

## 5.2 Saran

Berdasarkan penelitian ini, lingkungan ekstrim seperti pH yang terlalu rendah dan suhu yang terlalu tinggi dapat menyebabkan agregasi pada agar hasil depolimerisasi sehingga belum dihasilkan agar dengan kelarutan yang optimal pada suhu ruang. Oleh karena itu, perlu dilakukan depolimerisasi agar dengan asam perasetat pada pH yang lebih tinggi dan suhu depolimerisasi yang lebih rendah untuk menghasilkan agar dengan kelarutan optimal. Selain itu, waktu depolimerisasi dapat diperpanjang sehingga didapatkan penurunan berat molekul dan peningkatan kelarutan agar yang lebih maksimal.

## DAFTAR PUSTAKA

- Aguilera, J.M. dan Rademacher, B. 2004. Protein gels, dalam *Protein in Food Processing*. New York: Woodhead Publishing Limited dan CRC Press LLC, 468-482.
- Ahmad, R., Surif, M., Ramli, N., Yahya, N., Nor, A.R.M., dan Bekbayeva, L. 2011. A preliminary study on the agar content and agar gel strength of *Gracilaria manilaensis* using different agar extraction process. *World Applied Science Journal*, 15: 184-188.
- Alba, K, dan Kontogiorgos, V. 2018. *Seaweed Polysaccharides (Agar, Alginate, Carrageenan)*. Huddersfield: Elsevier, Inc.
- Alvaro, J. E., Moreno, S., Dianez, F., Santos, M., Carrasco, G., dan Urrestarazu, M. 2009. Effect of peracetic acid disinfectant on the postharvest of some fresh vegetables. *Journal of Food Engineering*, 95(1):11-15.
- Andriamanantoanina, H., Chambat, G., dan Rinaudo, M. 2007. Fractionation of extracted Madagascan *Gracilaria corticate* polysaccharides: structure and properties. *Carbohydrate Polymers*, 68: 77-88.
- AOAC. 2005. *Official Methods of Analysis 18<sup>th</sup> ed.* Maryland: Association of Official Analytical Chemists International.

- Aquaportal. 2010. <https://www.aquaportal.com/fiche-algue-1483-gracilaria-verrucosa.html>, diakses pada 19 Juli 2018.
- Armisen, R. dan Galatas, F. 2009. Agar, dalam Phillips, O.G. dan Williams, P.A. *Handbook of Hydrocolloids 2<sup>nd</sup>*. Boca Raton: Woodhead Publishing, 82–107.
- Arvizu-Higuera, D.L., Rodriguez-Montesinos, Y.E., Ivan Murillo-Alvarez, J.I., Munoz-Ochoa, M., dan Hernandez-Carmona. 2008. Effect of alkali treatment time and extraction time on agar from *Gracilaria vermiculophylla*. *Journal of Applied Phycology*, 20:515-519.
- Badan Standardisasi Nasional. 2015. SNI 2690:2015 - Rumput Laut Kering. Jakarta: Badan Standardisasi Nasional.
- Badan Standardisasi Nasional. 2015. SNI 2802: 2015 - Agar-Agar Tepung. Jakarta: Badan Standardisasi Nasional.
- Banerjee, S. dan Bhattacharya, S. 2012. Food gels: Gelling process and new applications. *Critical Review in Food Science and Nutrition*, 52: 334-346.
- Barros, F.C., da Silva, D.C., Sombra, V.G., Maciel, J.S., Feitosa, J.P., Freitas, A.L., dan de Paula, R.C. 2013. Structural characterization of polysaccharide obtained from red seaweed *Gracilaria caudata* (J Agardh). *Carbohydrate Polymers*, 92(1): 598-603.
- Bauermeister, L.J., Bowers, J.W., Townsend, J.C., dan McKee, S.R. 2008. The microbial and quality properties of poultry carcasses treated with peracetic acid as an antimicrobial treatment. *Poultry Science*, 87(11):2390-2398.
- Bezerra, A. F dan Marinho-Soriano, E. 2010. Cultivation of the red seaweed *Gracilaria birdiae* (Gracilariales, Rhodophyta) in tropical waters of northeast Brazil. *Biomass Bioenergy*, 34: 1813-1817.
- Brasileiro, L. B., Colodette, J.L., dan Pilo-Veloso, D. 2001. The use of peracetic acid in designation and bleeding of cellulosic pulp. *Quimica Nova*, 24:819-829.
- Campo, V.L., Kawano, D.F., da Silva Jr., D.B., dan Carvalho, I. 2009. Carrageenans: biological properties, chemical modification and structural analysis. *Carbohydrate Polymers*, 77: 167-180.
- Chaplin, M. Agar. 2018. <http://www1.lsbu.ac.uk/water/agar.html>, diakses pada 19 Juli 2018.
- Chi, W. J., Chang, Y.K., dan Hong, S.R. 2012. Agar degradation by microorganisms and agar-degrading enzymes. *Microbial Biotechnology*, 94:917-930.
- Distantina, S., Wiratni, M. F., Rochmadi. 2011. Carrageenan properties extracted from *Eucheuma cottonii*, Indonesia (ID). *World Academy of Science, Engineering and Technology*, 54:739-741.

- Dul'neva, L. V., Moskvin, A.V., dan Pavlov, S. 2005. Kinetics of formation of peroxyacetic acid [J]. *Russian Journal of General Chemistry*, 75(7):1125-1130.
- Eckborg. 2005. The Agarase System of *Saccharophagus degradans*: Analysis of The Agarase System and Protein Localization. *University of Maryland, USA*.
- Edwards, C.H., Warren, F.J., Campbell, G.M., Gaisford, S., Royall, P.G., Butterworth, P.J., dan Ellis, P.R. 2015. A study of starch gelatinization behavior in hydrothermally-processed plant food tissues and implication for in vitro digestibility. *Food and Function* 6(12): 3634-3641.
- Faezeli, M., Tahmasebi, M., dan Djomeh, Z.E., dalam: Mendez-Vilas, A. 2012. *Current Microscopy Contribution to Advances in Science and Technology*. Badajoz: Formatec Research Center, hal. 855-871.
- Fan, X., Niemira, B.A., Doona, C.J., Feeherry, F.E., dan Gravani, R.B. 2009. *Microbial Safety of Fresh Produce*. Iowa: Blackwell Publishing and the Institute of Food Technologists.
- FDA. 2002. [https://www.fda.gov/Food/GuidanceRegulation/Guidance Documents RegulatoryInformation/IngredientsAdditivesGRASPackaging/ucm063065.htm](https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/IngredientsAdditivesGRASPackaging/ucm063065.htm), diakses pada 19 Juli 2018.
- Fleurence, J dan Levine, I. 2016. *Seaweed in Health and Disease Prevention*. Oxford: Elsevier, Inc.
- Food Agriculture Organization (FAO). 2007. "Production, Properties and Uses of Agar", <http://www.fao.org/docrep/x5822e/x5822e03.htm>, diakses pada 8 Desember 2018.
- Food Agriculture Organization (FAO). 2007. Compendium of Food Additive Specification, *Joint FAO/WHO Expert Committee on Food Additives Monograph 4*. Rome: Food Agriculture Organization of The United Nations.
- Food Agriculture Organization (FAO). 2018. The State of World Fisheries and Aquaculture 2018 - Meeting the sustainable development goals. Rome.
- Freile-Pelegrin, Y. 2000. Does storage time influence yield and agar properties in the tropical agarophyte. *Journal of Applied Phycology*, 12: 153-158.
- Freile-Pelegrin, Y. dan Murano, E. 2005. Agar from three species of *Gracilaria* (Rhodophyta) from Yucatan Peninsula. *Bioresource Tehcnology*, 96: 295-302.
- Fudholi, A., Othman, M.Y., Ruslan, M.H., Yahya, M., Zaharim, A., dan Sopian, K. 2011. The effects of drying air temperature and humidity on the drying kinetics of seaweed. *Geography, Geology, Energy, Environment and Biomedicine*, 129-133.

- Ganesan, M., Reddy, C.R., Eswaran, K., dan Jha, B. 2008. Seasonal variation in the biomass, quantity and quality of agar from *Gelidiella acerosa* (Forsskal) Feldmann et Hamel (Gelidiales, Rhodophyta) from the Gulf of Mannar Marine Biosphere Reserve, India. *Phycological Research Journal*, 56: 93-104.
- Gorman, L., Kraemer, G. P., Yarish, C., Boo, S. M. dan Kim, J. K. 2017. The effects of temperature on the growth and nitrogen content of *Gracilaria vermiculophylla* and *Gracilaria tikvahiae* from LIS, USA. *Algae*, 32:57-66.
- Gu, Y., Cheong, K-L., dan Du, H. 2017. Modification and comparison of three *Gracilaria* spp. agarose with methylation for promotion of its gelling properties. *Chemistry Central Journal*, 11: 104-113.
- Guerrero, P., Garrido, T., Leceta, I., dan de la Caba, K. 2013. Films based on proteins and polysaccharides: preparation and physical-chemical characterization. *European Polymer Journal*, 49(11): 3713-3721.
- Haryanti, P., Setyawati, R., dan Wicaksono, R. 2014. Pengaruh suhu dan lama pemanasan suspense pati serta konsentrasi butanol terhadap karakteristik fisikokimia pati tinggi amilosa dari tapioka. *Agritech*, 34(3): 308-315.
- Hehemann, J. H., Smith, L., Yadav, A., Vocaldo, D.J., dan Boraston, A.B. 2012. Analysis of Keystone Enzyme in Agar Hydrolysis Provides Insight into the Degradation of a Polysaccharide from Red Seaweeds. *The Journal of Biological Chemistry* Vol. 287, No.17: 13985-13995.
- Heydari, M., Nematollahi, M.A., Motamedzadegan, A., Hosseini-Parvar, S., dan Hosseini, S. 2014. Optimization of the yield and Quality of Agar from *Gracilaria persica*. *Journal of Environment, Pharmacology, and Life Sciences*, Vol 3 Spl Issue III: 289-295.
- Hidayati, S, dan Zuidar, A.S. 2010. Kajian penggunaan asam perasetat untuk pemutihan terhadap sifat kimia pulp bagasse hasil organosolv. *Jurnal Agroekoteknologi* 2(1): 53-58.
- Holdt, S.L dan Kraan, S. 2011. Bioactive compounds in seaweed; functional good applications and legislation. *Journal Applied Phycology*, 23:543-597.
- Hurd, C.L., Harrison, P.J., Bischof, K., dan Lobban, C.S. 2014. *Seaweed Ecology and Physiology, second ed.* Cambridge: Cambridge University Press.
- Imeson, A. 2010. *Food Stabilisers, Thickeners and Gelling Agents*. Blackwell Publishing Ltd, Chichester.
- Jia, Z. dan Shen, D. 2002. Effect of reaction temperature and reaction time on the preparation of low-molecular-weight chitosan using phosphoric acid. *Carbohydrate Polymers*, 49: 393-396.
- Jimenez-Escríg, A. dan Sanchez-Muniz, F.J. 2000. Dietary fibre from edible seaweeds: Chemical structure, physicochemical properties and effects on cholesterol metabolism. *Nutrition Research*, 20(4): 585-598.

- Jolhe, P.D., Bhavnase, B.A., Patil, V.S., dan Sonawane, S.H. 2015. Sonochemical synthesis of *Peracetic acid* in a continuous flow microstructured reactor. *Journal of Chemical Engineering*, 276:91-96.
- Kementerian Kelautan dan Perikanan (KKP). 2014. *Profile of Business and Investment Opportunities on Seaweed in Indonesia*. Jakarta.
- Kementerian Kelautan dan Perikanan (KKP). 2018. KKP Pacu Pengembangan Daya Saing Rumput Laut Nasional. <http://kkp.go.id/djp/ artikel/3128-kkp-pacu-pengembangan-daya-saing-rumput-laut-nasional>, diakses pada 13 Juli 2018.
- Kim, J. K. dan Yarish, C. 2014. Development of a sustainable land-based *Gracilaria* cultivation system. *Algae*, 29:217- 225.
- Kitis, M. 2004. Disinfection of wastewater with peracetic acid. *Environment International*, 30: 47-55.
- Kumar, M, Gupta, V., Kumari, P., Reddy, C.R.K., dan Jha, B. 2011. Assessment of nutrient composition and antioxidant potential of Caulerpaceae seaweeds. *Journal of Food Composition and Analysis*, 24:270-278.
- Kumar, V. dan Fotedar, R. 2009. Agar extraction process for *Gracilaria cliftonii*. *Carbohydrate Polymers*, 78:813-819.
- Kusuma, W.I., Gunawan, W.S., dan Rini, P. 2013. Pengaruh Konsentrasi NaOH yang Berbeda terhadap Mutu Agar Rumput Laut *Gracilaria verrucosa*. *Journal of Marine Research*. Vol 2 No 2, hlm: 120-129.
- Laaman, T.R. 2011. *Hydrocolloids in Food Processing*. Iowa: Blackwell Publishing Ltd. And Institute of Food Technologists.
- Lahrech, Kh., Safouane, A., dan Peyrellasse, J. 2005. Sol state formation and melting of agar gels rheological study. *Physica A*, 358: 205-211.
- Lee, P. Y., Costumbado, K., Hsu, C-Y., dan Kim, Y. H. 2012. Agarose gel electrophoresis for the separation of DNA fragments. *Journal of Visualized Experiments*, 62: 3923-3928.
- Lee, W., Namasivayam, P., dan Ho, C. 2014. Effect of sulfate starvation on agar polysaccharides of *Gracilaria* spesies (Graciliaceae, Rhodophyta) from Morib, Malaysia. *Journal of Applied Phycology*, 26: 1791-1799.
- Lee, W-K., Lim, Y-Y., Leow, A.T-C., Namasivayam, P., Abdullah, J.O., dan Ho, C-L. 2016. Factor affecting yield and gelling properties of agar. *Journal of Applied Phycology*, 29 (3): 1527-1540.
- Leuner, C. dan Dressman, J. 2000. Improving drug solubility for oral delivery using solid dispersions. *European Journal of Pharmaceutics and Biopharmaceutics*, 50 (2000): 47-60.
- Li X, Xu, A., Xie, H., Yu, W., Xie, W., dan Maa, X. 2010. Preparation of low molecular weight alginate by hydrogen peroxide depolymerization for tissue engineering. *Carbohydrate Polymers*, 9: 660-664.

- Li, X., Shen, Q., Zhang, D., Mei, X., Ran, W., Xu, Y., dan Yu, G. 2013. Functional groups determine biochar properties (pH and EC) as studied by two-dimensional  $^{13}\text{C}$  NMR correlation spectroscopy. *PLoS ONE Journal*, 8(6): e65949.
- Lim, P.E, Yang, L.E., Tan, J., Maggs, C.A., dan Brodie, J.. 2017. Advancing the taxonomy of economically important red seaweeds (Rhodophyta). *European Journal of Phycology*, 52 (4):438-451.
- Maki-Arvela, P, Holmbom, B., Salmi, T., Murzin, D.Y., dan Willfor, S. 2011. Synthesis of sugars by hydrolysis of hemicelluloses. *Chemical Review* 111:5638-5666.
- Mao, R., Tang, J., Swanson, B. G. 2001. Water holding capacity and microstructure of gellan gels. *Carbohydrate Polymers*, 46: 365-371.
- Marinho-Soriano, E. dan Bourret, E. 2003. Effect of season on the yield and quality of agar from *Gracilaria* species (Gracilariaeae, Rhodophyta). *Bioresource Technology*, 90: 329-333.
- Marinho-Soriano, E. dan Bourret, E. 2005. Polysaccharides from the red seaweed *Gracilaria dura* (Gracilariales, Rhodophyta). *Bioresource Technology* 96: 379–382.
- Martin, L.A., Rodriguez, M.C., Matulewicz, M.C., Fissore, E.N., Gerschenson, L.N., dan Leonardi, P.I. 2013. Seasonal variation in agar composition and properties from *Gracilaria gracilis* (Gracilariales, Rhodophyta) of the Patagonian coast of Argentina. *Phycological Research Journal*, 61: 163-171.
- Marzialetti, T, Olarte, M.B.V., Sievers, C., Hoskins, T.J., Agrawal, P.K., dan Jones, C.W. 2008. Acid hydrolysis of Loblolly pine: A comprehensive approach. *Industrial and Engineering Chemistry Research*, 47: 7131-7140.
- Masyarakat Akuakultur Indonesia (MAI). 2018. <http://aquaculture-mai.org/archives/2533>, diakses pada 13 Juli 2018.
- Mateo, C, Palomo, J.M., Fuentes, M., Betancor, L., Grazu, F.L., Pessela, B.C.C., Hidalgo, A., Fernandez-Lorente, G., Fernandez-Lafuente, R., dan Guisan, J.M. 2006. Glyoxyl agarose: A fully inert and hydrophic support for immobilization and high stabilization of proteins. *Enzyme and Microbial Technology*, 39(2):274-280.
- Mazumder, S., Ghosal, P.K., Pujo, C.A., Carlucci, M.J., Damonte, E.B., dan Ray, B. 2002. Isolation, chemical investigation and antiviral activity of polysaccharides from *G. corticata* (Gracilariaeae, Rhodophyta). *International Journal of Biological Macromolecules*, 31:87-95.
- McHugh, D.J. 2003. *A guide to the seaweed industry*. Rome: FAO Fisheries Technical Paper.

- Meena, R., Prasad, K., dan Siddhanta, A.K. 2009. Development of a stable hydrogel network based on agar-kappa-carrageenan blend cross-linked with genipin. *Food Hydrocolloids*, 23: 497-509.
- Meena, R., Prasad, K., dan Siddhanta, A.K. 2011. Preparation of superior quality product from two Indian agarophytes. *Journal of Applied Phycology*, 23: 183-189.
- Meena, R., Prasad, K., Ganesan, M., dan Siddhanta, A.K. 2008. Superior quality agar from *Gracilaria species* (Gracilariales, Rhodophyta) collected from the Gulf of Mannar, India. *Journal of Applied Phycology*, 20: 397-402.
- Mehmet, K. 2004. Disinfection of wastewater with *Peracetic Acid*. *International Journal of Environmental*, 30 (1):47-55.
- Melo, M.R.S., Feitosa, J.P.A, Freitas, A.L.P., dan de Paula, R.C.M. 2002. Isolation and characterization of soluble sulfated polysaccharide from red seaweed *Gracilaria cornea*. *Carbohydrate Polymers*, 49: 491-498.
- Moo, S.K. dan Fu, X.T. 2010. Agarase: Review a major sources, categories, purification method, enzyme characteristics and applications. *Marine Drugs*, 8(1):200-218.
- Moore, E. 2016. *Fourier Transform Infrared Spectroscopy (FTIR): Methods, Analysis, and Research Insights*. New York: Nova Science Publishers, Incorporated.
- Nishinari, K. dan Zhang, H. 2004. Recent advances in the understanding of heat set gelling polysaccharides. *Trends in Food Science Technology*, 15: 305-312.
- Nishinari, K., dan Yapeng, F. 2017. Relation between structure and rheological/ thermal properties of agar on the effect of alkali treatment and the role of agarpectin. *Food Structure*: 24-34.
- Normand, V., Lootens, D.L., Amici, E., Plucknett, K.P., Aymard, P., 2000. New insight into agarose gel mechanical properties. *Biomacromolecules*, 1:730–738.
- Nussinovitch, A. 2010. *Polymer Macro- and Micro- Gel Beads: Fundamentals and Applications*. New York: Springer, 27-52.
- Orduna-Rojas, J., Suarez-Castro, R., Lopez-Alvarez, E.S., Riosmena-Rodriguez, R., Pachecho-Ruiz, I., Zertuche-Gonzalez, J.A., dan Meling-Lopez, A.E. 2008. Influence of alkali treatment on agar from *Gracilaropsis longissimi* and *Gracilaria vermiculophylla* from the gulf of California, Mexico. *Ciencias Marinas Journal*, 49: 267-271.
- Ouyang, Q.Q., Hu, Z., Li, S.D., Quan, W.Y., Wen, L.L., Yang, Z.M., dan Li, P.W. 2018. Thermal degradation of agar: mechanism and toxicity of products. *Food Chemistry* Vol. 264: 277-283.

- Pereira, R. dan Yarish, C. 2008. Mass production of marine macroalgae dalam Jørgensen, S. E. dan Fath, B. D. (Eds.) *Ecological Engineering*, 3: 2236-2247.
- Phillips, G. O., dan P. A. Williams. 2009. *Handbook of hydrocolloids 2<sup>nd</sup> ed.* Boca Raton: Woodhead Publishing Ltd.
- Praiboon, J., Chirapart, A., Akakabe, Y., Bhumibhamon, O., dan Kajiwara, T. 2006. Physical and chemical characterization of agar polysaccharides extracted from the Thai and Japanese species of *Gracilaria*. *Science Asia*, 32:11-17.
- Rahim, AR, Nursyam, H., Herawati, E.Y., dan Harianti, A.M. 2015. Cells characteristics, growth, and quality of *Gracilaria verrucosa* seaweed production with different doses of vermicompost fertilizer. *International Journal of Science Technology and Engineering*, 2(2):172-176.
- Rodriguez, M.C., Matulewicz, M.C., Noseda, M.D., Ducatti, D.R.B., dan Lenardi, P.I. 2009. Agar from *Gracilaria gracilis* (Gracilariales, Rhodophyta) of the patagonic coast of Argentina-content, structure and physical properties. *Bioresource Technology*, 100: 1435-1441.
- Romero, J.B, Villanueva, R.D, dan Montano, M.N.E. 2008. Stability of agar in the seaweed *Gracilaria eucheumatoides* (Gracilariales, Rhodophyta) during postharvest storage. *Bioresource Technology*, 99: 8151-8155.
- Sahu, N. dan Sahoo, D. 2013. Stufy of morphology and agar contents in some important *Gracilaria* spesies of Indian Coasts. *American Journal of Plant Sciences*, 4:52-29.
- Sandria, N., Uju, dan Suptijah, P. 2017. Depolimerisasi Kappa Karaginan dengan Menggunakan *Peracetic Acid*. *Jurnal Pengolahan Hasil Perikanan Indonesia* Vol. 20 (3):524- 535.
- Santoso, J., Podungge, F., Sumaryanto, H. 2013. Chemical composition and antioxidant activity of tropical brown alga *Padina australis* from Pramuka Island-District of Seribu Island, Indonesia. *Jurnal Ilmu dan Teknologi Kelautan Tropis*, 5(2):287-297.
- Shankar, S., dan Rhim, J.-W. 2016. Tocopherol-mediated synthesis of silver nanoparticles and preparation of antimicrobial PBAT/silver nanoparticles composite films. *LWT - Food Science and Technology*, 72: 149-156.
- Shankar, S., Reddy, J.P., dan Rhim, J.W. 2015. Effect of lignin on water vapor barrier, mechanical, and structural properties of agar/lignin composite films. *International Journal of Biological Macromolecules*, 81: 267-273.
- Shankar, S., Teng, X., dan Rhim, J.W. 2014. Properties and characterization of agar/CuNP bionanocomposite films prepared with different copper salts and reducing agents. *Carbohydrate Polymers*, 114: 484-492.

- Siregar, R. F., Santoso, J., dan Uju. 2016. Karakteristik Fisiko Kimia Kappa Karaginan Hasil Degradasi Menggunakan Hidrogen Peroksida. *Jurnal Pengolahan Hasil Perikanan Indonesia* Vol. 19 No. 3: 256-266.
- Song, H. 2018. *Engineering Fluid Mechanics*. Beijing: Metallurgical Industry Press, Beijing and Springer Nature Singapore Pte, Ltd.
- Sousa, A.M.M. dan Goncalves, M.P. 2015. The influence of locust bean gum on native and alkali-modified agar gels. *Food Hydrocolloids*, 44: 461-479.
- Stanley, N.F. 2006. Agars, dalam Stephen, A.M., Phillips, G.O. *Food Polysaccharides and Their Applications*. CRC Press, 217-230.
- Sugiyatno, M. I. dan Prihastanti, E.. 2013. Manajemen budidaya dan pengolahan pasca panen *Gracilaria verrucosa* (Hudson) Papenfus. *Manajemen Budidaya dan Pengolahan*, 42-50.
- Suliman, W., Harsh, J.B., Abu-Lail, N.I., Fortuna, A.M., Dallmeyer, I., dan Garcia-Perez, M. 2016. Influence of feedstock source and pyrolysis temperature on biochar bulk and surface properties. *Biomass Bioenergy*, 84: 37-48.
- Sun Y., Yang, B., Wu, Y., Gu, X., Zhang, H., Wang, C., Cao, H., Huang, L., dan Wang, Z. 2015. Structural characterization and antioxidant activities of kappa-carrageenan oligosaccharides degraded by different methods. *Food Chemistry*, 178:311-318.
- Suzuki, H., Sawai, Y., dan Takada M. 2001. The effect of apparent molecular weight and components of agar on gel formation. *Food Science and Technology Research*, 7(4): 280-284.
- Tanasale, M.F.J.D.P., Telussa, I., Sekewael, S.J., dan Kakerissa, L. 2016. Ekstraksi dan karakterisasi kitosan dari kulit udang windu (*Penaeus monodon*) serta proses depolimerisasi kitosan dengan hidrogen peroksida berdasarkan variasi suhu pemanasan. *Journal of Chemical Research*, 3(2): 308-316.
- Thomas, D.N. 2002. *Seaweeds*. London: Natural History Museum.
- Tiwari, B.K. dan Troy, D.J. 2015. *Seaweed Sustainability: Food and Non-Food Application*. Oxford: Elsevier, Inc.
- United States Pharmacopeial Convention. 2007. *The United States Pharmacopeia, 31<sup>st</sup> ed.* Rockville: The United States Pharmacopeial Convention.
- Venugopal, V. 2009. *Marine Products for Healthcare: Functional and Bioactive Nutraceutical Compounds from the Ocean*. New Delhi: CRC Press Taylor & Francis Group.
- Vergara-Rodarte, M.A., Hernandez-Carmona, G., Rodriguez-Montesinos, Y.E., Arvizu-Higuera, D.L., Riosmena-Rodriguez, R., dan Murillo-Alvarez, J.I. 2010. Seasonal variation of agar from *Gracilaria vermiculophylla*, effect of alkali treatment time, and stability of its Colagar. *Journal of Applied Phycology*, 22: 753-759.

- Villanueva, R., Sousa, A., Doncalves, M., Nilsson, M., dan Hilliou, L. 2010. Production and properties of agar from invasive marine alga, *Gracilaria vermiculophylla* (Gracilariales, Rhodophyta). *Journal of Applied Phycology*, 22(2): 211-220.
- Walstra, P. 2003. *Physical Chemistry of Foods*. New York: Marcel Dekker, Inc.
- Wang, C., Fang, R., dan Chin, J. 2006. Study on selection of conditions for researching peracetic acid and its stability [J]. *Chinese Journal of Disinfection*, 23(2):100-102.
- Wang, L., Shen, Z., Mu, H., Lin, Y., Zhang, J., dan Jiang, X. 2017. Impact of alkali pretreatment on yield, physico-chemical and gelling properties of high quality agar from *Gracilaria tenuistipitata*. *Food Hydrocolloids*, 70:356-362.
- Wardhani, I.K., Badres, S., dan Prasetyaningrum, A. Kinetika reaksi depolimerisasi karaginan pada suhu dan pH optimum dengan katalisator asam sulfat. *Jurnal Teknologi Kimia dan Industri*, 2(4): 177-183.
- Whistler, R. dan BeMiller, J. 2012. *Industrial Gums 3rd edition*. New York: Academic Press.
- Widiastuti, I. M. 2011. Produksi *Gracilaria verrucosa* yang Dibudidayakan Di Tambak dengan Berat Bibit dan Jarak Tanam yang Berbeda. *Jurnal Agrisains* 12 (1): 57-62.
- Wilson, JN. 2014. Peracetic acid as an alternative disinfectant. *Clear Water Winter*, 44(4): 17-19.
- Yarnpakdee, S., Benjakul, S., dan Kingwascharapong, P. 2015. Physico-chemical and gel properties of agar from *Gracilaria tenuistipitata* from the lake of Songkhla, Thailand. *Food Hydrocolloids*, 51: 217-226.
- Yuniarti, P., Suprijatna, E., Sarengat, W. 2015. Pengaruh penggunaan limbah rumput laut (*Gracilaria verrucosa*) terhadap performans puyuh jantan umur 6-10 minggu. *Animal Agriculture Journal* 4(2):225-228.
- Zhang, J., Liu, J., dan Liu, R. 2015. Effect of pyrolysis temperature and heating time on biochar obtained from the pyrolysis of straw and lignosulfonate. *Bioresource Technology*,176: 288-291.
- Zhao, S-X., Ta, N., dan Wang, X-D. 2017. Effect of temperature on the structural and physicochemical properties of biochar with apple tree branches as feedstock material. *Energies*, 10(9): 1293-1308.
- Zhao, X., Zhang, T., Zhou, Y., dan Liu, D. 2007. Preparation of peracetic acid from hydrogen peroxide Part I: Kinetics for peracetic acid synthesis and hydrolysis. *Journal of Molecular Catalysis A Chemical*, 271:246-252.