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DAFTAR PUSTAKA

Adawiyah, D. R., D. Puspitasari, dan Lince. 2020. Profil sensori deskriptif produk pemanis tunggal dan campuran. Jurnal Teknologi dan Industri Pangan 31(1): 9-20.

Adjali, A., I. Clarot, Z. Chen, E. Marchioni, and A. Boudier. 2022. Physicochemical degradation of phycocyanin and means to improve its stability: A short review. Journal of Pharmaceutical Analysis. *12*(3): 406-414.

Aftari, R., K. Rezaei, A. Mortazavi, and A. R. Bandani. 2015. The optimized concentration and purity of Spirulina platensis C-phycocyanin: a comparative study on microwave-assisted and ultrasound-assisted extraction methods. Journal of Food Processing and Preservation. *39*(6): 3080-3091.

Agustini T. W., E. S. Mauliasari dan U. Amalia. 2019. Stabilisasi fikosianin Spirulina platensis dengan perlakuan mikroenkapsulasi dan pH. *Jurnal Pengolahan Hasil Perikanan Indonesia*. 22(3): 526-534.

Ahmadi, A., S.A.A. Anvar, B. Nowruzi, and L. Golestan. 2024. Effect of phycocyanin and phycoerythrin on antioxidant and antimicrobial activity of refrigerated low-fat yogurt and cream cheese. Scientific Reports. 14(1): 27661.

Al-Ashmawy, M.A., and J.I. Ibrahim. 2009. Influence of potassium sorbate on the growth of yeasts and moulds in yogurt. International Journal of Dairy Technology. 62(2): 224-227.

Al-Dabbas, M.M., E.G. Abu Samaan, S. Iqbal, H.J. Hamad, R. Al-Jaloudi, M. Shahein, and M. Abughoush. 2025. Antioxidant, physiochemical, and sensory properties of functional marshmallow produced from honey, strawberry concentrates, and hibiscus extract. Foods. 14(2): 265.

Ambarwati, R., S. Andini, dan S. Salwah. 2023. Optimasi waktu perendaman dan waktu ekstraksi pembuatan gelatin dari sisik ikan nila hitam (*Oreochromis niloticus*) sebagai *gelling agent*: Optimization of soaking time and extraction time for making gelatin from black tilapia (*Oreochromis niloticus*) fish scales as a *gelling agent*. Jurnal Sains dan Kesehatan. 5(5): 685-694.

Amertaningtyas, D., F.B. Risti, E.S. Widyastuti, H. Evanuarini, K.U. Al Awwaly, D. Masyithoh, dan R.A. Saleha. 2025. Quality characteristics of marshmallow candy made with beef bone gelatin and powdered cream milk: Texture, water content, Aw, and pH. Proceedings of the 5th International Conference on Environmentally Sustainable Animal Industry (ICESAI 2024). 45: 47.

Aminah, A., S. Maryam, M. Baits, dan U. Kalsum. 2016. Perbandingan aktivitas antioksidan ekstrak etanol daun sirsak (*Annona muricata* L.) berdasarkan tempat

UNIVERSITAS
GADJAH MADA
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tumbuh dengan metode peredaman DPPH. Jurnal Fitofarmaka Indonesia. 3(1): 146-150.

Andini, D.F. 2017. Formulasi *hard candy* menggunakan pewarna alami fikosianin *Spirulina platensis*. Jurnal Agroindustri Halal. 3(2): 117-125.

Antelo, F.S., J.A. Costa, and S.J. Kalil. 2008. Thermal degradation kinetics of the phycocyanin from Spirulina platensis. Biochemical Engineering Journal. 41(1): 43-47.

AOAC. 2005. Official Methods of Analysis of the Association of Analytical Chemist. Association of Official Analytical Chemist. Inc, Virginia, USA.

Arizona, K., D. T. Laswati, D. dan K. S. A. Rukmi. 2021. Studi pembuatan *marshmallow* dengan variasi konsentrasi gelatin dan sukrosa. Agrotech: Jurnal Ilmiah Teknologi Pertanian. 3(2): 11-17.

Arlyza, I. S. 2005. Isolasi pigmen biru *phycocyanin* dari mikroalga *Spirulina platensis*. Oceanologi dan Limnologi di Indonesia. Pusat Penelitian Oceanografi-LIPI. (38): 79-92.

Arpi, N., Fahrizal, and M. Novita. 2018. Isolation of fish skin and bone gelatin from tilapia *(Oreochromis niloticus): Response surface approach*. IOP Conference Series: Materials Science and Engineering. 334: 012061.

Arslan, R., and S. Aksay. 2022. Investigation of sensorial and physicochemical properties of yoghurt colored with phycocyanin of *Spirulina platensis*. Journal of Food Processing and Preservation. 46(6): e15941.

ASTM International. 2024. ASTM E1909-24: Standard guide for time-intensity evaluation of sensory attributes. ASTM International. West Conshohocken.

ASTM. 2012. Standard Guide for Time Intensity Evaluation of Sensory Attributes. ASTM International. United States.

Athiyappan, K. D., W. Routray, and B. Paramasivan. 2024. Phycocyanin from Spirulina: a comprehensive review on cultivation, extraction, purification, and its application in food and allied industries. Food and Humanity. *2*: 100235.

Aziza, I. N., Y. S. Darmanto, R. A. Kurniasih. 2019. Pengaruh gelatin dari kulit ikan yang berbeda terhadap karakteristik fisik dan sensori produk *marshmallow*. Jurnal Perikanan. 21(1): 17–23.

Badan Pengawas Obat dan Makanan Republik Indonesia. 2011. Peraturan Kepala Badan Pengawas Obat dan Makanan Republik Indonesia Nomor HK.03.1.23.11.11.09909 Tahun 2011 tentang Pengawasan Klaim dalam Label dan Iklan Pangan Olahan. Badan Pengawas Obat dan Makanan Republik Indonesia. Jakarta.

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Badan Pengawas Obat dan Makanan Republik Indonesia. 2019. Peraturan Badan Pengawas Obat dan Makanan Nomor 11 Tahun 2019 tentang bahan tambahan pangan. Badan Pengawas Obat dan Makanan Republik Indonesia. Jakarta.

Barus, P. 2009. Pemanfaatan Bahan Pengawet dan Antioksidan Alami pada Industri Bahan Makanan. Universitas Sumatra Utara, Medan.

Bennett, A., and L. Bogorad. 1973. Complementary chromatic adaptation in a filamentous blue-green alga. The Journal of cell biology. *58*(2): 419-435.

Bintoro, V.P., B. Dwiloka, H.L. Ekaputri, and R.Z. Kamil. 2024. The effect of gelatin and konjac glucomannan concentrations on moisture content, water activity, texture, density, and protein content in synbiotic marshmallows. Food Research. 8(4): 409-419.

Biryulina, N.A., V.K. Mazo, and O.V. Bagryantseva. 2022. *Arthrospira platensis* phycocyanins: A perspective for use in foods for special dietary uses (brief review). Voprosy Pitaniia [Problems of Nutrition]. 91(6): 30-36.

Borowitzka, M.A. 2018. Microalgae in medicine and human health. In I.A. Levine and J. Fleurence (eds.). Microalgae in Health and Disease Prevention. Academic Press. London: 195-210.

Boruczkowska, H., T. Boruczkowski, M. Bronkowska, M. Prajzner, and E. Rytel. 2025. Comparison of colour measurement methods in the food industry. Processes. 13(5): 1268.

Bourne, M.C. 2002. Food texture and viscosity: Concept and measurement. 2nd ed. Academic Press. San Diego.

Braga-Souto, R.N., M. Bürck, M.M. Nakamoto, and A.R.C. Braga. 2025. Cracking Spirulina flavor: Compounds, sensory evaluations, and solutions. Trends in Food Science & Technology. 156: 104847.

Braune, S., A. Krüger-Genge, S. Kammerer, F. Jung, and J.H. Küpper. 2021. Phycocyanin from *Arthrospira platensis* as potential anti-cancer drug: Review of in vitro and in vivo studies. Life. 11(2): 91.

Bürck, M., C. Fratelli, M. Assis, and A.R.C. Braga. 2024. Naturally colored ice creams enriched with C-phycocyanin and Spirulina residual biomass: Development of a fermented, antioxidant, tasty and stable food product. Fermentation. 10(6): 304.

Cahyaningrum, R., K.K. Safira, G.N. Lutfiyah, S.I. Zahra, A.A. Rahasticha, dan N. Aini. 2021. Potensi gelatin dari berbagai sumber dalam memperbaiki karakteristik *marshmallow*. Pasundan Food Technology Journal. 8(2): 39-44.

Canazza, E., M. Grauso, D. Mihaylova, and A. Lante. 2025. Techno-functional properties and applications of inulin in food systems. Gels. 11(10): 829.

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Cano-Lamadrid, M., Á. Calín-Sánchez, J. Clemente-Villalba, F. Hernández, Á.A. Carbonell-Barrachina, E. Sendra, and A. Wojdyło. 2020. Quality parameters and consumer acceptance of jelly candies based on pomegranate juice "Mollar de Elche". Foods. 9(4): 516.

Carocho, M., P. Morales, and I.C.F.R. Ferreira. 2018. Antioxidants: Reviewing the chemistry, food applications, legislation and role as preservatives. Trends in Food Science & Technology. 71: 107-120.

Castro-Gerónimo, V.D., R.V. García-Rodríguez, A. Sánchez-Medina, G.A. Chamorro-Cevallos, D.J. Sánchez-González, and E. Méndez-Bolaina. 2024. C-phycocyanin: A phycobiliprotein from spirulina with metabolic syndrome and oxidative stress effects. Journal of Medicinal Food. 27(9): 807-813.

Chaiklahan, R., N. Chirasuwan, and B. Bunnag. 2012. Stability of phycocyanin extracted from Spirulina sp.: Influence of temperature, pH and preservatives. Process Biochemistry. 47(4): 659-664.

Chhirang, P., V.K. Gahlawat, and B.P. Singh. 2024. Phycocyanin: A potential bioresource for functional food product development. South African Journal of Botany. 174: 49-65.

Chittapun, S., V. Jonjaroen, K. Khumrangsee, and T. Charoenrat. 2020. C-phycocyanin extraction from two freshwater cyanobacteria by freeze thaw and pulsed electric field techniques to improve extraction efficiency and purity. Algal Research. 46: 101789.

Christwardana, M., Nur, M. M. A., dan Hadiyanto, H. 2013. Spirulina platensis: Potensinya sebagai bahan pangan fungsional. Jurnal Aplikasi Teknologi Pangan. 2(1).

Chu, W.-L., Y.-W. Lim, A.K. Radhakrishnan, and P.-E. Lim. 2010. Protective effect of aqueous extract from Spirulina platensis against cell death induced by free radicals. BMC Complementary and Alternative Medicine. 10: 53.

Cisneros, M., and M. Rito-Palomares. 2004. A simplified strategy for the release and primary recovery of C-phycocyanin produced by Spirulina maxima. Chemical and Biochemical Engineering Quarterly. 18(4): 385-390.

Cliff, M., & Heymann, H. (1993). Development and use of time-intensity methodology for sensory evaluation: A review. Food Research International, 26(5), 375-385.

Colmenares-Cuevas, S.I., A. Contreras-Oliva, J. Salinas-Ruiz, J.V. Hidalgo-Contreras, E. Flores-Andrade, and E.J. García-Ramírez. 2024. Development of the functional properties of marshmallow with bee *(Apis mellifera)* honey and encapsulated probiotics *(Lactobacillus rhamnosus)*. Frontiers in Nutrition. 11: 1353530.

Cucu, T., F. David, and C. Devos. 2022. Analysis of ethylene oxide and 2-chloroetanol in food products: Challenges and solutions. Column. 18(8): 10-16.

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Dai, H., X. Li, J. Du, L. Ma, Y. Yu, H. Zhou, and Y. Zhang. 2020. Effect of interaction between sorbitol and gelatin on gelatin properties and its mechanism under different citric acid concentrations. Food Hydrocolloids. 101: 105557.

Damayanti, E. 2004. Mempelajari Aktivitas Antioksidan dan Antibakteri dari Ekstrak Campuran Rempah Minuman Cinnaale. (Skripsi). Fakultas Teknologi Pertanian, Institut Pertanian Bogor, Bogor. 52.

Darmajana 2016. Pengaruh variasi ukuran partikel tepung jagung terhadap karakteristik fisikokimia mi jagung instan. Effect of particle size variation of corn flour on physicochemical characteristics of Corn Noodle. Jurnal Pangan Perum Bulog. 25:1.

de Amarante, M.C.A., A.R.C. Braga, L. Sala, and S.J. Kalil. 2020. Colour stability and antioxidant activity of C-phycocyanin-added ice creams after in vitro digestion. Food Research International. 137: 109602.

De Garmo, E. D., W. G. Sullivan and J. R. Canada. 1984. Engineering Economics. Mc. Millan Publishing Company. New York

Dewi, E. N., R. A. Kurniasih, and L. Purnamayati. 2018. The application of microencapsulated phycocyanin as a blue natural colorant to the quality of jelly candy. In IOP Conference Series: Earth and Environmental Science (Vol. 116, p. 012047). IOP Publishing.

Duizer, L.M., E.A. Gullett, and C.J. Findlay. 1996. The relationship between sensory time-intensity, physiological electromyography and instrumental texture profile analysis measurements of beef tenderness. Meat Science. 42(2): 215-224

Ekantari, N., Y. Marsono, Y. Pranoto, dan E. Harmayani. 2017. Pengaruh media budidaya menggunakan air laut dan air tawar terhadap sifat kimia dan fungsional biomassa kering (*Spirulina platensis*). Agritech, 37(2): 173-182.

Ervina, E. 2023. The sensory profiles and preferences of gluten-free cookies made from alternative flours sourced from Indonesia. International Journal of Gastronomy and Food Science, 33: 100796.

FAO. 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStat). 2021 70 https://openknowledge.fao.org/server/api/core/bitstreams/97409d09-2f8e 4712-b11e-60105d89959b/content. Diakses tanggal 11 Mei 2025.

Fernandes, R. 2023. Exploring the benefits of phycocyanin: form Spirulina cultivation to its widespread applications. Pharmaceuticals, 16(4): 592.

Ferraro, G., P. Imbimbo, A. Marseglia, R. Lucignano, D. M. Monti, and A. Merlino. 2020. X-ray structure of C-phycocyanin from *Galdieria phlegrea*: determinants of thermostability and comparison with a C-phycocyanin in the entire phycobilisome. Biochimica et Biophysica Acta (BBA)-Bioenergetics. 1861(9): 148236.

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Firdiyani, F., T. W. Agustini, dan W. F. Ma'ruf. 2015. Ekstraksi senyawa bioaktif sebagai antioksidan alami Spirulina platensis segar dengan pelarut yang berbeda. Jurnal Pengolahan Hasil Perikanan Indonesia. 18(1): 28-37.

Flaiș, D., and M. Oroian. 2026. Evaluation of the chemical and sensory composition of a marshmallow product enriched with tomato pomace powder *(Lycopersicon esculentum)*. Applied Sciences. 16(2): 951.

Furuki, T., S. Maeda, S. Imajo, T. Hiroi, T. Amaya, T. Hirokawa, and H. Nozawa. 2003. Rapid and selective extraction of phycocyanin from *Spirulina platensis* with ultrasonic cell disruption. Journal of Applied Phycology. 15(4): 319-324.

Ginting, R.F.B., dan A. Husni. 2020. Karakteristik flakes dengan fortifikasi tepung sargassum hystrix sebagai pangan fungsional. Industria: Jurnal Teknologi dan Manajemen Agroindustri. 9(3): 241-251.

Glazer, A.N., and S. Fang. 1973. Chromophore content of blue-green algal phycobiliproteins. Journal of Biological Chemistry. 248(2): 659-662.

Grembecka, M. 2015. Sugar alcohols—their role in the modern world of sweeteners: A review. European Food Research and Technology. 241(1): 1-14.

Gumansalangi, F., dan G. S. Djarkasi. 2019. Aktivitas antioksidan, sifat fisik dan sensoris marshmallow melon (Cucumis Melo L.) dengan penambahan ekstrak bit merah (Beta Vulgaris L. Var. Conditiva). Jurnal Teknologi Pertanian (Agricultural Technology Journal, 10(1).

Gunes, R., I. Palabiyik, and S. Kurultay. 2024. A preliminary study on the use of phycocyanin as a natural blue color source in toffee-type soft candy: Effect of storage temperature and pigment concentration. Food Science & Nutrition. 12(10): 7885-7895.

Gupta, M. 2018. Sugar substitutes: mechanism, availability, current use and safety concerns-an update. Open access Macedonian journal of medical sciences. 6(10): 1888.

Harris, G.K., and M.R. Marshall. 2017. Ash analysis. In: S.S. Nielsen (ed.). Food Analysis. Springer International Publishing. Cham: 287-297.

Hayakawa, F., Kazami, Y., Fujimoto, S., Kikuchi, H., & Kohyama, K. 2009. Time-intensity analysis of sourness of commercially produced gummy jellies available in Japan. Food science and technology research, 15(1), 75-82.

Hughes, R.L., D.A. Alvarado, K.S. Swanson, and H.D. Holscher. 2022. The prebiotic potential of inulin-type fructans: A systematic review. Advances in Nutrition. 13(2): 492-529.

Huo, Y., X. Hou, Y. Yu, X. Wen, Y. Ding, Y. Li, and Z. Wang. 2022. Improving the thermal and oxidative stability of food-grade phycocyanin from *Arthrospira platensis* by addition of saccharides and sugar alcohols. Foods. 11(12): 1752.

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Işık, O., L. Uslu, B.A. Çimen, S. Gökpınar, C. Reddad, and S. Sayın. 2020. Blue colored pigment phycocyanin extraction from *Spirulina platensis*. Acta Aquatica Turcica. 16(4): 506-510.

Jespersen, L., L.D. Strømdahl, K. Olsen, and L.H. Skibsted. 2005. Heat and light stability of three natural blue colorants for use in confectionery and beverages. European Food Research and Technology. 220(3-4): 261-266.

Julianti, E., Susanti, M. Singgih, and L.N. Mulyani. 2019. Optimization of extraction method and characterization of phycocyanin pigment from *Spirulina platensis*. Journal of Mathematical and Fundamental Sciences. 51(2): 168-176.

Jung, F., S. Braune, C.H.G. Jung, A. Krüger-Genge, P. Waldeck, I. Petrick, and J.-H. Küpper. 2022. Lipophilic and hydrophilic compounds from *Arthrospira platensis* and its effects on tissue and blood cells—An overview. Life. 12(10): 1497.

Kamaludin dan Holik, 2022 Kamaludin, A. M., dan H. A. Holik. 2022. Review article: Chemical content and pharmacological activities of Spirulina sp. Indonesian Journal of Biological Pharmacy. 2(2): 59-66.

Katari, J. K., Khan, M. R. U. Z., Trivedi, V., & Das, D. 2023. Extraction, purification, characterization and bioactivity evaluation of high purity C-phycocyanin from Spirulina sp. NCIM 5143. Process Biochemistry. 130: 322-333.

Khandual, S., E.O.L. Sanchez, H.E. Andrews, and J. D. P. De la Rosa. 2021. Phycocyanin content and nutritional profile of *Arthrospira platensis* from Mexico: Efficient extraction process and stability evaluation of phycocyanin. BMC chemistry. 15: 1-13.

Kowalska, M., S. Janas, and M. Woźniak. 2018. Validation of the water content determination method using a moisture analyzer as an important factor in ensuring the quality of the measurement. Towaroznawcze Problemy Jakości. Polish Journal of Commodity Science. 2(55): 46-58.

Kraft Heinz. 2021. Product specifications: Half Jet Marshmallows, product number 6006990028700. Kraft Heinz Ingredients. Glenview.

Krakauskaitė, U., S. Aboobacker, V. Kitrytė-Syrpa, and M. Syrpas. 2025. Optimised extraction and purification of dual-function cosmetic-grade phycocyanin and allophycocyanin from dried *Arthrospira platensis* biomass using conventional methods. Applied Sciences. 15(2): 532.

Kuatrakul, I., P. Kuarthongsri, C. Yabuuchi, K. Somsai, dan N. Utama-ang. 2018. Sensory descriptive analysis and physicochemical properties of Spirulina platensis from different drying processes: Hot air drying and microwave vacuum drying. Current Applied Science and Technology. 17(2): 191-199.

Kuhnholz, J., T. Glockow, V. Siebecke, A.T. Le, L.D. Tran, and A. Noke. 2024. Comparison of different methods for extraction of phycocyanin from the

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

cyanobacterium Arthrospira maxima (Spirulina). Journal of Applied Phycology. 36(4): 1725-1735.

Kurniati, F., dan D. Amertaningtyas. 2025. The effect of propolis addition on the quality of marshmallows in terms of texture, water content, water activity (Aw), and color. Jurnal Ilmu dan Teknologi Hasil Ternak. 20(1): 85–96.

Kurniawan, A., W.A. Tri, dan R. Laras. 2016. Pengaruh penambahan *Spirulina platensis* powder terhadap karakteristik *marshmallow*. Prosiding Seminar Nasional Tahunan V.

Kuş, E., and H.E. Eroğlu. 2015. Genotoxic and cytotoxic effects of Sunset Yellow and Brilliant Blue, colorant food additives, on human blood lymphocytes. Pakistan Journal of Pharmaceutical Sciences. 28(1): 227-230.

Lastriyanto, A., B.D. Argo, dan R.A. Pratiwi. 2019. Karakteristik fisik dan protein fillet daging ikan lele beku (*Clarias batrachus*) hasil penggorengan vakum. Journal of Tropical Agricultural Engineering and Biosystems. 7(1): 87-96.

Li, B., J.E. Hayes, and G.R. Ziegler. 2014. Just-about-right and ideal scaling provide similar insights into the influence of sensory attributes on liking. Food Quality and Preference. 35: 70-78.

Liang, R., L. Xu, C. Fan, L. Cao, and X. Guo. 2023. Structural characteristics and antioxidant mechanism of donkey-hide gelatin peptides by molecular dynamics simulation. Molecules. 28(24): 7975.

Livesey, G. 2003. Health potential of polyols as sugar replacers, with emphasis on low glycaemic properties. Nutrition Research Reviews. 16(2): 163-191.

Luzardo-Ocampo, I., A.K. Ramírez-Jiménez, J. Yañez, L. Mojica, and D.A. Luna-Vital. 2021. Technological applications of natural colorants in food systems: A review. Foods. 10(3): 634.

Lv, L.C., Q.Y. Huang, W. Ding, X.H. Xiao, H.Y. Zhang, and X.H. Xiong. 2019. Fish gelatin: The novel potential applications. Journal of Functional Foods. 63: 103581.

Ma, J., Hu, J., Sha, X., Meng, D., & Yang, R. 2024. Phycobiliproteins, the pigment protein complex form of natural food colorants and bioactive ingredients. Critical Reviews in Food Science and Nutrition. 64(10): 2999-3017.

Mahmoud, N.H. 2006. Toxic effects of the synthetic food dye Brilliant Blue on liver, kidney and testes functions in rats. Journal of the Egyptian Society of Toxicology. 34: 77-84.

Majeed, M., M. A. Mahmood, M. U. Khan, M. Fazel, M. A. Shariati and I. Pigorev. 2018. Effect of sorbitol on dough rheology and quality of sugar replaced cookies. Slovak Journal of Food Sciences/Potravinarstvo. 12: (1).

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Maraqy, N. A., dan T. H. W. Handayani. 2020. Pengembangan snack bar dengan fortifikasi Spirulina sebagai sumber protein. Prosiding Pendidikan Teknik Boga Busana. 15(1).

Mardani, M., M. Kilicli, O.S. Toker, S. Yeganehzad, R. Niazmand, I. Palabiyik, and N. Konar. 2022. Investigation of process parameters and albumin concentration as foaming agent on quality of marshmallow dough: Production simulation with rheometer. Rheologica Acta. 61(4): 339-351.

Mardiana, N.A., and B. Prasetiyo. 2023. Quantitative Descriptive Analysis of shelf life bebek ungkep in retort pouch. G-Tech: Jurnal Teknologi Terapan, 7(2): 526 532.

Margiati, D., D. Ramdani, and A.P. Wulandari. 2019. Comparative study of antioxidant phycocyanin extracts activity between *S. platensis* with *S. fusiformis* using DPPH method. Indonesian Journal of Pharmaceutical Science and Technology, 6(2): 52-58.

Market Research Future, 2025. Marshmallow Market Research Report By Application (Food and Beverages, Confectionery, Baking and Patisserie, Marshmallows as Ingredients, Others), By Form (Rope Marshmallows, Twisted Marshmallows, Extruded Marshmallows, Coated Marshmallows, Filled Marshmallows), By Flavor (Vanilla, Strawberry, Chocolate, Raspberry, Orange, Others), By Distribution Channel (Supermarkets and Hypermarkets, Convenience Stores, Online Retailers, Specialty Stores, Wholesalers), By End User (Children, Adults, Manufacturers, Institutional (e.g. foodservice, health). [online] https://www.marketresearchfuture.com/reports/marshmallow-market-26582. Diakses tanggal 10 September 2025.

Marlina, D., D. Purwaningsih, R. Pratiwi, R. W. Saputra, W. Setyaningsih, dan Supriyono. 2024. Comparing conventional and modern methods for the phycocyanin extraction from *Spirullina* sp. Advance Sustainable Science, Engineering and Technology 6(3): 02403023-01–02403023-08.

Marques, C., S. Magdouli, T. Rouissi, and K. Brar. 2016. Sorbitol Production from Biomass and Its Global Market. In Brar, K., Sarma, S.J. and Pakshirajan, K. (Eds.) Platform Chemical Biorefinery, p. 217 – 227. USA: Elsevier.

Martelli, F., M. Cirlini, C. Lazzi, E. Neviani, and V. Bernini. 2020. Solid-state fermentation of *Arthrospira platensis* to implement new food products: Evaluation of stabilization treatments and bacterial growth on the volatile fraction. Foods. 10(1): 67.

Masithah, E. D. 2023. Buku Ajar Bioteknologi Hasil Perikanan. Airlangga University Press.

Mauliasari, E.S., T.W. Agustini, dan U. Amalia. 2019. Stabilisasi fikosianin *Spirulina platensis* dengan perlakuan mikroenkapsulasi dan pH. Jurnal Pengolahan Hasil Perikanan Indonesia. 22(3): 526-534.

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Melanie, H., A. Aspiyanto, Y. Maryati, A. Susilowati, H. Mulyani, E. Filailla, and S. Budiari. 2023. Recovery of phycocyanin from microalgae Spirulina using membrane technology and evaluation of its antioxidant activity. AIP Conference Proceedings. 2902(1): 060024.

Mendis, E., N. Rajapakse, and S. K. Kim. 2005. Antioxidant properties of a radical-scavenging peptide purified from enzymatically prepared fish skin gelatin hydrolysate. Journal of Agricultural and Food Chemistry. 53(3): 581-587.

Miranda, J. S., B. V. Costa, I. V. de Oliveira, D. C. N. de Lima, E. M. F. Martins, B. R. D. C. L., Júnior, and M. L. Martins. 2020. Probiotic jelly candies enriched with native Atlantic Forest fruits and Bacillus coagulans GBI-30 6086. Lwt. 126: 109275.

Mohammadi-Gouraji, E., Soleimanian-Zad, S., & Ghiaci, M. 2019. Phycocyanin-enriched yogurt and its antibacterial and physicochemical properties during 21 days of storage. Lwt, 102, 230-236.

Morais, E.C., A.C.M. Pinheiro, C.A. Nunes, and H.M.A. Bolini. 2014. Multiple time-intensity analysis and temporal dominance of sensations of chocolate dairy dessert using prebiotic and different high-intensity sweeteners. Journal of Sensory Studies. 29(5): 339-350.

Moskowitz, H.R. 1971. The sweetness and pleasantness of sugars. The American Journal of Psychology. 84(3): 387-405.

Msomi, N.Z., O.L. Erukainure, and M.S. Islam. 2021. Suitability of sugar alcohols as antidiabetic supplements: A review. Journal of Food and Drug Analysis. 29(1): 1.

Mudannayake, D.C., D.D. Jayasena, K.M. Wimalasiri, C.S. Ranadheera, and S. Ajlouni. 2022. Inulin fructans–food applications and alternative plant sources: A review. International Journal of Food Science and Technology. 57(9): 5764-5780.

Munawaroh, S.Z. 2016. Potensi mikroalga yang dikultivasi pada media limbah cair industri karet remah sebagai sumber protein. Skripsi. Fakultas Pertanian, Universitas Lampung.

Mustakova, P., I. Milkova-Tomova, Z. Goranova, K. Nikolova, D. Buhalova, G. Gentscheva, and N. Panova. 2025. Innovative applications of *Spirulina platensis L.* and phycocyanin in food products: Effects on the quality of sponge cakes. Bulgarian Chemical Communications. 57.

Nakai, S., and H.W. Modler. 1999. Food proteins: Processing applications. Wiley. New York.

Nege, A.S., E.D. Masithah, and J. Khotib. 2020. Trends in the uses of Spirulina microalga: A mini-review. Scientific Journal of Fisheries and Marine. 12(1).

Neti, M.L., V. Larasati, and P.A. Herlina. 2018. A natural combination extract of mangosteen pericarp and phycocyanin of *Spirulina platensis* decreases plasma

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

malonaldialdehyde level in acute exercise-induced oxidative stress. Majalah Sriwijaya. 30(17): 1-16.

Nishiyama-Hortense, Y.P.O., M.J.P. Rossi, V.D. Shimizu-Marin, N.S. Janzantti, S. Gómez-Alonso, R. Da-Silva, and E.S. Lago-Vanzela. 2022. Jelly candy enriched with BRS Violeta grape juice: Anthocyanin retention and sensory evaluation. Future Foods. 6: 100179.

Nowruzi, B., S.A.A. Anvar, and A. Shafaroodi. 2024. Study of phycocyanin powder on probiotic bacteriologically and antioxidant of yogurt at 4°C. Nutrire. 49(2): 42.

Nurlaela, R.S., S.R.R. Pertiwi, dan M.R. Maulidi. 2025. Profil sensori *marshmallow* dengan penambahan sari buah kecombrang (*Etlingera elatior*) menggunakan metode RATA. Jurnal Ilmiah Pangan Halal. 7(1): 117-127.

Pakbin, B., S. Allahyari, S.P. Dibazar, W.M. Brück, R. Vahidi, R. Mahmoudi, and A. Khanjari. 2022. Production of bovine collagen hydrolysate with antioxidant activity optimized by response surface methodology. Scientia Pharmaceutica. 90(4): 62.

Palabiyik, I., M.G. Albas, E. Ersahin, O.S. Toker, N. Konar, B. Şentürk, ..., and D. Karahan. 2025. Developing low-calorie marshmallow products using polyols and soluble fibers as substitutes for mono- and disaccharides. ACS Omega. 10(39): 45124-45131.

Pandir, D. 2016. DNA damage in human germ cell exposed to the some food additives in vitro. Cytotechnology. 68(4): 725-733.

Patel, A., S. Mishra, R. Pawar, and P.K. Ghosh. 2005. Purification and characterization of C-phycocyanin from cyanobacterial species of marine and freshwater habitat. Protein Expression and Purification. 40(2): 248-255.

Periche, A., A. Heredia, I. Escriche, A. Andrés, and M.L. Castelló. 2015. Potential use of isomaltulose to produce healthier marshmallows. LWT-Food Science and Technology. 62(1): 605-612.

Petersen, S.B., V. Jonson, P. Fojan, R. Wimmer, and S. Pedersen. 2004. Sorbitol prevents the self-aggregation of unfolded lysozyme leading to an up to 13°C stabilisation of the folded form. Journal of Biotechnology. 114(3): 269-278.

Pradeep, H.N., and C.A. Nayak. 2019. Enhanced stability of C-phycocyanin colorant by extrusion encapsulation. Journal of Food Science and Technology. 56(10): 4526-4534.

Pratama, G.M., I.G.N. Hartawan, I.G.A. Indriani, M.U. Yusrika, S.A. Suryantari, and P.S. Sudarsa. 2020. Potency of *Spirulina platensis* extract as sunscreen on ultraviolet B exposure. Journal of Medicine and Health. 2(6).

Pujilestari, T. 2015. Sumber dan pemanfaatan zat warna alam untuk keperluan industri. Dinamika Kerajinan dan Batik. 32(2): 93-106.

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Purbasari, A., dan S. B. M. Abduh. 2013. Nilai pH, kekentalan, citarasa, dan kesukaan pada susu fermentasi dengan perisa alami jambu air (*Syzygium sp*.). Jurnal Aplikasi Teknologi Pangan. 3(4).

Raczyk, M., K. Polanowska., B. Kruszewski., A. Grygier, and D. Michalowska. 2022. Effect of spirulina *(Arthrospira platensis)* supplementation on physical and chemical properties of Semolina *(Triticum durum)* based fresh pasta. Molecules. 27(2): 1-13.

Raeatya, M., dan R. Rosida. 2024. Karakteristik *marshmallow* carica (*Carica pubescens* L.) dan sari wortel (*Daucus carota* L.) dengan perlakuan penambahan gelatin dan putih telur. G-Tech: Jurnal Teknologi Terapan. 8(3): 1444-1452.

Rahma, D.U.Z., G.H. Nurahman, H. Hadiyanto, and R.A. Baihaqi. 2023. Production of high-antioxidant yoghurt using phycocyanin from microalgae Spirulina sp. Journal of Emerging Science and Engineering. 1(2): 36-43.

Rahmawati, S. I. 2016. Ekstrak biopigmen biru fikosianin spirulina plantesis sebagai pewarna alami minuman ringan karbonasi. Jurnal Agroindustri Halal. 2(2): 097-108.

Rahmawati, S. I., Hidayatullah, S., dan M. Suprayatmi. 2017. Ekstraksi fikosianin dari *Spirulina plantesis* sebagai biopigmen dan antioksidan. Jurnal Pertanian. 8(1): 36-45.

Richter, V.B., T.C.A. de Almeida, S.H. Prudencio, and M. de Toledo Benassi. 2010. Proposing a ranking descriptive sensory method. Food Quality and Preference. 21(6): 611-620.

Ridlo, A., S. Sedjati, dan E. Supriyantini. 2016. Aktivitas antioksidan fikosianin dari Spirulina Sp. menggunakan metode transfer elektron dengan DPPH (1, 1-difenil-2-pikrilhidrazil). Jurnal Kelautan Tropis, 18:(2).

Romay C, J. Armesto D. Remirez R. Gonzalez N. Ledon and I. Garcia. 1998. Antioxidant and antiinflammatory properties of c-phycocyanin from blue-green algae. Inflammatory Research. 47(1): 36- 41.

Rosmawati, E. Abustam, A.B. Tawali, M.I. Said, and D.K. Sari. 2018. Effect of body weight on the chemical composition and collagen content of snakehead fish *Channa striata* skin. Fisheries Science. 84(6): 1081-1089.

Ross, A.S. 2006. Instrumental measurement of physical properties of cooked Asian wheat flour noodles. Cereal Chemistry. 83(1): 42-51.

Saha, D., and S. Bhattacharya. 2010. Hydrocolloids as thickening and gelling agents in food: A critical review. Journal of Food Science and Technology. 47(6): 587-597.

Samatra, M.Y., N.Q.I.M. Noor, U.H.M. Razali, J. Bakar, and S.M. Shaarani. 2022. Bovidae-based gelatin: Extractions method, physicochemical and functional

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

properties, applications, and future trends. Comprehensive Reviews in Food Science and Food Safety. 21(4): 3153-3176.

Santoso, U., Y. Pranoto, Y.T. Afriyanti, and S. Mulyani. 2019. The physical and chemical properties of marshmallow made from Bufallo *(Bubalus bubalis)* hide gelatin compared to commercial gelatin. Journal of Applied Food Technology. 6(2).

Sarofa, U., dan W. L. P. Dewi. 2019. Karakteristik *marshmallow* dari kulit pisang raja (*Musa textilia*): kajian konsentrasi gelatin dan putih telur. Jurnal Teknologi Pangan. 13(1): 20 27.

Sedjati, S., E. Yudiati, dan Suryono. 2012. Profil pigmen polar dan non polar mikroalga laut *Spirulina* sp. dan potensinya sebagai pewarna alami. Jurnal Kelautan. 17(3): 176-181.

Shahid, A., Z. Fan, K. Su, A. Zhao, M.A. Mehmood, J.S. Chang, and J. Xu. 2025. Sensory chemistry of Spirulina: Unveiling trends and innovations in aromatic volatile organic compound biosynthesis in off-flavors and odor mitigation strategies. Trends in Food Science & Technology. 156: 104886.

Shahidi, F., and P. Ambigaipalan. 2015. Phenolics and polyphenolics in foods, beverages and spices: Antioxidant activity and health effects–A review. Journal of Functional Foods. 18: 820-897.

Shang, H. M., H. Z. Zhou, J. Y. Yang, R. Li, H. Song, and H. X. Wu. 2018. In vitro and in vivo antioxidant activities of inulin. PLOS ONE. 13(2): e0192273.

Slavin, J.L., and S.K. Engstrom. 2024. Carbohydrates. Advances in Nutrition. 15(S1): 100311.

Spinola, M. P., M. M. Costa, and J. A. Prates. 2022. Digestive constraints of *Arthrospira platensis* in poultry and swine feeding. Foods. 11(19): 1-14.

Standar Nasional Indonesia (SNI) 3547-2:2008. Kembang Gula- Bagian 2 : Lunak, Jakarta.

Stone, H., and J.L. Sidel. 2004. Sensory evaluation practices. 3rd ed. Elsevier Academic Press. San Diego.

Stone, H., J.L. Sidel, S. Oliver, A. Woolsey, and R.C. Singleton. 1974. Sensory evaluation by Quantitative Descriptive Analysis. Food Technology. 28(11): 24-34.

Suprayitno, E. 2019. Amino acid marshmallow profile from grouper bone gelatin. International Journal of Scientific and Research Publications. 9(11): 111-113.

Tan, H.T., N.M.H. Khong, Y.S. Khaw, S.A. Ahmad, and F.M. Yusoff. 2020. Optimization of the freezing-thawing method for extracting phycobiliproteins from Arthrospira sp. Molecules. 25(17): 3894.

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Tan, J.M., and M.H. Lim. 2008. Effects of gelatine type and concentration on the shelf-life stability and quality of marshmallows. International Journal of Food Science and Technology. 43(9): 1699-1704.

Tavanandi, H.A., R. Mittal, J. Chandrasekhar, and K.S.M.S. Raghavarao. 2018. Simple and efficient method for extraction of C-phycocyanin from dry biomass of *Arthrospira platensis*. Algal Research. 31: 239-251.

Temple, N.J. 2022. A rational definition for functional foods: A perspective. Frontiers in Nutrition. 9: 957516.

Ulfah, H. M. (2025). Persepsi dan Preferensi Konsumen terhadap Puding Susu dengan Fortifikasi Fikosianin *Arthrospira platensis* (Doctoral dissertation, Universitas Gadjah Mada).

Ungure, E., E. Straumite, S. Muizniece-Brasava, dan L. Dukalska. 2013. Consumer attitude and sensory evaluation of marshmallow. Proceedings of the Latvian Academy of Sciences. Section B. Natural, Exact, and Applied Sciences 67(4–5): 442–447.\

Utomo, A. 2025. Pengaruh perbedaan konsentrasi ekstrak bit merah dan gelatin terhadap sifat fisikokimia dan organoleptik *marshmallow Beet*. Jurnal Teknologi Pangan dan Gizi.

Verma, A. K., K. Dewangan, L. Daunday, K. Naurange, K. Verma, and M. Bhiaram. 2024. Spirulina as functional food: insights into cultivation, production, and health benefits. Journal of Applied Pharmaceutical Research. 12(5): 28-50.

Warsito, H. 2022. Studi pembuatan permen marshmallow jambu biji merah sebagai makanan selingan untuk pencegahan penyakit degeneratif. HARENA: Jurnal Giz. 2(3): 114-124.

World Integrated Trade Solution (WITS). 2024. Indonesia sugar confectionery (incl. white chocolate), no imports by country. World Integrated Trade Solution. World Bank. Washington, D.C.

Wu, Q., L. Liu, A. Miron, B. Klímová, D. Wan, and K. Kuča. 2016. The antioxidant, immunomodulatory, and anti-inflammatory activities of Spirulina: an overview. Archives of toxicology. 90: 1817-1840

Xie, G., and S.N. Timasheff. 1997. Mechanism of the stabilization of ribonuclease A by sorbitol: Preferential hydration is greater for the denatured than for the native protein. Protein Science. 6(1): 211-221.

Yudhistira, B., A. K. Putri, and S. Prabawa. 2021. The effect of sorbitol and white sweet potatoes *(Ipomea batatas L.)* inulin extract application on marshmallow physical, chemical and organoleptic properties. Food Research. 5(1): 298-305.

UNIVERSITAS
GADJAH MADA
**Pengaruh Penambahan Ekstrak Fikosianin Arthrospira platensis terhadap Karakteristik Fisik, Sensoris,
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Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Zhou, P., M. Guo, D. Liu, X. Liu, and T.P. Labuza. 2013. Maillard-reaction-induced modification and aggregation of proteins and hardening of texture in protein bar model systems. Journal of Food Science. 78(3): C437-C444.