment stability and extraction yield enhancement via utilization of appropriate pretreatment and extraction methods. *Critical Reviews in Food Science and Nutrition*. 57(15):3243-3259. <https://doi.org/10.1080/10408398.2015.1109498>.
- Ngamwonglumlert, L., Devahastin, S., and Chiewchan, N. (2017). Molecular structure, stability and cytotoxicity of natural green colorants produced from *Centella asiatica* L. leaves treated by steaming and metal complexations. *Food Chemistry*, 232: 387–394. <https://doi.org/10.1016/j.foodchem.2017.04.034>.
- Ngo, T., and Zhao, Y. (2007). Formation of zinc-chlorophyll-derivative complexes in thermally processed green pears (*Pyrus communis* L.). *Journal of Food Science*, 72(7): 397–404. <https://doi.org/10.1111/j.1750-3841.2007.00465.x>.
- Niciforovic, N., Mihailovic, V., Maškovic, P., Solujic, S., Stojkovic, A., and Pavlovic, D. (2010). Antioxidant activity of selected plant species; potential new sources of natural antioxidants. *Food and Chemical Toxicology*, 48: 3125–3130. <https://doi.org/10.1016/j.fct.2010.08.007>.
- Nikolaeva, M. K., Maevskaya, S. N., Shugaev, A. G., and Bukhov, N. G. (2010). Effect of drought on chlorophyll content and antioxidant enzyme activities in leaves of three wheat cultivars varying in productivity. *Russian Journal of Plant Physiology*, 57(1): 87–95. <https://doi.org/10.1134/S1021443710010127>.
- Ningrum, A., and Schreiner, M. (2014). Pandan leaves (*Pandanus amaryllifolius*

- Roxb.) "Vanilla of the East" and its application as food ingredient. *Tropentag, September*: 17–19. [https://www.teknoscienze.com/Contents/Riviste/PDF/AF3\\_2014\\_RGB\\_12-16.pdf](https://www.teknoscienze.com/Contents/Riviste/PDF/AF3_2014_RGB_12-16.pdf).
- Nurdin, C., Kusharto, C. M., dan Tanziha, I. (2009). Kandungan klorofil berbagai jenis daun tanaman dan Cu-turunan klorofil serta sifat fisiko kimianya. *Jurnal Gizi dan Pangan*, 4(1): 13–19. <https://doi.org/10.25182/jgp.2009.4.1.13-19>.
- Ohashi, S., Kasahara, M., Fukuyo, S., Nakazato, M., Iwamoto, K., Shiraiwa, Y., Kato, Y., Watanabe, T., and Kobayashi, M. (2008). Redox potential of chlorophyll d. In J. F. Allen, E. Gantt, J. H. Golbeck, and B. Osmond (Eds.), *Photosynthesis. Energy from the Sun: 14th International Congress on Photosynthesis*, pp: 105–106. Springer, Dordrecht. [https://doi.org/10.1007/978-1-4020-6709-9\\_24](https://doi.org/10.1007/978-1-4020-6709-9_24).
- Oliveira, W. P., Souza, C. R. F., Kurozawa, L. E., and Park, K. L. (2010). Spray drying of food and herbal products. In M. W. Woo, A. S. Mujumdar, and W. R. W. Daud (Eds.), *Spray Drying Technology*, pp: 113–156. National University of Singapore, Singapore.
- Oluwaniyi, O. O., Dosumu, O. O., Awolola, G. . V, and Abdulraheem, A. F. (2009). Nutritional analysis and stability studies of some natural and synthetic food colourants. *American Journal of Food Technology*, 4(5): 218–225. <https://dx.doi.org/10.3923/ajft.2009.218.225>.
- Onwulata, C. L., Smith, P. W., and Holsinger, V. H. (1995). Flow and compaction of spray-dried powders of anhydrous butter oil and high melting milkfat encapsulated in disaccharides. *Journal of Food Science*, 60(4): 836–840. <https://doi.org/10.1111/j.1365-2621.1995.tb06242.x>.
- Özkan, G., and Bilek, S. E. (2014). Microencapsulation of natural food colourants. *International Journal of Nutrition and Food Sciences*, 3(3): 145–156. <https://doi.org/10.11648/j.ijnfs.20140303.13>.
- Park, J, Lee, G., Kang, J., Jeon, I., Kim, J., Kim, T., and Kang, C. (2013). Improvement of photostability and dissolution profile of isradipine using inclusion complex. *Journal of Pharmaceutical Investigation*, 43: 55–61. <https://doi.org/10.1007/s40005-013-0052-9>.
- Park, J, Kim, T. S., Kim, M., and Lee, J. (2013). Prooxidative and antioxidative properties of b-carotene in chlorophyll and riboflavin photosensitized oil-in-water emulsions. *Food Chemistry*, 140(1–2): 255–261. <https://doi.org/10.1016/j.foodchem.2013.02.036>.
- Pathare, P. B., Opara, U. L., and Al-Said, F. A. (2013). Colour Measurement and Analysis in Fresh and Processed Foods: A Review. *Food and Bioprocess Technology*, 6(1): 36–60. <https://doi.org/10.1007/s11947-012-0867-9>.
- Patnaik, P. (2003). *Handbook of Inorganic Chemicals*. Mc Graw-Hill. New York.
- Pendrous, R. (2006). Natural progression of color. *Food Manufacture* **June**:18. [www.foodmanufacture.co.uk](http://www.foodmanufacture.co.uk).

- Perez-Galvez, A., Viera, I., and Roca, M. (2020). Carotenoids and Chlorophylls as Antioxidants. *Antioxidants*, 9(505):1-39. <http://dx.doi.org/10.3390/antiox9060505>
- Petisco, C., García-Criado, B., García-Criado, L., Vázquez-de-Aldana, B. R., and García-Ciudad, A. (2009). Quantitative analysis of chlorophyll and protein in alfalfa leaves using fiber-optic near-infrared spectroscopy. *Communications in Soil Science and Plant Analysis*, 40(15–16): 2474–2484. <https://doi.org/10.1080/00103620903111350>.
- Petrovic, J., Nikolic, G., and Markovic, D. (2006). In vitro complexes of copper and zinc with chlorophyll. *Journal of the Serbian Chemical Society*, 71(5): 501–512. <https://doi.org/10.2298/JSC0605501P>.
- Phunpee, S., Ruktanonchai, U. R., Yoshii, H., Assabumrungrat, S., and Soottitantawat, A. (2017). Encapsulation of lemongrass oil with cyclodextrins by spray drying and its controlled release characteristics. *Bioscience, Biotechnology and Biochemistry*, 81(4): 718–723. <https://doi.org/10.1080/09168451.2016.1277942>.
- Ponginebbi, L., Nawar, W.W., and Chinachoti, P. (1999). Oxidation of linoleic acid in emulsions: Effect of substrate, emulsifier, and sugar concentration. *Journal of The American Oil Chemist' Society*, 76(1): 131-138.
- Poonlaphdecha, J., Gantet, P., Maraval, I., Sauvage, F., Menut, C., Morère, A., Boulanger, R., Wüst, M., and Gunata, Z. (2016). Biosynthesis of 2-acetyl-1-pyrroline in rice calli cultures : Demonstration of 1-pyrroline as a limiting substrate. *Food Chemistry*, 197: 965–971. <https://doi.org/10.1016/j.foodchem.2015.11.060>.
- Porrarud, S., and Pranee, A. (2010). Microencapsulation of Zn-chlorophyll pigment from pandan leaf by spray drying and its characteristic. *International Food Research Journal*, 17(4): 1031–1042. <http://www.ifrj.upm.edu.my/>
- Premi, M., and Sharma, H. K. (2017). Effect of different combinations of maltodextrin, gum arabic and whey protein concentrate on the encapsulation behavior and oxidative stability of spray dried drumstick (*Moringa oleifera*) oil. *International Journal of Biological Macromolecules*, 105: 1232–1240. <https://doi.org/10.1016/j.ijbiomac.2017.07.160>.
- Prochaska, K., Kedziora, P., Thanh, J. L., and Lewandowicz, G. (2007). Surface properties of enzymatic hydrolysis products of octenylsuccinate starch derivatives. *Food Hydrocolloids*, 21: 654–659. <https://doi.org/10.1016/j.foodhyd.2006.07.010>.
- Pumilia, G., Cichon, M. J., Cooperstone, J. L., Giuffrida, D., Dugo, G., and Schwartz, S. J. (2014). Changes in chlorophylls, chlorophyll degradation products and lutein in pistachio kernels (*Pistacia vera* L.) during roasting. *Food Research International*, 65(PB): 193–198. <https://doi.org/10.1016/j.foodres.2014.05.047>.
- Raei, A., Ali, S., Ardakani, Y., and Daneshi, M. (2017). Microencapsulation of the

- green pigment of alfalfa and its applications on heated food. *Journal of Food Process Engineering*, e12529: 1–9. <https://doi.org/10.1111/jfpe.12529>.
- Raharjo, S. (2006). *Kerusakan Oksidatif Pada Makanan*. Gadjah Mada University Press. Yogyakarta.
- Rahayu, S.E., Kartawinata, K., Chikmawati, T., Hartana, A. (2011). Leaf anatomy of pandanus spesies (Pandanaceae) from Java. *Reinwardtia*, 13(3): 305–313. <https://doi.org/10.14203/reinwardtia.v13i3.449>.
- Rahayu, S. E., dan Handayani, S. (2013). Keanekaragaman morfologi dan anatomi pandanus (Pandanaceae) di Jawa Barat. *Vis Vitalis*, 01(2): 29–44. <https://www.researchgate.net/publication/325127044>.
- Rajabi, H., Ghorbani, M., Jafari, S. M., Sadeghi Mahoonak, A., and Rajabzadeh, G. (2015). Retention of saffron bioactive components by spray drying encapsulation using maltodextrin, gum arabic and gelatin as wall materials. *Food Hydrocolloids*, 51: 327–337. <https://doi.org/10.1016/j.foodhyd.2015.05.033>.
- Rajendiran, N., and Venkatesh, G. (2015). Micrometer size rod formed by secondary self assembly of omeprazole with  $\alpha$ - And  $\beta$ -cyclodextrins. *Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy*, 137: 832–840. <https://doi.org/10.1016/j.saa.2014.08.074>.
- Rakshit, A., Khatua, K., Shanbhag, V., Comba, P., and Datta, A. (2018). Cu<sup>2+</sup> selective chelators relieve copper-induced oxidative stress in vivo. *Chemical Science*, 9: 7916–7930. <https://doi.org/10.1039/c8sc04041a>.
- Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. ., Minorsky, P. V., and Jackson, R. B. (2005). *Campbell Biology* (6th edn). Pearson Benjamin Cummings Publisher, San Fransisco.
- Reineccius, G. A. (2004). The spray drying of food flavors. *Drying Technology*, 22(6): 1289–1324. <https://doi.org/10.1081/DRT-120038731>.
- Rios, J.J. Roca, M., and Perez-Galvez, A. (2014). Non-fluorescent chlorophyll catabolites in quince fruits. *Food Research International*, 65(part B): 255–262. <https://doi.org/10.1016/j.foodres.2014.03.063>
- Roca, M., Chen, K., and Pérez-Gálvez, A. (2016). Chlorophylls. In R. Carle and R. M. Schweiggert (Eds.), *Handbook on Natural Pigments in Food and Beverages: Industrial Applications for Improving Food Color*, pp: 125–158. Elsevier Ltd. <https://doi.org/10.1016/B978-0-08-100371-8.00006-3>.
- Rodriguez-Amaya, D. B. (2016). Natural food pigments and colorants. In *Current Opinion in Food Science*, Vol. 7. <https://doi.org/10.1016/j.cofs.2015.08.004>.
- Rohmawati, E. (2010). Skrining kandungan kimia daun pandan (*Pandanus amaryllifolius*) serta isolasi dan identifikasi alkaloidnya. In: Sundari, P. D., Dzulkarnain, B., Widowati, L., Winarno, M.W., Astuti, Y, N., Adjirni (Ed.), *Penelitian tanaman obat di beberapa perguruan tinggi di Indonesia*. Badan Penelitian dan Pengembangan Kesehatan, Pusat Penelitian dan

Pengembangan Farmasi, Departemen Kesehatan RI, Jakarta.

- Rohrig, B. (2015). The chemistry of food coloring: eating with your eyes. *ChemMatters*, October/November, 5–7. <http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=680031>.
- Rosenberg, M., Kopelman, I. J., and Talmon, Y. J. (1990). Factors affecting retention in spray-drying microencapsulation of volatile materials. *Journal of Agricultural and Food Chemistry*, 38(5): 1288–1294. <https://doi.org/10.1021/jf00095a030>.
- Roy, M. K., Juneja, R. L., Isobe, S., and Tsushida, T. (2009). Steam processed broccoli (*Brassica oleracea*) has higher antioxidant activity in chemical and cellular assay systems. *Food Chemistry*, 114: 263–269. <https://doi.org/10.1016/j.foodchem.2008.09.050>.
- Rukmini, A., and Raharjo, S. (2010). Pattern of peroxide value changes in virgin coconut oil (VCO) due to photo-oxidation sensitized by chlorophyll. *Journal of the American Oil Chemists Society*, 87(12): 1407–1412. <https://doi.org/10.1007/s11746-010-1641-7>.
- Rymbai, H., Sharma, R. R. R., and Srivastav, M. M. (2011). Biocolorants and its implications in health and food industry - A review. *International Journal of PharmTech Research*, 3(4): 2228–2244. [http://sphinxσαι.com/Vol.3No.4/pharm/pdf/PT=52\(2228-2244\)OD11.pdf](http://sphinxσαι.com/Vol.3No.4/pharm/pdf/PT=52(2228-2244)OD11.pdf).
- Sánchez, C., Baranda, A. B., and De Marañón, I. M. (2014). The effect of high pressure and high temperature processing on carotenoids and chlorophylls content in some vegetables. *Food Chemistry*, 163: 37–45. <https://doi.org/10.1016/j.foodchem.2014.04.041>.
- Sanjeev, K., and Ramesh, M. N. (2006). Low oxygen and inert gas processing of foods. *Critical Reviews in Food Science and Nutrition*, 46: 423–451. <https://doi.org/10.1080/10408390500215670>.
- Santoso, U. (2016). *Antioksidan pangan*. Gadjah Mada University Press. Yogyakarta.
- Sarker, U., Islam, T., Rabbani, G., and Oba, S. (2018). Variability in total antioxidant capacity, antioxidant leaf pigments and foliage yield of vegetable amaranth. *Journal of Integrative Agriculture*, 17(5): 1145–1153. [https://doi.org/10.1016/S2095-3119\(17\)61778-7](https://doi.org/10.1016/S2095-3119(17)61778-7).
- Sasaki, Y. F., Kawaguchi, S., Kamaya, A., Ohshita, M., Kabasawa, K., Iwama, K., Taniguchi, K., and Tsuda, S. (2002). The comet assay with 8 mouse organs: Results with 39 currently used food additives. *Mutation Research - Genetic Toxicology and Environmental Mutagenesis*, 519(1–2): 103–119. [https://doi.org/10.1016/S1383-5718\(02\)00128-6](https://doi.org/10.1016/S1383-5718(02)00128-6).
- Schilsky, M. L., Blank, R. R., Czaja, M. J., Zern, M. A., Scheinberg, I. H., Stockert, R. J., and Sternlieb, I. (1989). Hepatocellular copper toxicity and its attenuation by zinc. *Journal of Clinical Investigation*, 84(5): 1562–1568.



<https://doi.org/10.1172/JCI114333>.

- Schumann, R., Häubner, N., Klausch, S., and Karsten, U. (2005). Chlorophyll extraction methods for the quantification of green microalgae colonizing building facades. *International Biodeterioration and Biodegradation*, 55(3): 213–222. <https://doi.org/10.1016/j.ibiod.2004.12.002>.
- Schwartz, S.J., Cooperstone, J. L., Cichon, M. J., von Elbe, J. H., and Giusti, M. M. (2017). Colorants. In S. Damodaran, K. L. Parkin, and O. R. Fennema (Eds.), *Fennema's food chemistry*, 5th Edn, pp: 698–701. CRC Press Taylor and Francis Group, Boca Raton.
- Schwartz, Steven J., and Lorenzo, T. V. (1990). Chlorophylls in Foods. *Critical Reviews in Food Science and Nutrition*, 29(1): 1–17. <https://doi.org/10.1080/10408399009527511>.
- Sekhon, B. S. (2010). Food nanotechnology - an overview. *Nanotechnology, Science and Applications*, 3(1): 1–15. <https://doi.org/10.2147/NSA.S8677>.
- Selig, M. J., Gamaleldin, S., Celli, G. B., Marchuk, M. A., Smilgies, D. M., and Abbaspourrad, A. (2020). The stabilization of food grade copper-chlorophyllin in low pH solutions through association with anionic polysaccharides. *Food Hydrocolloids*, 98: 1–5. <https://doi.org/10.1016/j.foodhyd.2019.105255>.
- Senklang, P., and Anprung, P. (2010). Optimizing enzymatic extraction of Zn-chlorophyll derivatives from pandan leaf using response surface methodology. *Journal of Food Processing and Preservation*, 34(5): 759–776. <https://doi.org/10.1111/j.1745-4549.2009.00393.x>.
- Sessa, M., Ferrari, G., and Donsì, F. (2015). Novel edible coating containing essential oil nanoemulsions to prolong the shelf life of vegetable products. *Chemical Engineering Transactions*, 43: 55–60. <https://doi.org/10.3303/CET1543010>.
- Shah, N. N., and Singhal, R. S. (2018). A two-tier modified starch-oxidation followed by n-octenyl succinylation as gum Arabic substitute: Process details and characterization. *Journal of Food Engineering*, 226: 96–104. <https://doi.org/10.1016/j.jfoodeng.2018.01.019>.
- Shahidi, F. (2015). Antioxidants: principles and applications. In F Shahidi (Ed.), *Handbook of Antioxidants for Food Preservation*, pp: 1–14. Woodhead Publishing Limited, Ansterdam. <https://doi.org/10.1016/B978-1-78242-089-7.00001-4>.
- Shahidi, F., and Han, X. (1993). Encapsulation of Food ingredients. *Critical Reviews in Food Science and Nutrition*, 33(6): 501–547. <https://doi.org/10.1080/10408399309527645>.
- Shantha, N. C., and Decker, E. A. (1994). Rapid, sensitive, iron-based spectrophotometric methods for determination of peroxide values of food lipids. *Journal of AOAC International*, 77(2): 421–424. <https://doi.org/>

[10.1093/jaoac/77.2.421](https://doi.org/10.1093/jaoac/77.2.421).

- Sharma, L. K., Agarwal, D., Sharma, Y., Rathore, S. S., and Saxena, S. N. (2014). Cryogenic grinding technology enhances volatile oil, oleoresin and antioxidant activity of cumin (*Cuminum cyminum* L.). *International Journal of Seed Spices*, 4(2): 68–72. <http://issind.in/pdf/2014volume/11.pdf>.
- Shekhar, K., Madhu, M. N., Pradeep, B., and Banji, D. (2010). A review on microencapsulation. *International Journal of Pharmaceutical Sciences Review and Research*, 5(2): 58–62. [www.globalresearchonline.net](http://www.globalresearchonline.net).
- Shim, S. (2012). Chelating effect of leek (*Allium tuberosum* Rottler ex Sprengel) containing chlorophyll on Cd, Pb, and As. *Journal of the Korean Society for Applied Biological Chemistry*, 55: 311–315. <https://doi.org/10.1007/s13765-012-1151-4>.
- Shimada, C., Kano, K., Sasaki, Y. F., Sato, I., and Tsudua, S. (2010). Differential colon DNA damage induced by azo food additives between rats and mice. *The Journal of Toxicological Sciences*, 35(4): 547–554. <https://doi.org/10.2131/jts.35.547>.
- Simpson, B.K., Benjakul, S., and Klomklao, S. (2012). Natural Food Pigments. In: Simpson, B. K., Leo, M.L., Nollet, Toldra, F., Benjakul, S., Paliyath, G., and Hui, Y.H. (eds.). *Food Biochemistry and Food Processing*. 2<sup>nd</sup> edn. John and Wiley Son, Inc, USA.
- Simpson, B. K. (1985). Chemical Changes in Natural food Pigments. In: Rochardson, T. and Finley, J. W. (eds) *Chemical Changes in Foods During Processing*. Springer Science+Business Media, LLC, New York
- Smolin, A. A., and Grosvenor, M. B. (2010). *Nutrition Science and Applications* (2nd ed.). John Wiley and Son, New Jersey.
- Sowndhararajan, K., Chin, N. L., Yusof, Y. A., Lai, L. L., and Mustapha, W. A. W. (2016). Effect of blender and blending time on color and aroma characteristics of juice and its freeze-dried powder of *Pandanus amaryllifolius* Roxb. leaves (pandan). *International Journal of Food Engineering*, 12(1): 75–81. <https://doi.org/10.1515/ijfe-2015-0096>.
- Stich, E. (2016). Food Color and Coloring Food: Quality, Differentiation and Regulatory Requirements in the European Union and the United States. In: Carle, R. and Schweiggert, R. M. (eds). *Handbook on Natural Pigments in Food and Beverages: Industrial Applications for Improving Food Color*. Woodhead Publishing, Cambridge.
- Stone, B. C. C. (1978). Studies in Malesian Pandanaceae XVII on the taxonomy of “pandan wangi” a pandanus cultivar with scented leaves. *Economic Botany*, 32(3): 285–293. <https://doi.org/10.1007/BF02864702>.
- Suryani, C, L., dan Setyowati, A. (2016). *Pengembangan makanan fungsional bagi penderita diabetes berbasis beras dan tepung pandan*. Universitas Mercu Buana Yogyakarta, Yogyakarta.

- Suryani, C. L., Tamaroh, S., and Budipitojo, T. (2018). Increased of hypoglycemic effect and pancreatic regeneration of *Pandanus amaryfollius* leaves ethyl acetate extract in streptozotocin-induced diabetic rats. *International Food Research Journal*, 25(5): 1792–1798. <http://www.ifrj.upm.edu.my>.
- Suryani, C. L., Tamaroh, S., Ardiyan, A., and Setyowati, A. (2017). Aktivitas antioksidan ekstrak etanol daun pandan (*Pandanus Amaryllifolius*) dan fraksi-fraksinya. *Agritech*, 37(3), 271–279. <https://doi.org/http://doi.org/10.22146/agritech.11312>.
- Suzuki, T., Inoue, M., and Shioi, Y. (2014). Purification and properties of metal-chelating substance in chlorophyll degradation. *Journal of Tropical Plant Physiology*, 6(1): 35–49. <https://www.researchgate.net/publication/273946090>
- Sweedman, M. C., Tizzotti, M. J., Schäfer, C., and Gilbert, R. G. (2013). Structure and physicochemical properties of octenyl succinic anhydride modified starches: A review. *Carbohydrate Polymers*, 92(1): 905–920. <https://doi.org/10.1016/j.carbpol.2012.09.040>.
- Szejtli, J. (1998). Introduction and general overview of cyclodextrin chemistry. *Chemical Reviews*, 98(5): 1743–1753. <https://doi.org/10.1021/cr970022c>.
- Taroreh, M., Raharjo, S., Hastuti, P., and Murdiati, A. (2015). Antioxidant activities of sequentially extracted gedi (*Abelmoschus manihot* L) leaves. *Agritech*, 35(3): 280–287. <https://doi.org/10.22146/agritech.9338>.
- Todd, D. B. (2014). Solvent Extraction. In H. C. Vogel and C. L. Todaro (Eds.), *Fermentation and Biochemical Engineering Handbook*, 3th edn, pp: 225–238. Elsevier Inc. London. <https://doi.org/10.1016/B978-1-4557-2553-3.00012-X>.
- Tonucci, L. H., and von Elbe, J. H. (1992). Kinetics of the formation of zinc complexes of chlorophyll derivatives. *Journal of Agricultural and Food Chemistry*, 40(12): 2341–2344. <https://doi.org/10.1021/jf00024a004>.
- Turkmen, N., Poyrazoglu, E. S., Sari, F., and Velioglu, Y. S. (2006). Effects of cooking methods on chlorophylls, pheophytins and colour of selected green vegetables. *International Journal of Food Science and Technology*, 41: 281–288. <https://doi.org/10.1111/j.1365-2621.2005.01061.x>.
- Uekaji, Y., Jo, A., Urano, A., and Terao, K. (2013). Application of  $\gamma$ -Cyclodextrin in Nanomedicinal Foods and Cosmetics. In F. S. D. Bagchi, M. Bagchi, H. Moriyama (Eds.), *Bio-Nanotechnology*. John Wiley and Sons, New Jersey. <https://doi.org/10.1002/9781118451915.ch10>
- Usuki, R., Endo, Y., and Kaneda, T. (1984). Prooxidant activities of chlorophylls and pheophytins on the photooxidation of edible oils. *Agricultural and Biological Chemistry*, 48(4): 991–994. <https://doi.org/10.1080/00021369.1984.10866254>.
- Valente, A. J.M., and Soderman, O. (2014). The formation of host-guest complexes

- between surfactants and cyclodextrins. *Advances in Colloid and Interface Science*, 205:156-176 doi: 10.1016/j.cis.2013.08.001
- Vernon, L. P. (1960). Spectrophotometry determination of chlorophylls and pheophytins in plant extracts. *Analytical Chemistry*, 32(9): 1144–1150. <https://doi.org/10.1021/ac60165a029>.
- Vongsawasdi, P., Nopharatana, M., Sasaeng, K., Tantek, P., and Wongphaisitpisan, S. (2010). Kinetics of chlorophyll degradation in pandanus juice during pasteurization. *Asian Journal of Food and Agro-Industry*, 3(01): 44–51. [www.ajofai.info](http://www.ajofai.info).
- Wagner, L. A. and Warthesen, J.J. (1995). Stability of spray-dried encapsulated carrot carotenes. *Journal of Food Science*, 60(5): 1048–1053. <https://doi.org/10.1111/j.1365-2621.1995.tb06290.x>.
- Wakte, K. V, Nadaf, A. B., Thengane, R. J., and Jawali, N. (2009). *Pandanus amaryllifolius* Roxb. cultivated as a spice in coastal regions of India. *Genetic Resources and Crop Evolution*, 56(5): 735–740. <https://doi.org/10.1007/s10722-009-9431-5>.
- Wakte, K. V, Thengane, R. J., Jawali, N., and Nadaf, A. B. (2010). Optimization of HS-SPME conditions for quantification of 2-acetyl-1-pyrroline and study of other volatiles in *Pandanus amaryllifolius* Roxb . *Food Chemistry*, 121(2): 595–600. <https://doi.org/10.1016/j.foodchem.2009.12.056>.
- Wang, J., Su, L., and Wang, S. (2010). Physicochemical properties of octenyl succinic anhydride-modified potato starch with different degrees of substitution. *Journal of the Science of Food and Agriculture*, 90(3): 424–429. <https://doi.org/10.1002/jsfa.3832>.
- Wang, T., Jónsdóttir, R., and Ólafsdóttir, G. (2009). Total phenolic compounds, radical scavenging and metal chelation of extracts from Icelandic seaweeds. *Food Chemistry*, 116(1): 240–248. <https://doi.org/10.1016/j.foodchem.2009.02.041>.
- Wang, X., Liu, C., Shi, Z., Pan, M., and Yu, D. (2020). Protein-encapsulated chlorophyll a molecules for biological solar cells. *Materials and Design*, 195: 1–6. <https://doi.org/10.1016/j.matdes.2020.108983>.
- Wen, X., Takenaka, M., Murata, M., and Homma, S. (2004). Antioxidative activity of a zinc-chelating substance in coffee. *Bioscience, Biotechnology and Biochemistry*, 68(11): 2313–2318. <https://doi.org/10.1271/bbb.68.2313>.
- Wijaya, C, H., dan Sadikin, A, C. (1994). Pembuatan flavor bubuk dari pandan wangi (*Pandanus amaryllifolius*) dengan metode mikrokapsulasi. *Buletin Penelitian Ilmu dan Teknologi Pangan*, IV(2): 1-6.
- Wilczek, M., Bertling, J., and Hintemann, D. (2004). Optimised technologies for cryogenic grinding. *International Journal of Mineral Processing*, 74S: S425–S434. <https://doi.org/10.1016/j.minpro.2004.07.032>.
- Wongpornchai, S. (2006). Pandan wangi. In K. Peter (Ed.), *Handbook of Herbs and*

- Spices*, Vol. 3, pp: 453–459. Woodhead Publishing Ltd, Cambridge.  
<https://doi.org/10.1533/9781845691717.3.453>.
- Wu, D., and Sun, D. W. (2013). Colour measurements by computer vision for food quality control - A review. *Trends in Food Science and Technology*, 29(1): 5–20. <https://doi.org/10.1016/j.tifs.2012.08.004>.
- Yang, C. M., Chang, K. W., Yin, M. H., and Huang, H. M. (1998). Methods for the determination of the chlorophylls and their derivatives. *Taiwania*, 43(2): 116–122. <https://taiwania.ntu.edu.tw/pdf/tai.1998.43.116.pdf>.
- Yakimovskii, A.F., and Kryzhanovskaya, S.Y. (2015). Zinc chloride and zinc acetate injected into neotriatum produce opposite effect on locomotor behavior of rats. *Bulletin of Experimental Biology and Medicine*, 160(2):281–282. DOI 10.1007/s10517-015-3150-z.
- Young, A. J., and Lowe, G. L. (2018). Carotenoids — Antioxidant properties. *Antioxidants*, 7(28), 10–13. <https://doi.org/10.3390/antiox7020028>.
- Yulianti, D., Sunardi, and Wibowo, W. (2017). Effect of tween 80 addition on natural dye extraction into suji Leaf (*Pleomele angustifolia* N.E. Brown) and Pandan Leaves (*Pandanus amaryllifolius* Roxb). Proceeding of *The 2nd International Seminar on Chemical Education 2017*: 137–145. <http://chemistryeducation.uii.ac.id/wp-content/uploads/2017/10/pdf>.
- Zasyepkin, D., and Porzio, M. (2004). Glass encapsulation of flavours with chemically modified starch blends. *Journal of Microencapsulation*, 21(4): 385–397. <https://doi.org/10.1080/02652040410001695924>.
- Zeb, A., and Imran, M. (2019). Carotenoids, pigments, phenolic composition and antioxidant activity of *Oxalis corniculata* leaves. *Food Bioscience*, 32(September 2018): 1–9. <https://doi.org/10.1016/j.fbio.2019.100472>.
- Zhan, R., Wu, J., and Ouyang, J. (2014). In vitro antioxidant activities of sodium zinc and sodium iron chlorophyllins from pine needles. *Food Technology and Biotechnology*, 52(4): 505–510. <https://doi.org/10.17113/ftb.52.04.14.3592>.
- Zhang, H., Schäfer, C., Wu, P., Deng, B., Yang, G., Li, E., Gilbert, R. G., and Li, C. (2018). Mechanistic understanding of the relationships between molecular structure and emulsification properties of octenyl succinic anhydride (OSA) modified starches. *Food Hydrocolloids*, 74: 168–175. <https://doi.org/10.1016/j.foodhyd.2017.08.009>.
- Zhang, Y. J., Yan, F., Gao, H., Xu, Y. Z., Guo, Y. Y., Wang, E. J., Li, Y. H., and Xie, Z. K. (2015). Chlorophyll content, leaf gas exchange and growth of oriental lily as affected by shading. *Russian Journal of Plant Physiology*, 62(3): 334–339. <https://doi.org/10.1134/S1021443715030206>.
- Zheng, Y., Shi, J., Pan, Z., Cheng, Y., Zhang, Y., and Li, N. (2014). Effect of heat treatment, pH, sugar concentration, and metal ion addition on green color retention in homogenized puree of Thompson seedless grape. *LWT - Food Science and Technology*, 55(2): 595–603. <https://doi.org/10.1016/j.lwt>.



[2013.10.01.](#)

- Zvezdanovic, J. B., Petrovic, S. M., Markovic, D. Z., Andjelkovic, T. D., and Andjejkovic, D. H. (2014). Electrospray ionization mass spectrometry combined with ultra high performance liquid chromatography in the analysis of in vitro formation of chlorophyll complexes with copper and zinc. *Journal of Serbian Chemical Society*, 79(6): 689–706. <http://wrviv.doiserbia.nb.rs/img/doi/0352-5139/2014/0352-51391400009Z.pdf>
- Zvezdanović, J., and Marković, D. (2009). Copper, iron, and zinc interactions with chlorophyll in extracts of photosynthetic pigments studied by VIS spectroscopy. *Russian Journal of Physical Chemistry A*, 83(9): 1542–1546. <https://doi.org/10.1134/S0036024409090222>.