KEANEKARAGAMAN GENETIK *Chlorella* sp. PADA MEDIA LIMBAH TAHU DENGAN METODE KARAKTERISTIK BIOKIMIA DAN *RANDOM AMPLIFIED POLYMORPHIC DNA*

SKRIPSI

diajukan untuk memenuhi sebagian syarat untuk memperoleh gelar Sarjana Sains

Program Studi Biologi

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PROGRAM STUDI BIOLOGI

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Sebuah Skripsi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Sarjana Sains pada Program Studi Biologi, Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam

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LEMBAR PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi dengan judul "Keanekaragaman Genetik *Chlorella* sp. pada Media Limbah Tahu dengan Metode Karakteristik Biokimia dan *Random Amplified Polymorphic DNA*" ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung sanksi apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya.

Bandung, Agustus 2024
Yang membuat pernyataan,

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ABSTRAK

Kemampuan adaptasi organisme dipengaruhi oleh adanya seleksi lingkungan yang memengaruhi variabilitas genetik. *Chlorella* sp., berpotensi sebagai fikoremediator dan untuk dapat memanfaatkan potensinya secara optimal yaitu dengan memahami karakteristik fenotipik dan keanekaragaman genetiknya. Penelitian ini bertujuan untuk menganalisis keanekaragaman genetik *Chlorella* sp. pada media limbah tahu dengan karakteristik biokimia dan PCR-RAPD. Metode penelitian mencakup analisis biokimia (protein, lipid, karbohidrat, klorofil-a, dan karotenoid) dan PCR-RAPD untuk menganalisis variasi genetik. *Chlorella* sp. dalam media LT OUT 100% + Fe (C) menghasilkan protein tertinggi, media LT OUT 100% + Mg + Fe (D) dengan klorofil-a dan karotenoid tertinggi, dan media LT OUT 100% + Mg + Fe + AF6 A2 (E) menghasilkan karbohidrat tertinggi, dengan lipid tertinggi dihasilkan oleh *Chlorella* sp. dalam media kontrol/AF6 (A). Variasi genetik *Chlorella* sp. setiap perlakuan berbeda-beda berdasarkan pola pita, dengan persentase polimorfisme dari OPA-5, OPA-7, dan OPA-11 mencapai 89.3% dan nilai PIC 0.35, menunjukkan polimorfisme tinggi dan primer yang informatif. Perbedaan pola karakteristik biokimia (protein, lipid, karbohidrat, klorofil-a, dan karotenoid) juga tercermin pada variasi genetik hasil amplifikasi PCR-RAPD, melalui dendrogram dan pola pita yang terbentuk menunjukkan bahwa komposisi media LT OUT 100% + Mg + Fe (D) dan LT OUT 100% + Mg + Fe + AF6 A2 (E) menghasilkan variasi genetik yang berbeda daripada *Chlorella* sp. dalam media kontrol/AF6 (K) dan LT OUT 100% (A), yang menunjukkan semakin kompleks dan bervariasi komposisi media limbah tahu, maka semakin kurang atau jauh kemiripan genetik dengan *Chlorella* sp. dalam media kontrol/AF6 (K) dan LT OUT 100% (A).

Kata kunci: Adaptasi, *Chlorella* sp., keanekaragaman genetik, media limbah tahu, PCR-RAPD

GENETIC DIVERSITY OF *Chlorella* sp. IN TOFU WASTE MEDIA BY BIOCHEMICAL CHARACTERISTICS AND *RANDOM AMPLIFIED POLYMORPHIC DNA* METHODS

ABSTRACT

The adaptability of organisms is influenced by environmental selection, which in turn affects genetic variability. *Chlorella* sp. has the potential to be a phycoremediator and can optimize its potential by understanding its phenotypic characteristics and genetic diversity. The objective of this study is to analyze the genetic diversity of *Chlorella* sp. in tofu waste media using biochemical characteristics and PCR-RAPD. The methods employed biochemical analysis (protein, lipid, carbohydrate, chlorophyll-a, and carotenoid) as well as PCR-RAPD to assess genetic variation. Among the different media tested, *Chlorella* sp. in LT OUT 100% + Fe (C) media demonstrated the highest protein production, while LT OUT 100% + Mg + Fe (D) media showed the highest levels of chlorophyll-a and carotenoids. In addition, LT OUT 100% + Mg + Fe + AF6 A2 (E) media produced the highest carbohydrate content, while *Chlorella* sp. in the control/AF6 (A) media exhibited the highest lipid production. The genetic variation of *Chlorella* sp. varied among the different treatments, as evident from the banding patterns. Notably, the percentage of polymorphism for OPA-5, OPA-7, and OPA-11 reached 89.3%, indicating a high level of polymorphism and informative primers with a PIC value of 0.35. The differences in biochemical characteristics (proteins, lipids, carbohydrates, chlorophyll-a, and carotenoids) were reflected in the genetic variation observed through PCR-RAPD amplification results. The dendrogram and banding patterns formed indicate that the composition of LT OUT 100% + Mg + Fe (D) and LT OUT 100% + Mg + Fe + AF6 A2 (E) media yield genetic variations distinct from those of *Chlorella* sp. in the control/AF6 (K) and LT OUT 100% (A) media. This suggests that the complexity and variability of tofu waste media composition have an impact on the genetic similarity between *Chlorella* sp. and the control/AF6 (K) and LT OUT 100% (A) media.

Keywords: Adaptation, *Chlorella* sp., genetic diversity, tofu waste water media, PCR-RAPD

DAFTAR ISI

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DAFTAR LAMPIRAN

DAFTAR PUSTAKA

Abdulameer, S. H., & Thabit, H. M. (2022). The DNA Extraction from *Chlorella* Algae, and its Preparation for Real Time-polymerase Chain Reaction. *International Journal of Drug Delivery Technology*, *12*(4), 1853–1856. https://doi.org/10.25258/ijddt.12.4.61

Abreu, A. P., Martins, R., & Nunes, J. (2023). Emerging Applications of *Chlorella* sp. and *Spirulina* (*Arthrospira*) sp. *Bioengineering (Basel, Switzerland)*, *10*(8), 955. https://doi.org/10.3390/bioengineering10080955

Abubakar, B. M., Izham, N. H. M., Salleh, F. M., Omar, M. S. S., & Wagiran, A. (2018). Comparison of Different DNA Extraction Methods from Leaves and Roots of *Eurycoma longifolia* Plant. *Advanced Science Letters*, *24*(5), 3641–3645. https://doi.org/10.1166/asl.2018.11456

Admirasari, R., Hindersin, S., von Schwartzenberg, K., & Hanelt, D. (2022). Nutritive Capability of Anaerobically Digested Black Water Increases Productivity of *Tetradesmus obliquus*: Domestic Wastewater as an Alternative Nutrient Resource. *Bioresource Technology Reports*, *17*, 1–8. https://doi.org/10.1016/j.biteb.2021.100905

Ahmad, M. T., Shariff, M., Md. Yusoff, F., Goh, Y. M., & Banerjee, S. (2018). Applications of Microalga *Chlorella vulgaris in* Aquaculture. *Reviews in Aquaculture*, 1-19. https://doi.org/10.1111/raq.12320

Ahmed, Hanan. H., & Okba, A. K. (2017). Determination of *Anabaena oryzae* Survival by Chlorophyll-a and Carotenoid under Using Treated Sewage Water. *J.Agric.Chem.and Biotechn*, *8*(5), 157–161. https://doi.org/http://dx.doi.org/10.21608/jacb.2017.38496

Ajijah, N., Tjandra, B. C., Hamidah, U., Widyarani, & Sintawardani, N. (2020). Utilization of Tofu Wastewater as a Cultivation Medium for *Chlorella vulgaris* and *Arthrospira platensis*. *IOP Conference Series: Earth and Environmental Science*, *483*(1). https://doi.org/10.1088/1755-1315/483/1/012027

Alghanmi, H. A., & Al-Khazali, Z. K. M. (2021). Effect of Magnesium Oxide Nanoparticles on Growth and Biochemical Content of Blue-green Alga *Wollea salina*. *Al-Qadisiyah Journal of Pure Science*, *426*(4), 114–129. https://doi.org/10.29350/jops

Aljabri, H., Cherif, M., Siddiqui, S.A., Bounnit, T., & Saadoui, I. (2023). Evidence of The Drying Technique's Impact on The Biomass Quality of *Tetraselmis subcordiformis* (Chlorophyceae). *Biotechnol Biofuels 16*(85), 1-11. https://doi.org/10.1186/s13068-023-02335-x

Almomani, F. A. (2019). Assessment and Modeling of Microalgae Growth Considering The Effects of CO_2, Nutrients, Dissolved Organic Carbon and

Solar Irradiation. *Journal of Environmental Management, 247,* 738–748. https://doi.org/10.1016/j.jenvman.2019.06.085

Amaral, E. T., Bender, L. B. Y. C, Rizzetti, T. M., & Schneider, R. C. S. (2023). Removal of Organic Contaminants in Water Bodies or Wastewater by Microalgae of The Genus *Chlorella*: A Review. *Case Studies in Chemical and Environmental Engineering, 8,* 1-8. https://doi.org/10.1016/j.cscee.2023.100476

Amiteye S. (2021). Basic Concepts and Methodologies of DNA Marker Systems in Plant Molecular Breeding. *Heliyon*, *7*(10), e08093, 1-20. https://doi.org/10.1016/j.heliyon.2021.e08093

Anzano, A., Bonanomi, G., Mazzoleni, S., & Lanzotti, V. (2022). Plant Metabolomics in Biotic and Abiotic Stress: a Critical Overview. *Phytochemistry Reviews, 21*(2), 503–524. https://doi.org/10.1007/s11101-021-09786-w

Arora, N., Patel, A., Pruthi, P. A., & Pruthi, V. (2016). Synergistic Dynamics of Nitrogen and Phosphorous Influences Lipid Productivity in *Chlorella minutissima* for Biodiesel Production. *Bioresource technology*, *213*, 79–87. https://doi.org/10.1016/j.biortech.2016.02.112

Arora, N., & Philippidis, G. P. (2021). Insights Into The Physiology of *Chlorella vulgaris* Cultivated in Sweet Sorghum Bagasse Hydrolysate for Sustainable Algal Biomass and Lipid Production. *Scientific Reports*, *11*(1), 1–14. https://doi.org/10.1038/s41598-021-86372-2

Arruda, S. R., Pereira, D. G., Silva-Castro, M. M., Brito, M. G., & Waldschmidt, A. M. (2017). An Optimized Protocol for DNA Extraction in Plants with a High Content of Secondary Metabolites, Based on Leaves of *Mimosa tenuiflora* (Willd.) Poir. (Leguminosae). *Genetics and Molecular Research, 16*(3). https://doi.org/10.4238/gmr16039063

Astuti, J. T., Putro, A., & Sembiring, T. (2010). Growth and Fatty Acid Composition of Marine Microalgae *Nannochloropsis* sp in Medium Enriched with Magnesium. *Jurnal Teknik Lingkungan*, *11*(3), 409–416. https://doi.org/http://dx.doi.org/10.29122/jtl.v11i3.1186

Babu, K. N., Rajesh, M. K., Samsudeen, K., Minoo, D., Suraby, E. J., Anupama, K., & Ritto, P. (2014). *Randomly Amplified Polymorphic DNA (RAPD) and Derived Techniques*. Dalam Molecular Plant Taxonomy Methods and Protocols Methods in Molecular Biology (Vol. 1115, hlm. 191–209). http://www.springer.com/series/7651

Bajguz, A. (2000). Effect of Brassinosteroids on Nucleic Acids and Protein Content in Cultured Cells of *Chlorella vulgaris*. *Plant Physiol. Biochem, 38*(3), 209–215. https://doi.org/10.1016/S0981-9428(00)00733-6

Barbarino, E., & Lourenço, S. O. (2005). An Evaluation of Methods for Extraction and Quantification of Protein from Marine Macro- and Microalgae. *Journal of Applied Phycology*, *17*(5), 447–460. https://doi.org/10.1007/s10811-005-1641-4

Beatrice-Lindner, P., Garrido-Cardenas, J. A., Sepulveda, C., & Acien-Fernandez, F. G. (2018). A New Approach for Detection and Quantification of Microalgae in Industrial-scale Microalgal Cultures. *Applied Microbiology and Biotechnology*, *102*(19), 8429–8436. https://doi.org/10.1007/s00253-018-9268-y

Ben, A. B. A. H, Taidi, B., Ayadi, H., Pareau, D., & Stambouli, M. (2017). The Use of *Chlorella vulgaris* to Accumulate Magnesium under Different Culture Conditions. *Journal of Applied Biotechnology & Bioengineering*, *2*(5), 43–48. https://doi.org/10.15406/jabb.2017.02.00043

Blanquart, F., Kaltz, O., Nuismer, S. L., & Gandon, S. (2013). A Practical Guide to Measuring Local Adaptation. *Ecology Letters*, *16*(9), 1195–1205. https://doi.org/10.1111/ele.12150

Boamponsem, G. A., Leung, D. W. M., & Lister, C. (2018). Relationships among Iron Deficit-Induced Potato Callus Growth Inhibition, Fe Distribution, Chlorosis, and Oxidative Stress Amplified by Reduced Antioxidative Enzyme Activities. *Plant Cell, Tissue and Organ Culture*, *132*(2), 393–412. https://doi.org/10.1007/s11240-017-1338-9

Boesenberg-Smith, K. A., Pessarakli, M. M., & Wolk, D. M. (2012). Assessment of DNA Yield and Purity: An Overlooked Detail of PCR Troubleshooting. *Clinical Microbiology Newsletter*, *34*(1), 1–6. https://doi.org/10.1016/j.clinmicnews.2011.12.002

Bott, N. J., Ophel-Keller, K. M., Sierp, M. T., Herdina, Rowling, K. P., Mckay, A. C., Loo, M. G. K., Tanner, J. E., & Deveney, M. R. (2010). Toward Routine, DNA-based Detection Methods for Marine Pests. *Biotechnology Advances*, *28*(6), 706–714. https://doi.org/10.1016/j.biotechadv.2010.05.018

Cagliari, A., Margis, R., Dos Santos Maraschin, F., Turchetto-Zolet, A. C., Loss, G., & Margis-Pinheiro, M. (2011). Biosynthesis of Triacylglycerols (TAGs) in Plants and Algae. *International Journal of Plant Biology*, *2*(1), 40–52. https://doi.org/10.4081/pb.2011.e10

Carneiro, D. C, Mascarenhas Oliveira, M., & da Cunha Lima, S. T. (2019). Estimating Protein Quantities from Microalgae: Protein per Biomass Percentage, Spectroscopic Concentration, and Lectin Content. *Chemical Papers*, *73*(10), 2535–2540. https://doi.org/10.1007/s11696-019-00807-9

Chen, C. L., Chang, J. S., & Lee, D. J. (2015). Dewatering and Drying Methods for Microalgae. *Drying Technology*, *33*(4), 443–454. https://doi.org/10.1080/07373937.2014.997881

Chen, C. M., Lu, Y. L., Sio, C. P., Wu, G. C., Tzou, W. S., & Pai, T. W. (2014). Gene Ontology based Housekeeping Gene Selection for RNA-seq Normalization. *Methods*, *67*(3), 354–363. https://doi.org/10.1016/j.ymeth.2014.01.019

Chen, H., Zheng, Y., Zhan, J., He, C., & Wang, Q. (2017). Comparative Metabolic Profiling of The Lipid-Producing Green Microalga *Chlorella* Reveals That Nitrogen and Carbon Metabolic Pathways Contribute to Lipid Metabolism. *Biotechnol Biofuels*, *10*, 153. https://doi.org/10.1186/s13068-017-0839-4

Chesnokov, Yu. V., & Artemyeva, A. M. (2015). Evaluation of The Measure of Polymorphism Information of Genetic Diversity. *Agricultural Biology, Sel'skokhozyaistvennaya Biologiya*, *50*(5), 571–578. https://doi.org/10.15389/agrobiology.2015.5.571rus

Chiu, S. Y., Kao, C. Y., Chen, T. Y., Chang, Y. Bin, Kuo, C. M., & Lin, C. S. (2014). Cultivation of Microalgal *Chlorella* for Biomass and Lipid Production using Wastewater as Nutrient Resource. *Bioresource Technology*, *184*, 179–189. https://doi.org/10.1016/j.biortech.2014.11.080

Chu, F. F., Chu, P. N., Cai, P. J., Li, W. W., Lam, P. K. S., & Zeng, R. J. (2013). Phosphorus Plays an Important Role in Enhancing Biodiesel Productivity of *Chlorella vulgaris* under Nitrogen Deficiency. *Bioresource Technology*, *134*, 341–346. https://doi.org/10.1016/j.biortech.2013.01.131

Chu, W. L., See, Y. C., & Phang, S. M. (2009). Use of Immobilised *Chlorella vulgaris* for The Removal of Colour from Textile Dyes. *Journal of Applied Phycology*, *21*(6), 641–648. https://doi.org/10.1007/s10811-008-9396-3

Chong, J.F., Fadhullah, W., Lim, V., & Lee, C. K. (2019). Two-stage Cultivation of The Marine Microalga *Chlorella salina* for Starch and Carbohydrate Production. *Aquacult Int*, *27*, 1269–1288. https://doi.org/10.1007/s10499-019-00385-3

Costa, R., Pereira, G., Garrido, I., Tavares-De-Sousa, M. M., & Espinosa, F. (2016). Comparison of RAPD, ISSR, and AFLP Molecular Markers to Reveal and Classify Orchardgrass (*Dactylis glomerata* L.) Germplasm Variations. *PLoS ONE*, *11*(4). https://doi.org/10.1371/journal.pone.0152972

Cui, J., & Tcherkez, G. (2021). Potassium Dependency of Enzymes in Plant Primary Metabolism. *Plant Physiology and Biochemistry*, *166*, 522–530. https://doi.org/10.1016/j.plaphy.2021.06.017

Daliry, S., Hallajisan, A., Roshandeh, J. M., Nouri, H., & Golzary, A. (2017). Investigation of Optimal Condition for *Chlorella vulgaris* Microalgae Growth. *Global J. Environ. Sci. Manage*, *3*(2), 217-230. https://doi.org/10.22034/gjesm.2017.03.02.010

Das, S., Misra, R. C., Rout, G. R., Pattanaik, M. C., & Aparajita, S. (2009). Relationship of Status of Polymorphic RAPD Bands wtih Genotypic Adaptation in Early Finger Millet Genotypes. *African Crop Science Journal*, *17*(2), 61–69.

Dasgupta, N., Nandy, P., Sengupta, C., & Das, S. (2018). Genetic Variation in Relation to Adaptability of Three Mangrove Species from The Indian Sundarbans Assessed with RAPD and ISSR Markers. *J. For. Res*., *29*(2). 301-310. https://doi.org/10.1007/s11676-017-0467-7

da Silva, J.C., Lombardi, A.T. (2020). Chlorophylls in Microalgae: Occurrence, Distribution, and Biosynthesis. In: Jacob-Lopes, E., Queiroz, M., Zepka, L. (eds) Pigments from Microalgae *Handbook. Springer, Cham*. https://doi.org/10.1007/978-3-030-50971-2_1

de Souza, D. C., & Teixeira, T. A. (2019). A Simple and Effective Method to Obtain High DNA Quality and Quantity from Cerrado Plant Species. *Molecular Biology Reports*, *46*(4), 4611–4615. https://doi.org/10.1007/s11033-019-04845-0

de Carvalho, J. C., Sydney, E. B., Assú Tessari, L. F., & Soccol, C. R. (2019). Culture Media for Mass Production of Microalgae. *Biofuels from Algae*, 33–50. https://doi.org/10.1016/b978-0-444-64192-2.00002-0

Devkota, A., Bimb, H. P., Bajracharya, J., & Jha, P. K. (2011). Optimization of RAPD-PCR Conditions for the Study of Genetic Diversity of *Centella asiatica*. *Nepal Journal of Science and Technology*, *12,* 69–74. https://doi.org/http://dx.doi.org/10.3126/njst.v12i0.6482

Dianursanti, Rizkyata, B. T., Gumelar, M. T., & Abdullah, T. H. (2014). Industrial Tofu Wastewater as a Cultivation Medium of Microalgae *Chlorella vulgaris*. *Energy Procedia, 47*, 56-61. https://doi.org/10.1016/j.egypro.2014.01.196

Dimas, A., Istirokhatun, T., & Praharyawan, S. (2017). Pemanfaatan Air Lindi TPA Jatibarang sebagai Media Alternatif Kultivasi Mikroalga untuk Perolehan Lipid. *Jurnal Teknik Lingkungan*, *6*(1), 1–15. https://api.semanticscholar.org/CorpusID:90996099

Ding, J., Zhao, F., Cao, Y., Xing, L., Liu, W., Mei, S., & Li, S. (2014). Cultivation of Microalgae in Dairy Farm Wastewater Without Sterilization. *International Journal of Phytoremediation*, *17*(3), 222–227. https://doi.org/10.1080/15226514.2013.876970

Dorado, G., Unver, T., Budak, H., & Hernández, P. (2017). Molecular Markers. *Reference Module in Biomedical* Sciences, 1-12. https://doi.org/10.1016/b978-0-12-801238-3.08996-0

Dyhrman, S. T. (2016). *Nutrients and Their Acquisition: Phosphorus Physiology in Microalgae.* Dalam Borowitzka, M., Beardall, J., Raven, J. (eds) The

Physiology of Microalgae. Developments in Applied Phycology (Vol 6). Springer, Cham. https://doi.org/10.1007/978-3-319-24945-2_8

Ebenezer, V., Medlin, L. K., & Ki, J. S. (2012). *Molecular Detection, Quantification, and Diversity Evaluation of Microalgae.* Dalam Marine Biotechnology (Vol. 14, Nomor 2, hlm. 129–142). https://doi.org/10.1007/s10126-011-9427-y

El-Sheekh, M., Abu-Faddan, M., Abo-Shandy, A., Nassar, M. Z. A., & Labib, W. (2020). Molecular dentification, Biomass, and Biochemical Composition of The Marine Chlorophyte *Chlorella* sp. MF1 Isolated from Suez Bay. *Journal of Genetic Engineering and Biotechnology*, *18*(27), 1-10. https://doi.org/10.1186/s43141-020-00044-8

Ermis, H., Guven-Gulhan, U., Cakir, T., & Altinbas, M. (2020). Effect of Iron and Magnesium addition on Population Dynamics and High Value Product of Microalgae Grown in Anaerobic Liquid Digestate. *Scientific Reports*, *10*(3510), 1–12. https://doi.org/10.1038/s41598-020-60622-1

Estevam, B. R., Pinto, L. F. R., Filho, R. M., & Fregolente, L. V. (2023). Growth and Metabolite Production in *Chlorella* sp.: Analysis of Cultivation System and Nutrient Reduction. *Bioenergy Research*, *16*(3), 1829–1840. https://doi.org/10.1007/s12155-022-10532-z

Fei, C., Zou, S., Wang, T., Wang, C., Kemuma, N. D., He, M., Amin, S. A., & Wang, C. (2020). A Quick Method for Obtaining High-quality DNA Barcodes without DNA Extraction in Microalgae. *Journal of Applied Phycology*, *32*(2), 1165–1175. https://doi.org/10.1007/s10811-019-01926-2

Ferdous, J., Hanafi, M. M., Y, R. M., & Muhammad, K. (2012). A Quick DNA Extraction Protocol: Without Liquid Nitrogen in Ambient Temperature. *African Journal of Biotechnology*, *11*(27), 6956–6964. https://doi.org/10.5897/ajb11.3283

Galili, S., Amir, R., & Galili, G. (2008). Genetic Engineering of Amino Acid Metabolism in Plants. *Advances in Plant Biochemistry and Molecular Biology*, *1*, 49–80. https://doi.org/10.1016/S1755-0408(07)01003-X

Galvão, L. M. C, & Lages-Silva, E. (2008). *Randomly Amplified Polymorphic DNA (RAPD) : A Useful Tool for Genomic Characterization of Different Organisms.* Dalam Molecular Biomethods Handbook: Second Edition (Vol. 10, hlm. 133–147). Humana Press. https://doi.org/10.1007/978-1-60327-375-6

Gunawan, T. J., Ikhwan, Y., Restuhadi, F., & Pato, U. (2018). Effect of Light Intensity and Photoperiod on Growth of *Chlorella pyrenoidosa* and CO_2 Biofixation. *E3S Web of Conferences*, *31*, 1-7. https://doi.org/10.1051/e3sconf/20183103003

Gregory, T. R. (2008). The Evolution of Complex Organs. *Evo Edu Outreach*, *1*, 358-389. https://doi.org/10.1007/s12052-008-0076-1

Gregory, T. R. (2009). Understanding Natural Selection: Essential Concepts and Common Misconceptions. *Evo Edu Outreach*, *2*, 156–175. https://doi.org/10.1007/s12052-009-0128-1

Ghalambor, C. K., McKay, J. K., Carroll, S. P., & Reznick, D. N. (2007). Adaptive versus Non-Adaptive Phenotypic Plasticity and The Potential for Contemporary Adaptation in New Environments. *Functional Ecology*, *21*(3), 394–407. https://doi.org/10.1111/j.1365-2435.2007.01283.x

Gillespie, J. H., & Langley, C. H. (1974). A General Model to Account for Enzyme Variation in Natural Populations. *Genetics*, *76*, 837–884. https://doi.org/https://doi.org/10.1093/genetics/76.4.837

Grenier, S., Barre, P., & Litrico, I. (2016). Phenotypic Plasticity and Selection: Nonexclusive Mechanisms of Adaptation. *Scientifica*, *2016*, 1-9. https://doi.org/10.1155/2016/7021701

Guldhe, A., Kumari, S., Ramanna, L., Ramsundar, P., Singh, P., Rawat, I., & Bux, F. (2017). Prospects, Recent Advancements and Challenges of Different Wastewater Streams for Microalgal Cultivation. *Journal of Environmental Management*, *203*, 299–315. https://doi.org/10.1016/j.jenvman.2017.08.012

Gusmiaty, Restu, M., & Pongtuluran, I. (2012). Seleksi Primer untuk Analisis Keragaman Genetik Jenis Bitti (*Vitex coffassus*). *Jurnal Perennial*, *8*(1), 25–29. http://journal.unhas.ac.id/index.php/perennial

Halac, S. R., Ruibal-Conti, A. L., Mengo, L. del V., Ullmer, F., Cativa, A., Bazan, R., & Rodriguez, M. I. (2023). Effect of Iron Availability on the Growth and Microcystin Content of Natural Populations of *Microcystis* spp. from Reservoirs in Central Argentina: A Microcosm Experiment Approach. *Phycology*, *3*(1), 168–185. https://doi.org/10.3390/phycology3010011

Hasan, S., Abdel-Rahman, M., Mansour, E. S., & Monir, W. (2020). Prevalence and Antibiotic Susceptibility of Bacterial Pathogens Implicating the Mortality of Cultured Nile Tilapia, *Oreochromis niloticus*. *Egyptian Journal for Aquaculture*, *10*(1), 23-43. https://doi.org/ 10.21608/eja.2020.25437.1017

Haque, K. A., Pfeiffer, R. M., Beerman, M. B., Struewing, J. P., Chanock, S. J., & Bergen, A. W. (2003). Performance of High-throughput DNA Quantification Methods. *BMC Biotechnology*, *3*, 1–10. http://www.biomedcentral.com/1472-6750/3/20

Hedrick, P. W. (2006). Genetic Polymorphism in Heterogeneous Environments: The Age of Genomics. *Annual Review of Ecology, Evolution, and Systematics*, *37*, 67–93. https://doi.org/10.1146/annurev.ecolsys.37.091305.110132

Hongyang, S., Yalei, Z., Chunmin, Z., Xuefei, Z., & Jinpeng, L. (2011). Cultivation of Chlorella pyrenoidosa in Soybean processing wastewater. *Bioresource Technology*, *102*(21), 9884–9890. https://doi.org/10.1016/j.biortech.2011.08.016

Hu, Q., Sommerfeld, M., Jarvis, E., Ghirardi, M., Posewitz, M., Seibert, M., & Darzins, A. (2008). Microalgal Triacylglycerols as Feedstocks for Biofuel Production: Perspectives and Advances. *Plant Journal*, *54*(4), 621–639. https://doi.org/10.1111/j.1365-313X.2008.03492.x

Huang, L., Xu, J., Li, T., Wang, L., Deng, T., & Yu, X. (2014). Effects of Additional Mg^{2+} on The Growth, Lipid Production, and Fatty Acid Composition of *Monoraphidium* sp. FXY-10 under Different Culture Conditions. *Annals of Microbiology, 64*, 1247–1256. https://doi.org/10.1007/s13213-013-0768-9

Huang, Q., Jiang, F., Wang, L., & Yang, C. (2017). Design of Photobioreactors for Mass Cultivation of Photosynthetic Organisms. *Engineering*, *3*(3), 318–329. https://doi.org/10.1016/J.ENG.2017.03.020

Idenyi, & Nwokpuru, J. (2019). Biodiversity of *Chlorella* Species using Random Amplification of Polymorphic DNA (RAPD) Molecular Markers. *International Journal of Biology, Pharmacy and Allied Sciences*, *8*(8). https://doi.org/10.31032/ijbpas/2019/8.8.4787

Jebali, A., Sanchez, M. R., Hanschen, E. R., & Starkenburg, S. R. (2022). Trait Drift in Microalgae and Applications for Strain Improvement. *Biotechnology Advances*, *60*, 1–67. https://doi.org/https://doi.org/10.1016/j.biotechadv.2022.108034

Ji, M. K., Kim, H. C., Sapireddy, V. R., Yun, H. S., Abou-Shanab, R. A. I., Choi, J., Lee, W., Timmes, T. C., Inamuddin, & Jeon, B. H. (2013). Simultaneous Nutrient Removal and Lipid Production from Pretreated Piggery Wastewater by *Chlorella vulgaris* YSW-04. *Applied Microbiology and Biotechnology*, *97*(6), 2701–2710. https://doi.org/10.1007/s00253-012-4097-x

Karamore, A., Pal, R., & Sen, R. (2013). Strategic Enhancement of Algal Biomass and Lipid in *Chlorococcum infusionum* as Bioenergy Feedstock. *Algal Research*, *2*(2), 113-121. https://doi.org/10.1016/j.algal.2013.01.005

Kato, S., & Shinomura, T. (2020). Chapter 4: Carotenoid Synthesis and Accumulation in Microalgae Under Environmental Stress. In: Jacob-Lopes, E., Queiroz, M., Zepka, L. (eds) Pigments from Microalgae *Handbook. Springer, Cham*. https://doi.org/10.1007/978-3-030-50971-2_4

Koçer, A. T., İnan, B., Kaptan Usul, S., Özçimen, D., Yılmaz, M. T., & Işıldak, İ. (2021). Exopolysaccharides from Microalgae: roduction, Characterization, Optimization and Techno-economic Assessment. *Brazilian Journal of Microbiology : [Publication of The Brazilian Society for Microbiology]*, *52*(4), 1779–1790. https://doi.org/10.1007/s42770-021-

00575-3

Kodrostami, M., & Rahimi, M. (2015). Molecular Markers in Plants: Concepts and Applications. *Molecular Markers*, 4024–4031. https://www.researchgate.net/publication/282954774

Kosgey, K., Zungu, P. V., Bux, F., & Kumari, S. (2022). Biological Nitrogen Removal from Low Carbon Wastewater. *Frontiers in Microbiology*, *13*, 1–19. https://doi.org/10.3389/fmicb.2022.968812

Kulak, M., Jorrín-Novo, J. V., Romero-Rodriguez, M. C., Yildirim, E. D., Gul, F., & Karaman, S. (2021). Seed Priming with Salicylic Acid on Plant Growth and Essential Oil Composition in Basil (*Ocimum basilicum* L.) Plants Grown under Water Stress Conditions. *Industrial Crops and Products*, *161*(1), 1–11. https://doi.org/10.1016/j.indcrop.2020.113235

Kumar, N. A., Sridhar, S., Jayapprian, K. R., & Raja, R. (2023). Chapter 33 - Applications of Microalgae in Aquaculture Feed. *Handbook of Food and Feed from Microalgae*, 421-433. https://doi.org/10.1016/B978-0-323-99196-4.00011-5

Kurzyna-Szklarek, M., Cybulska, J., & Zdunek, A. (2022). Analysis of The Chemical Composition of Natural Carbohydrates – An Overview of Methods. *Food Chemistry*, *394*, 1-13. https://doi.org/10.1016/j.foodchem.2022.133466

Lai, J. W. S., Lim, P. E., Wong, C. Y., Phang, S. M., & Beardall, J. (2019). Photosynthetic Response and DNA Mutation of Tropical, Temperate and Polar *Chlorella* under Short-term UVR Stress. *Polar Science*, *20*, 35–44. https://doi.org/10.1016/j.polar.2018.12.004

Lee, C. R., & Mitchell-Olds, T. (2012). Environmental Adaptation Contributes to Gene Polymorphism Across The *Arabidopsis thaliana* Genome. *Molecular Biology and Evolution*, *29*(12), 3721–3728. https://doi.org/10.1093/molbev/mss174

Lee, S. B., Crouse, C. A., & Kline, M. C. (2010). Optimizing Storage and Handling of DNA Extracts. *Forensic Science Review*, *22*(2), 131–144. https://www.researchgate.net/publication/280872661

Li, H., Luo, J., Hemphill, J. K., Wang, J.-T., & Gould, J. H. (2001). A Rapid and High Yielding DNA Miniprep for Cotton (*Gossypium* spp.). *Plant Molecular Biology Reporter*, *19*, 183. https://doi.org/https://doi.org/10.1007/BF02772162

Li, T., Zhan, C., Guo, G., Liu, Z., Hao, N., & Ouyang, P. (2021). Tofu Processing Wastewater as a Low-Cost Substrate for High Activity Nattokinase Production using *Bacillus subtilis*. *BMC Biotechnology*, *21*(57), 1–12. https://doi.org/10.1186/s12896-021-00719-1

Li, S.W., Wei, F.-C., Du, J., & Yang, M.-F. (2017). Genetic diversity and spread of *Lissorhoptrus oryzophilus* (Coleoptera: Curculionidae) in China, based on Amplified Fragment Length Polymorphism. *Journal of Asia-Pacific Entomology*, *20*(3), 935–941. https://doi.org/10.1016/j.aspen.2017.06.012

Lim, Y. A., Ilankoon, I. M. S. K., Khong, N. M. H., Priyawardana, S. D., Ooi, K. R., Chong, M. N., & Foo, S. C. (2024). Biochemical Trade-offs and Opportunities of Commercialized Microalgae Cultivation Under Increasing Carbon Dioxide. *Bioresource Technology*, *393*, 1–10. https://doi.org/10.1016/j.biortech.2023.129898

Liu, J., & Chen, F. (2014). Biology and Industrial Applications of *Chlorella*: Advances and Prospects. *Advances in Biochemical Engineering/Biotechnology*, 153, 1–35. https://doi.org/10.1007/10_2014_286

Liu, Y., Jia, K., Chen, H., Wang, Z., Zhao, W., & Zhu, L. (2023). Cold-Adapted Enzymes: Mechanisms, Engineering and Biotechnological Application. *Bioprocess and Biosystems Engineering*, *46*(10), 1399–1410. https://doi.org/10.1007/s00449-023-02904-2

Lizawati, Nusifera, S., Neliyati, Alia, Y., & Antony. (2019). RAPD-PCR Primer Selection to Analyze Genetic Diversity of Cinnamon Plant. *IOP Conference Series: Earth and Environmental Science*, *391*(1). https://doi.org/10.1088/1755-1315/391/1/012002

López, C. V. G., del Carmen Cerón García, M., Fernández, F. G. A., Bustos, C. S., Chisti, Y., & Sevilla, J. M. F. (2010). Protein Measurements of Microalgal and Cyanobacterial Biomass. *Bioresource Technology*, *101*(19), 7587–7591. https://doi.org/10.1016/j.biortech.2010.04.077

Lowry, O. H., Rosebrough, N. J., Farr, A. L., & Randall, R. J. (1951). Protein Measurment with The Folin Phenol Reagent. *Journal of Biological Chemistry*, *193*(1), 265–275. https://doi.org/https://doi.org/10.1016/S0021-9258(19)52451-6

Luhung, I., Wu, Y., Ng, C. K., Miller, D., Cao, B., & Chang, V. W. C. (2015). Protocol Improvements for Low Concentration DNA-based Bioaerosol Sampling and Analysis. *PLoS ONE*, *10*(11), 1–18. https://doi.org/10.1371/journal.pone.0141158

Lv, J. M., Cheng, L. H., Xu, X. H., Zhang, L., & Chen, H. L. (2010). Enhanced Lipid Production of *Chlorella vulgaris* by Adjustment of Cultivation Conditions. *Bioresource Technology*, *101*(17), 6797–6804. https://doi.org/10.1016/j.biortech.2010.03.120

Manikan, V., Kalil, S., Omar, O., Jalil, A., Kader, A., & Hamid, A. (2014). Effects of Mg^{2+}, Fe^{3+}, Mn^{2+} and Cu^{2+} Ions on Lipid Accumulation by *Cunninghamella bainieri* 2A1. *Sains Malaysiana*, *43*(3), 443–449.

https://www.researchgate.net/publication/272944514

Martínez-González, C. R., Ramírez-Mendoza, R., Jiménez-Ramírez, J., Gallegos-Vázquez, C., & Luna-Vega, I. (2017). Improved Method for Genomic DNA Extraction for Opuntia Mill. (Cactaceae). *Plant Methods*, *13*, 1–10. https://doi.org/10.1186/s13007-017-0234-y

Martins, E. M., Vilarinho, L., Esteves, S., Lopes-Marques, M., Amorim, A., & Azevedo, L. (2011). Consequences of Primer Binding-Sites Polymorphisms on Genotyping Practice. *Open Journal of Genetics*, *01*(02), 15–17. https://doi.org/10.4236/ojgen.2011.12004

Marwal, A., & Gaur, R. K. (2020). Molecular Markers: Tool for Genetic Analysis. *Animal Biotechnology: Models in Discovery and Translation*, 353–372. https://doi.org/10.1016/B978-0-12-811710-1.00016-1

Masojídek, J., Torzillo, G., & Koblízek, M. (2013). *Photosynthesis in Microalgae*. Dalam Handbook of Microalgal Culture: Applied Phycology and Biotechnology: Second Edition (hlm. 21–36). Wiley. https://doi.org/10.1002/9781118567166.ch2

Mavrodiev, E. V., Dervinis, C., Whitten, W. M., Gitzendanner, M. A., Kirst, M., Kim, S., Kinser, T. J., Soltis, P. S., & Soltis, D. E. (2021). A New, Simple, Highly Scalable, and Efficient Protocol for Genomic DNA Extraction from Diverse Plant Taxa. *Applications in Plant Sciences*, *9*(3), 1–6. https://doi.org/10.1002/aps3.11413

Mehar, J., Shekh, A., Malchira, N. U., & Mudliar, S. (2019). *Application of Microalgae in Wastewater Treatment : Potential of Microalgae for Integrated Biomass Production Utilizing CO2 and Food Industry Wastewater*. Dalam Application of Microalgae in Wastewater Treatment (hlm. 41–67). Springer International Publishing. https://doi.org/https://doi.org/10.1007/978-3-030-13909-43

Metsoviti, M. N., Papapolymerou, G., Karapanagiotidis, I. T., & Katsoulas, N. (2019). Effect of Light Intensity and Quality on Growth Rate and Composition of *Chlorella vulgaris*. *Plants (Basel, Switzerland)*, *9*(1), 31. https://doi.org/10.3390/plants9010031

Meunier, J.-R., & Grimont, P. A. D. (1993). Factors Affecting Reproducibility of Random Amplified Polymorphic DNA Fingerprinting. *Research in Microbiology*, *144*, 373–379. https://doi.org/https://doi.org/10.1016/0923-2508(93)90194-7

Michiels, A., Van Den Ende, W., Tucker, M., Van Riet, L., & Van Laere, A. (2003). Extraction of High-Quality Genomic DNA from Latex-containing Plants. *Analytical Biochemistry*, *315*(1), 85–89. https://doi.org/10.1016/S0003-2697(02)00665-6

Mienis, E., Vandamme, D., & Foubert I (2024) Resuspended Freeze-dried *Nannochloropsis* as a Model Laboratory System for Concentrated Fresh *Nannochloropsis* in Ultrasound Cell Disruption Experiments. *Front. Mar. Sci. 11*:1359090. https://doi.org/10.3389/fmars.2024.1359090

Millar, Anthony. A., Smith, Mark. A., & Kunst, L. (2000). All Fatty Acids are not Equal: Discrimination in Plant Membrane Lipids. *Trends in Plant Science*, *5*(3), 95–101. https://doi.org/https://doi.org/10.1016/s1360-1385(00)01566-1

Minter, M., Nielsen, E. S., Blyth, C., Bertola, L. D., Kantar, M. B., Morales, H. E., Orland, C., Segelbacher, G., & Leigh, D. M. (2021). What is Genetic Diversity and Why does it Matter? *Biodiversity*, *9*(1), 1–9.

Mohammed, A. S. A., Naveed, M., & Jost, N. (2021). Polysaccharides; Classification, Chemical Properties, and Future Perspective Applications in Fields of Pharmacology and Biological Medicine (A Review of Current Applications and Upcoming Potentialities). *Journal of polymers and the environment*, *29*(8), 2359–2371. https://doi.org/10.1007/s10924-021-02052-2

Mohseni, A., Kube, M., Fan, L., & Roddick, F. A. (2020). Potential of *Chlorella vulgaris* and *Nannochloropsis salina* for Nutrient and Organic Matter Removal from Municipal Wastewater Reverse Osmosis Concentrate. *Environmental Science and Pollution Research*, *27*(21), 26905–26914. https://doi.org/10.1007/s11356-020-09103-6

Mostafa, N., Omar, H., Tan, S. G., & Napis, S. (2011). Studies on The Genetic Variation of The Green Unicellular Alga *Haematococcus pluvialis* (Chlorophyceae) Obtained from Different Geographical Locations using ISSR and RAPD Molecular Marker. *Molecules*, *16*(3), 2599–2608. https://doi.org/10.3390/molecules16032599

Mufarida, N. A., & Abidin, A. (2021). The Innovation of Tofu Waste Liquid Biogas Reactor Technology as an Alternative Energy Resource. *Waste Technology*, *9*(1), 20–24. https://doi.org/10.14710/wastech.9.1.20-24

Munir, N., Imtiaz, A., Sharif, N., & Naz, S. (2015). Optimization of Growth Conditions of Different Algal Strains and Determination of Their Lipid Contents. *The Journal of Animal & Plant Sciences*, *25*(2), 546-553. https://www.researchgate.net/publication/275519543

Najar-Almanzor, C. E., Velasco-Iglesias, K. D., Nunez-Ramos, R., Uribe-Velázquez, T., Solis-Bañuelos, M., Fuentes-Carrasco, O. J., Chairez, I., García-Cayuela, T., & Carrillo-Nieves, D. (2023). Microalgae-assisted Green Bioremediation of Food-processing Wastewater: A Sustainable Approach Toward a Circular Economy Concept. *Journal of Environmental Management*, *345*. https://doi.org/10.1016/j.jenvman.2023.118774

Nasution, F., Theanhom, A. A., Sukartini, Bhuyar, P., & Chumpookam, J. (2021). Genetic Diversity Evaluation in Wild *Muntingia calabura* L. Based on Random Amplified Polymorphic DNA (RAPD) Markers. *Gene Reports*, *25*, 101335. https://doi.org/10.1016/j.genrep.2021.101335

Nguyen, L. N., Aditya, L., Vu, H. P., Johir, A. H., Bennar, L., Ralph, P., Hoang, N. B., Zdarta, J., & Nghiem, L. D. (2022). Nutrient Removal by Algae-Based Wastewater Treatment. *Current Pollution Reports*, *8*(4), 369–383. https://doi.org/10.1007/s40726-022-00230-x

Niaz, K., Khan, F., & Shah, M. A. (2020). Analysis of Carbohydrates (Monosaccharides, Polysaccharides). *Recent Advances in Natural Products Analysis,* 621–633. https://doi.org/10.1016/b978-0-12-816455-6.00018-4

Nordin, N., Yusof, N., & Samsudin, S. (2017). Biomass Production of *Chlorella* sp., *Scenedesmus* sp., and *Oscillatoria* sp. in Nitrified Landfill Leachate. *Waste and Biomass Valorization*, *8*(7), 2301–2311. https://doi.org/10.1007/s12649-016-9709-8

Nurrusyda, F. S., Subroto, T., Hardianto, A., Sumeru, H. A., Ishmayana, S., Pratomo, U., Oktavia, D. N., Latifah, R. G., Dewi, D. A. S. L. A., & Rachmadona, R. (2024). Analyzing The Impact of Physicochemical Factors on *Chlorella vulgaris* Growth Through Design of Experiment (DoE) for Carbon Capture System. *Mol Biotechnol*. https://doi.org/10.1007/s12033-023-01036-y

Osman, A. I., Fawzy, S., Farghali, M., El-Azazy, M., Elgarahy, A. M., Fahim, R. A., Maksoud, M. I. A. A., Ajlan, A. A., Yousry, M., Saleem, Y., & Rooney, D. W. (2022). Biochar for Agronomy, Animal Farming, Anaerobic Digestion, Composting, Water Treatment, Soil Remediation, Construction, Energy Storage, and Carbon Sequestration: a Review. *Environmental Chemistry Letters*, *20*(4), 2385–2485. https://doi.org/10.1007/s10311-022-01424-x

Panahi, Y., Yari Khosroushahi, A., Sahebkar, A., & Heidari, H. R. (2019). Impact of Cultivation Condition and Media Content on *Chlorella vulgaris* Composition. *Advanced pharmaceutical bulletin*, *9*(2), 182–194. https://doi.org/10.15171/apb.2019.022

Pandey, R. N., Adams, R. P., & Flournoy, L. E. (1996). Inhibition of Random Amplified Polymorphic DNAs (RAPDs) by Plant Polysaccharides. *Plant Molecular Biology Reporter*, *14*(1), 17–22. https://doi.org/https://doi.org/10.1007/BF02671898

Park, S.-H., Steichen, S. A., & Brown, J. K. (2021). Single Nucleotide Polymorphism-mismatch Primer Development for Rapid Molecular dentification of elected Microalgal Species. *Journal of Applied Phycology*, *33*. https://doi.org/10.1007/s10811-021-02409-z/Published

Peña-Castro, J. M., Martínez-Jerónimo, F., Esparza-García, F., & Cañizares-Villanueva, R. O. (2004). Phenotypic Plasticity in *Scenedesmus incrassatulus* (Chlorophyceae) in Response to Heavy Metals Stress. *Chemosphere*, *57*(11), 1629–1636. https://doi.org/10.1016/j.chemosphere.2004.06.041

Perrineau, M.-M., Zelzion, E., Gross, J., Price, D. C., Boyd, J., & Bhattacharya, D. (2014). Evolution of Salt Tolerance in a Laboratory Reared Population of *Chlamydomonas reinhardtii*. *Environmental Microbiology*, *16*(6), 1755–1766. https://doi.org/10.1111/1462-2920.12372

Peterson, G. L. (1979). Review of the Folin Phenol Protein Quantitation Method of Lowry Rosebrough, Farr and Randall. *Analytical Biochemistry*, *100*(1), 201–220. https://doi.org/https://doi.org/10.1016/0003-2697(79)90222-7

Pharmawati, M., Wrasiati, L. P., & Yowani, S. C. (2021). ISSR and RAPD Primers Selection for Assessing Genetic Diversity of *Enhalusacoroides* (L.f.) Royle. *IOP Conference Series: Earth and Environmental Science*, *709*(1), 1–7. https://doi.org/10.1088/1755-1315/709/1/012054

Poerba, Y. S., & Martanti, D. (2008). Genetic variability of *Amorphophallus muelleri* Blume in Java based on Random Amplified Polymorphic DNA. *Biodiversitas Journal of Biological Diversity*, *9*(4). https://doi.org/10.13057/biodiv/d090401

Power, E. G. M. (1996). RAPD Typing in Microbiology-a Technical Review. *Journal of Hospital Infection*, *34*, 247–265. https://doi.org/https://doi.org/10.1016/S0195-6701(96)90106-1

Putri, D., Ulhidayati, A., Musthofa, I. A., & Wardani, A. K. (2018). Single Cell Protein Production of *Chlorella* sp. using Food Processing Waste as a Cultivation Medium. *IOP Conference Series: Earth and Environmental Science*, *131*(1), 1–6. https://doi.org/10.1088/1755-1315/131/1/012052

Raina, S. N., Jain, S., Sehgal, D., Kumar, A., Dar, T. H., Bhat, V., Pandey, V., Vaishnavi, S., Bhargav, A., Singh, V., Rani, V., Tandon, R., Tewari, M., & Mahmoudi, A. (2012). Diversity and Relationships of Multipurpose Seabuckthorn (*Hippophae* L.) Germplasm from The Indian Himalayas as Assessed by AFLP and SAMPL Markers. *Genetic Resources and Crop Evolution*, *59*(6), 1033–1053. https://doi.org/10.1007/s10722-011-9742-1

Ramos Tercero, E. A., Sforza, E., Morandini, M., & Bertucco, A. (2014). Cultivation of *Chlorella protothecoides* with Urban Wastewater in Continuous Photobioreactor: Biomass Productivity and Nutrient Removal. *Applied Biochemistry and Biotechnology*, *172*(3), 1470–1485. https://doi.org/10.1007/s12010-013-0629-9

Rana, M. S., Bhushan, S., Sudhakar, D. R., & Prajapati, S. K. (2020). Effect of Iron Oxide Nanoparticles on Growth and Biofuel Potential of *Chlorella* spp. *Algal Research*, *49*, 1–11. https://doi.org/10.1016/j.algal.2020.101942

Rawat, D., Sharma, U., Poria, P. Finlan, A., Parker, B., Sharma, R. S., & Mishra, V. (2022). Iron-Dependent Mutualism between *Chlorella sorokiniana* and *Ralstonia picketti i* forms The Basis for a ustainable Bioremediation System. *ISME COMMUN2*(83). https://doi.org/10.1038/s43705-022-00161-0

Ren, Q., Wang, Y. chu, Lin, Y., Zhen, Z., Cui, Y., & Qin, S. (2021). The Extremely Large Chloroplast Genome of The Green Alga *Haematococcus pluvialis*: Genome Structure, and Comparative Analysis. *Algal Research*, *56*, 1–11. https://doi.org/10.1016/j.algal.2021.102308

Rizwan, M., Mujtaba, G., & Lee, K. (2017). Effects of Iron Sources on The Growth and Lipid/Carbohydrate Production of Marine Microalga *Dunaliella tertiolecta*. *Biotechnology and Bioprocess Engineering*, *22*(1), 68–75. https://doi.org/10.1007/s12257-016-0628-0

Rocco, L., Valentino, I. V., Scapigliati, G., & Stingo, V. (2014). RAPD-PCR Analysis for Molecular Characterization and Genotoxic Studies of a New Marine Fish Cell Line Derived from *Dicentrarchus labrax*. *Cytotechnology*, *66*(3), 383–393. https://doi.org/10.1007/s10616-013-9586-y

Roldán-Ruiz, I., Dendauw, J., Van Bockstaele, E., Depicker, A., & De Loose, M. (2000). AFLP Markers Reveal High Polymorphic Rates in Ryegrasses (*Lolium* spp.). *Molecular Breeding*, *6*(2), 125–134. https://doi.org/10.1023/A:1009680614564

Rout, G. R., & Sahoo, S. (2015). Role of Iron in Plant Growth and Metabolism. *Reviews in Agricultural Science, 3*, 1–24. https://doi.org/10.7831/ras.3.1

Ru, I. T. K., Sung, Y. Y., Jusoh, M., Wahid, M. E. A., & Nagappan, T. (2020). *Chlorella vulgaris*: a Perspective on its Potential for Combining High Biomass with High Value Bioproducts. *J. App.l Phycol., 1*(1), 1–10. https://doi.org/10.1080/26388081.2020.1715256

Ryckebosch, E., Muylaert, K., & Foubert, I. (2012). Optimization of an Analytical Procedure for Extraction of Lipids from Microalgae. *JAOCS, Journal of the American Oil Chemists' Society*, *89*(2), 189–198. https://doi.org/10.1007/s11746-011-1903-z

Safafar, H., Nørregaard, P. U., Ljubic, A., Møller, P., Holdt, S. L., & Jacobsen, C. (2016). Enhancement of Protein and Pigment Content in Two *Chlorella* species Cultivated on Industrial Process Sater. *Journal of Marine Science and Engineering*, *4*(84). https://doi.org/10.3390/jmse4040084

Safi, C., Zebib, B., Merah, O., Pontalier, P. Y., & Vaca-Garcia, C. (2014). Morphology, Composition, Production, Processing and Applications of *Chlorella vulgaris*: A Review. *Renewable and Sustainable Energy Reviews*, *35*, 265–278. https://doi.org/10.1016/j.rser.2014.04.007

Saini, R. K., Prasad, P., Sreedhar, R. V., Akhilender, N. K., Shang, X., & Keum, Y. S. (2021). Omega-3 Polyunsaturated Fatty Acids (PUFAs): Emerging Plant and Microbial Sources, Oxidative Stability, Bioavailability, and Health Benefits-A Review. *Antioxidants (Basel, Switzerland)*, *10*(10), 1627. https://doi.org/10.3390/antiox10101627

Sarstedt, M., Mooi, E. (2019). Cluster Analysis. In: A Concise Guide to Market Research : Chapter 9. Cluster Analysis. *Springer Texts in Business and* Economics, 326-329. https://doi.org/10.1007/978-3-662-56707-4_9

Säull, T., Lind-Halldén, C., & Halldén, C. (2000). Primer Mixtures in RAPD Analysis. *Hereditas*, *132*(3), 203–208. https://doi.org/10.1111/j.1601-5223.2000.00203.x

Schenk, J. J., Becklund, L. E., Carey, S. J., & Fabre, P. P. (2023). What is The “Modified” CTAB Protocol? Characterizing Modifications to The CTAB DNA Extraction Protocol. *Applications in Plant Sciences*, *11*, 1–11. https://doi.org/10.1002/aps3.11517

Schüler, L. M., Gangadhar, K. N., Duarte, P., Placines, C., Molina-Márquez, A. M., Léon-Bañares, R., Sousa, V. S., Varela, J., & Barreira, L. (2020). Improvement of Carotenoid Extraction from a Recently Isolated, Robust Microalga, Tetraselmis sp. CTP4 (Chlorophyta). *Bioprocess and Biosystems Engineering*, *43*(5), 785–796. https://doi.org/10.1007/s00449-019-02273-9

Senthamilselvi, D., & Kalaiselvi, T. (2023). Gamma Ray Mutants of Oleaginous Microalga *Chlorella* sp. KM504965 with Enhanced Biomass and Lipid for Biofuel Production. *Biomass Conversion and Biorefinery*, *13*, 15501–15517. https://doi.org/10.1007/s13399-022-02400-9

Serrote, C. M. L., Reiniger, L. R. S., Silva, K. B., Rabaiolli S. S. S., & Stefanel, C. M. (2020). Determining The Polymorphic Information Content of a Molecular Marker. *Gene*, *726*, 144175. https://doi.org/10.1016/j.gene.2019.144175

Severo, I. A., Dias, R. R., do Nascimento, T. C., Deprá, M. C., Maroneze, M. M., Zepka, L. Q., & Jacob-Lopes, E. (2022). Microalgae-Derived Polysaccharides: Potential Building Blocks for Biomedical Applications. *World Journal of Microbiology and Biotechnology*, *38*(9). https://doi.org/10.1007/s11274-022-03342-0

Seyfabadi, J., Ramezanpour, Z., & Khoeyi, Z. A. (2011). Protein, Fatty Acid, and Pigment Content of *Chlorella vulgaris* under Different Light Regimes. *Journal of Applied Phycology*, *23*(4), 721–726. https://doi.org/10.1007/s10811-010-9569-8

Shi, T. Q., Wang, L. R., Zhang, Z. X., Sun, X. M., & Huang, H. (2020). Stresses as First-Line Tools for Enhancing Lipid and Carotenoid Production in Microalgae. *Frontiers in Bioengineering and Biotechnology*, *8*, 610.

https://doi.org/10.3389/fbioe.2020.00610

Shihira, I., & Krauss, R. W. (1963). *Chlorella*: Physiology and Taxonomy of Forty-one Isolates. *Biosciences*, 11-52. https://ntrs.nasa.gov/api/citations/19660005349/downloads/19660005349.pdf

Sigalingging, F. A., Padil, & Muria, S. R. (2019). Kultivasi Mikroalga menggunakan Media AF6 Berdasarkan Perbedaan Volume Solution A Media AF6. *Jom FTEKNIK*, *6*(1), 1–5. https://jnse.ejournal.unri.ac.id/index.php/JOMFTEKNIK/article/view/23591/22848

Silva, J. C., Quirós, S. E., Lombardi, A. T., & Figueroa, F. L. (2023). Biomass, Photosynthetic Activity, and Biomolecule Composition in *Chlorella fusca* (Chlorophyta) Cultured in a Raceway Pond Operated Under Greenhouse Conditions. *Journal of Biotechnology*, *367*, 98–105. https://doi.org/10.1016/j.jbiotec.2023.04.005

Singh, J., & Saxena, R. C. (2015). *An Introduction to Microalgae: Diversity and Significance. Diversity and Significance*. Dalam Handbook of Marine Microalgae: Biotechnology Advances (hlm. 11–24). Elsevier Inc. https://doi.org/10.1016/B978-0-12-800776-1.00002-9

Srikant, T., & Drost, H. G. (2021). How Stress Facilitates Phenotypic Innovation Through Epigenetic Diversity. *Frontiers in Plant Science*, *11*, 1–14. https://doi.org/10.3389/fpls.2020.606800

Stefańska, I., Kwiecień, E., Górzyńska, M., Sałamaszyńska-Guz, A., & Rzewuska, M. (2022). RAPD-PCR-Based Fingerprinting Method as a Tool for Epidemiological Analysis of *Trueperella pyogenes* Infections. *Pathogens*, *11*, 1–10. https://doi.org/10.3390/pathogens11050562

Su, Y. (2020). Revisiting Carbon, Nitrogen, and Phosphorus Metabolisms in Microalgae for Wastewater Treatment. *Science of The Total Environment*, 144590. https://doi.org/10.1016/j.scitotenv.2020.144590

Syamkumar, S., Lowarence, B., & Sasikumar, B. (2003). Isolation and Amplification of DNA From Rhizomes of Turmeric and Ginger. *Plant Molecular Biology Reporter*, *21*, 171a–171e. https://doi.org/https://doi.org/10.1007/BF02774243

Tan, J. S., Lee, S. Y., Chew, K. W., Lam, M. K., Lim, J. W., Ho, S. H., & Show, P. L. (2020). A Review on Microalgae Cultivation and Harvesting, and Their Biomass Extraction Processing using Ionic Liquids. *Bioengineered*, *11*(1), 116–129. https://doi.org/10.1080/21655979.2020.1711626

Tanaka, A., & Tsuji, H. (1980). Effects of Calcium on Chlorophyll Synthesis and Stability in the Early Phase of Greening in Cucumber Cotyledons. *Plant*

Physiol, *65*, 1211–1215. https://academic.oup.com/plphys/article/65/6/1211/6076148

Taufikurahman, T., Ardiansyah, M. A., Astutiningsih, N. T., & Suyono, E. A. (2020). Cultivation of *Chlorella vulgaris* in Anaerobically Digested Dairy Manure Wastewater (ADDMW) for Protein and Chlorophyll Production. *Sains Malaysiana*, *49*(9), 2035–2042. https://doi.org/10.17576/jsm-2020-4909-01

Tawfik, E. (2021). Different Cultivation Media Conditions Affecting Behavior and Genetic Stability of *Lepidium sativum* L. *Natural Resources for Human Health*, *1*(2), 85–90. https://doi.org/10.53365/nrfhh/142323

Tewari, R. K., Hadacek, F., Sassmann, S., & Lang, I. (2013). Iron Deprivation-Induced Reactive Oxygen Species Generation Leads to Non-Autolytic PCD in *Brassica napus* Leaves. *Environmental and Experimental Botany, 91*, 74–83. https://doi.org/10.1016/j.envexpbot.2013.03.006

Tonk, F. A., Tosun, M., Ilker, E., Istipliler, D., & Tatar, O. (2014). Evaluation and Comparison of ISSR and RAPD Markers for Assessment of Genetic Diversity in Triticale Genotypes. *Bulgarian Journal of Agricultural Science*, *20*(6), 1413–1420. https://www.researchgate.net/publication/271525296

Udayan, A., Sreekumar, N., & Arumugam, M. (2022). Statistical Optimization and Formulation of Microalga Cultivation Medium for Improved Omega 3 Fatty Scid Production. *Systems Microbiology and Biomanufacturing*, *2*(2), 369–379. https://doi.org/10.1007/s43393-021-00069-1

Umar, B. D., Hassan, Z. Y., & Lawal, M. (2021). Genetic Variability In Wild Populations of (*Clarias gariepinus*) using Random Amplified Polymorphic DNA (RAPD) Marker for Selective Breeding. *Nigerian Society for Animal Production* (NSAP), *45*, 791-795. https://www.njap.org.ng/index.php/njap/article/view/5511

Vignal, A., Milan, D., SanCristobal, M., & Eggen, A. (2002). A Review on SNP and Other Types of Molecular Markers and Their use in Animal Genetics. *Genetics Selection Evolution*, *34*(3), 275–305. https://doi.org/10.1051/gse:2002009

Villarrubia, C. W. N., Tumas, K. C., Chauhan, R., Macdonald, T., Dattelbaum, A. M., Omberg, K., & Gupta, G. (2022). Long-term Stabilization of DNA at Room Temperature using a One-step Microwave Assisted Process. *Emergent Materials*, *5*, 307–314. https://doi.org/10.1007/s42247-021-00208-3/Published

Vu, H. T., Otsuka, S., Ueda, H., & Senoo, K. (2010). Cocultivated Bacteria can Increase or Decrease The Culture Lifetime of *Chlorella vulgaris*. *The Journal of General and Applied Microbiology, 56*(5), 413–418. https://doi.org/10.2323/jgam.56.413

Wadgymar, S. M., Demarche, M. L., Josephs, E. B., Sheth, S. N., & Anderson, J. T. (2022). Local Adaptation: Causal Agents of Selection and Adaptive Trait Divergence. *Annu Rev Ecol Evol Syst*, *53*(1), 87–111. https://doi.org/10.1146/annurev

Wang, F., Gao, B., Su, M., Dai, C., Huang, L., & Zhang, C. (2019). Integrated Biorefinery Strategy for Tofu Wastewater Biotransformation and Biomass Valorization with The Filamentous Microalga *Tribonema minus. Bioresource Technology*, *292,* 1-7. https://doi.org/10.1016/j.biortech.2019.12193

Wang, L., Xue, C., Wang, L., Zhao, Q., Wei, W., & Sun, Y. (2016). Strain Improvement of *Chlorella* sp. for Phenol Biodegradation by Adaptive Laboratory Evolution. *Bioresource Technology*, *205,* 264-268. http://dx.doi.org/10.1016/j.biortech.2016.01.022

Wang, Z., Huang, M., Qi, R., & Zhang, Y. (2017). Enhancing Nitrogen Removal via The Complete Autotrophic Nitrogen Removal Over Nitrite Process in a Modified Single-stage Tidal Flow Constructed Wetland. *Ecological Engineering*, *103,* 170–179. https://doi.org/10.1016/j.ecoleng.2017.04.005

Waters, D.L.E., Shapter, F.M. (2014). The Polymerase Chain Reaction (PCR): General Methods. In: Henry, R., Furtado, A. (eds) Cereal Genomics. *Methods in Molecular Biology*, *1099*. Humana Press, Totowa, NJ. https://doi.org/10.1007/978-1-62703-715-0_7

Weber, S., Grande, P. M., Blank, L. M., & Klose, H. (2022). Insights into Cell Wall Disintegration of *Chlorella vulgaris*. *PloS one*, *17*(1), e0262500. https://doi.org/10.1371/journal.pone.0262500

Weeden, N. F., Muehlbauer, F. J., & Ladizinsky, G. (1992). Extensive Conservation of Linkage Relationships Between Pea and Lentil Genetic Maps. *Journal of Heredity*, *92,* 123–129. https://doi.org/https://doi.org/10.1093/oxfordjournals.jhered.a111171

Whalne, A. S., Cowen, S., Foy, C. A., & Hugget, J. F. (2013). Methods for Applying Accurate Digital PCR Analysis on Low Copy DNA Samples. *PLoS ONE*, *8*(3), 1-10. https://doi.org/0.1371/journal.pone.0058177

Widayat, Philia, J., & Wibisono, J. (2018). Cultivation of Microalgae *Chlorella* sp on Fresh Water and Waste Water of Tofu Industry. *E3S Web of Conferences*, *31*. https://doi.org/10.1051/e3sconf/20183104009

Widjaja, A., Chien, C.-C., & Ju, Y.-H. (2009). Study of Increasing Lipid Production from Fresh Water Microalgae *Chlorella vulgaris. Journal of the Taiwan Institute of Chemical Engineers,* *40*(1), 13–20. https://doi.org/10.1016/j.jtice.2008.07.007

Williams, J. G. K., Kubelik, A. R., Livak, K. J., Rafalski', J. A., & Tingey1, S. V. (1990). DNA Polymorphisms Amplified by Arbitrary Primers are Useful as

Genetic Markers. *Nucleic Acids Research*, *18*(22), 6531–6535. https://doi.org/https://doi.org/10.1093/nar/18.22.6531

Wongsawad, P., & Peerapornpisal, Y. (2014). Molecular Identification and Phylogenetic Relationship of Green Algae, *Spirogyra ellipsospora* (Chlorophyta) using ISSR and rbcL Markers. *Saudi Journal of Biological Sciences*, *21*(5), 505–510. https://doi.org/10.1016/j.sjbs.2014.01.003

Xie, Y., Liu, X., Wei, H., Chen, X., Gong, N., Ahmad, S., Lee, T., Ismail, S., & Ni, S. Q. (2022). Insight Into Impact of Sewage Discharge on Microbial Dynamics and Pathogenicity in River Ecosystem. *Scientific Reports*, *12*(1). https://doi.org/10.1038/s41598-022-09579-x

Xiong, Y., Zhao, Y., He, Y., Zhao, L., Hu, H., Russell, L. B., Chen, Z., & Lu, L. (2024). Current Progress and Future Prospects for nderstanding Genetic Diversity of Seed Plants in China. *Biological Diversity*, *1*(1), 13-21. https://doi.org/10.1002/bod2.12005

Yaakob, M. A., Mohamed, R. M. S. R., Al-Gheethi, A., Ravishankar, G. A., & Ambati, R. R. (2021). Influence of Nitrogen and Phosphorus on Microalgal Growth, Biomass, Lipid, and Fatty Acid Production: An overview. *Cells*, *10*(2), 1–19. https://doi.org/10.3390/cells10020393

Yang, F., Xiang, W., Li, T., & Long, L. (2018). Transcriptome Analysis for Phosphorus Starvation-induced Lipid Accumulation in *Scenedesmus* sp. *Scientific Reports*, *8*(1). https://doi.org/10.1038/s41598-018-34650-x

Yang, L., Chen, J., Qin, S., Zeng, M., Jiang, Y., Hu, L., Xiao, P., Hao, W., Hu, Z., Lei, A., & Wang, J. (2018). Growth and Lipid Accumulation by Different Nutrients in The Microalga *Chlamydomonas reinhardtii*. *Biotechnology for Biofuels*, *11*(1). https://doi.org/10.1186/s13068-018-1041-z

Yarmohammadi, S., Hosseini-Ghatar, R., Foshati, S., Moradi, M., Hemati, N., Moradi, S., Kermani, M. ali H., Farzaei, M. H., & Khan, H. (2021). Effect of *Chlorella vulgaris* on Liver Function Biomarkers: a Systematic Review and Meta-Analysis. *Clinical Nutrition Research*, *10*(1), 83–94. https://doi.org/10.7762/cnr.2021.10.1.83

Zhang, B., Wu, J., & Meng, F. (2021). Adaptive Laboratory Evolution of Microalgae: A Review of the Regulation of Growth, Stress Resistance, Metabolic Processes, and Biodegradation of Pollutants. *Frontiers in microbiology*, *12*, 737248. https://doi.org/10.3389/fmicb.2021.737248

Zhou, W., Chen, P., Min, M., Ma, X., Wang, J., Griffith, R., Hussain, F., Peng, P., Xie, Q., Li, Y., Shi, J., Meng, J., & Ruan, R. (2014). Environment-enhancing Algal Biofuel Production using Wastewaters. *Renewable and Sustainable Energy Reviews*, *36*, 256–269. https://doi.org/10.1016/j.rser.2014.04.073

Zhuang, L.-L., Yu, D., Zhang, J., Liu, F., Wu, Y.-H., Zhang, T.-Y., … Hu, H.-Y. (2018). The Characteristics and Influencing Factors of The Attached Microalgae Cultivation: A Review. *Renewable and Sustainable Energy Reviews*, 94, 1110–1119. https://doi.org/10.1016/j.rser.2018.06.006

Zhu, S., Huang, W., Xu, J., Wang, Z., Xu, J., & Yuan, Z. (2014). Metabolic Changes of Starch and Lipid Triggered by Nitrogen Starvation in The Microalga *Chlorella zofingiensis*. *Bioresource Technology*, *152*, 292–298. https://doi.org/10.1016/j.biortech.2013.10.092

Zhu, S., Wang, Y., Xu, J., Shang, C., Wang, Z., Xu, J., & Yuan, Z. (2015). Luxury Uptake of Phosphorus Changes The Accumulation of Starch and Lipid in *Chlorella* sp. Under Nitrogen Depletion. *Bioresource technology*, *198,* 165–171. https://doi.org/10.1016/j.biortech.2015.08.142

Zizka, V. M. A., Weiss, M., & Leese, F. (2020). Can Metabarcoding Resolve Intraspecific Genetic Diversity Changes to Environmental Stressors? A Test Case using River Macrozoobenthos. *Metabarcoding and Metagenomics*, *4*, 23–34. https://doi.org/10.3897/mbmg.4.51925

Zou, Y., Ge, X., Yan, C., Zhong, Q., Chen, D., Chen, Z., Yuan, Y., Guo, H., Zhou, Y., Wang, J., & Cao, L. (2024). Assessment of Genetic Diversity of *Camellia yuhsienensis* Based on Leaf Structure and Inter Simple Sequence Repeat (ISSR) Markers. *Genetic Resources and Crop Evolution*. https://doi.org/10.1007/s10722-024-01910-x