

7.4. Self-Reflection

When I decided to apply to this faculty, I felt somewhat disoriented. My primary goal was to improve my English and immerse myself in a country where sustainability is deeply embedded in everyday life. My ambition to work on sustainable products never hesitated. Indeed, even during my application process, when asked to propose a possible Master's thesis topic, I developed the idea of designing a wearable gadget capable of capturing CO₂—despite having no clear understanding of how to turn such a complex vision into reality. Two years later, that initial ambition materialized into something tangible: my thesis on a living textile capable of capturing CO₂ and releasing oxygen. This opportunity arose from my participation in the course Fundamentals of Biodesign, where I had the chance to meet my current thesis chair. The journey, however, has been anything but easy. Working on a research-intensive thesis like this has presented numerous challenges, pushing me to develop essential skills such as time management, determination, patience, consistency, charisma, and precision. At times, it was difficult, but each challenge strengthened my ability to adapt and persist. Some skills came more naturally than others, but I never lost sight of my goal. Thanks to the guidance and support of my chair and mentor, I was able to navigate these 20 weeks of research. Now, as I conclude this journey, I can confidently say that I have successfully developed a functional living textile prototype, demonstrating its potential applicability in sustainable material innovation.

8. Bibliography

Salolainen, M. (2022). *Interwoven: Exploring Materials and Structures*. (Aalto University publication series ART + DESIGN + ARCHITECTURE; Vol. 2022, No. 1). Aalto ARTS Books.

Shenton, J. (2014). *Woven Textile Design*. Laurence King Publishing.

9. References

Abbass, K., Qasim, M. Z., Song, H., Murshed, M., Mahmood, H., & Younis, I. (2022). A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environmental Science and Pollution Research*, 29(28), 42539–42559. <https://doi.org/10.1007/s11356-022-19718-6>

Abdul Hai Alami, Shamma Alasad, Mennatalah Ali, Maitha Alshamsi, (2021). Investigating algae for CO₂ capture and accumulation and simultaneous production of biomass for biodiesel production. *Science of The Total Environment*, Volume 759, 143529, ISSN 0048-9697. <https://doi.org/10.1016/j.scitotenv.2020.143529>.

Abid, N., Ceci, F., & Ikram, M. (2021). Green growth and sustainable development: dynamic linkage between technological innovation, ISO 14001, and environmental challenges. *Environmental Science and Pollution Research*, 29(17), 25428–25447. <https://doi.org/10.1007/s11356-021-17518-y>

Abrishami S, Shirali A, Sharples N, Kartal GE, Macintyre L, Doustdar O. Textile Recycling and Recovery: An Eco-friendly Perspective on Textile and Garment Industries Challenges. *Textile Research Journal*. 2024;94(23-24):2815-2834. doi:10.1177/00405175241247806

Adetunji, A., & Erasmus, M. (2024). Green Synthesis of Bioplastics from Microalgae: A State-of-the-Art Review. *Polymers*, 16(10), 1322. <https://doi.org/10.3390/polym16101322>

agar. (2025). In Merriam-Webster Dictionary. <https://www.merriam-webster.com/dictionary/agar>

Aisyah, H. A., Paridah, M. T., Sapuan, S. M., Ilyas, R. A., Khalina, A., Nurazzi, N. M., Lee, S. H., & Lee, C. H. (2021). A Comprehensive Review on Advanced Sustainable Woven Natural Fibre Polymer Composites. *Polymers*, 13(3), 471. <https://doi.org/10.3390/polym13030471>

Ambika, Pradeep Pratap Singh, A. (2021). 11 - Natural polymer-based hydrogels for adsorption applications. In *Natural Polymers-Based Green Adsorbents for Water Treatment* (pp. 267–306). <https://doi.org/10.1016/B978-0-12-820541-9.00008-9>.

An, B., Wang, Y., Huang, Y., Wang, X., Liu, Y., Xun, D., Church, G. M., Dai, Z., Yi, X., Tang, T., & Zhong, C. (2022). Engineered living materials for sustainability. *Chemical Reviews*, 123(5), 2349–2419. <https://doi.org/10.1021/acs.chemrev.2c00512>

Anderson TR, Hawkins E, Jones PD (2016). CO₂, the greenhouse effect and global warming: from the pioneering work of Arrhenius and Callendar to today's Earth System Models. *Endeavour* 40(3):178–187. <https://doi.org/10.1016/j.endeavour.2016.07.002>

Anila Satish, Sheela Sobana Rani, Saranya B, (2017). Fabric Texture Analysis and Weave Pattern Recognition by Intelligent Processing. https://www.researchgate.net/publication/319328133_Fabric_Texture_Analysis_and_Weave_Pattern_Recognition_by_Intelligent_Processing.

Animesh Jana, Akshay Modi, (2024). Recent progress on functional polymeric membranes for CO₂ separation from flue gases: A review, *Carbon Capture Science & Technology*, Volume 11, 100204, ISSN 2772-6568. <https://doi.org/10.1016/j.ccst.2024.100204>.

Antoni Mateu Vera-Vives, Tim Michelberger, Tomas Morosinotto, Giorgio Perin, (2024). Assessment of photosynthetic activity in dense microalgae cultures using oxygen production. *Plant Physiology and Biochemistry*, Volume 208, 108510, ISSN 0981-9428. <https://doi.org/10.1016/j.plaphy.2024.108510>.

Aqdas Noreen, Khalid Mahmood Zia, Mohammad Zuber, Shazia Tabasum, Ameer Fawad Zahoor, (2016). Bio-based polyurethane: An efficient and environment friendly coating systems: A review. *Progress in Organic Coatings*, Volume 91, Pages 25–32, ISSN 0300-9440. <https://doi.org/10.1016/j.porgcoat.2015.11.018>.

Arul, S. (2024). Microalgae *Scenedesmus* SP.SAR1 as a potential source for bioplastic production. www.academia.edu. https://www.academia.edu/126187478/Microalgae_Scenedesmus_Sp_SAR1_as_a_Potential_Source_for_Bioplastic_Production

Ayoub El Idrissi, Badr-eddine Channab, Younes Essamlali, Mohamed Zahouily, Y. (2024). Superabsorbent hydrogels based on natural polysaccharides: Classification, synthesis, physicochemical properties, and agronomic efficacy under abiotic stress conditions: A review. *International Journal of Biological Macromolecules*. Volume 258, Part 2. <https://doi.org/10.1016/j.ijbiomac.2023.128909>.

B. Jagannathan, J.H. Golbeck, (2009). Photosynthesis: Microbial. Editor(s): Moselio Schaechter. *Encyclopedia of Microbiology* (Third Edition). Academic Press. Pages 325–341. ISBN 9780123739445. <https://doi.org/10.1016/B978-012373944-5.00352-7>.

Balasubramanian, S., Yu, K., Meyer, A. S., Karana, E., & Aubin-Tam, M. (2021). Bioprinting of regenerative photosynthetic living materials. *Advanced Functional Materials*, 31(31). <https://doi.org/10.1002/adfm.202011162>

Begum, M. S., & Milašius, R. (2022). Factors of weave estimation and the Effect of weave structure on fabric Properties: a review. *Fibers*, 10(9), 74. <https://doi.org/10.3390/fib10090074>

Bernal-Chávez, S.A., Romero-Montero, A., Hernández-Parra, H., Peña-Corona, S.I., Del Prado-Audelo, M.L., Alcalá-Alcalá, S., Cortés, H., Kiyekbayeva, L., Sharifi-Rad, J., & Leyva-Gómez, G. (2023). Enhancing chemical and physical stability of pharmaceuticals using freeze-thaw method: challenges and opportunities for process optimization through quality by design approach. *Journal of Biological Engineering*, 17(1). <https://doi.org/10.1186/s13036-023-00353-9>

Bulathsinghala, R. L. (2022). Investigation on material variants and fabrication methods for microstrip textile antennas: A review based on conventional and novel concepts of weaving, knitting and embroidery. *Cogent Engineering*, 9(1). <https://doi.org/10.1080/23311916.2022.2025681>

Buso, A., McQuillan, H., Jansen, K., & Karana, E. (n.d.). The unfolding of textileness in animated textiles: An exploration of woven textile-forms. *DRS Digital Library*. <https://dl.designresearchsociety.org/drs-conference-papers/drs2022/researchpapers/208/>

Byung Sun Yu, Ha Eun Yang, Ranjna Sirohi, Sang Jun Sim, (2022). Novel effective bioprocess for optimal CO₂ fixation via microalgae-based biomineralization under semi-continuous culture. *Bioresource Technology*, Volume 364, 128063, ISSN 0960-8524, <https://doi.org/10.1016/j.biortech.2022.128063>.

Chen, X., Fan, Y., Wu, L. et al. Ultra-selective molecular-sieving gas separation membranes enabled by multi-covalent-crosslinking of microporous polymer blends. *Nat Commun* 12, 6140 (2021). <https://doi.org/10.1038/s41467-021-26379-5>

C.Y.Tong,C.J.C.Derek,(2023).Bio-coatings as immobilized microalgae cultivation enhancement: A review,Science of The Total Environment, Volume 887,ISSN 0048-9697. <https://doi.org/10.1016/j.scitotenv.2023.163857>.

Courtyard | SL Rasch. (n.d.). <https://www.sl-rasch.com/en/projects/courtyard/>

David F. Williams, (2019). Chapter 36 - Hydrogels in Regenerative Medicine, Editor(s): Anthony Atala, Robert Lanza, Antonios G. Mikos, Robert Nerem, Principles of Regenerative Medicine (Third Edition), Academic Press, Pages 627-650, ISBN 9780128098806, <https://doi.org/10.1016/B978-0-12-809880-6.00036-9>.

Davidson, E. A. (2024, December 16). Carbohydrate | Definition, Classification, & Examples. Encyclopedia Britannica. <https://www.britannica.com/science/carbohydrate>

Davidson, & A, E. (2025, February 15). Carbohydrate | Definition, Classification, & Examples. Encyclopedia Britannica. <https://www.britannica.com/science/carbohydrate>

Devendorf, L., DeKoninck, S., & Sandry, E. (2022b). An Introduction to Weave Structure for HCI: a how-to and reflection on modes of exchange. Designing Interactive Systems Conference. <https://doi.org/10.1145/3532106.3534567>

drape. (2025). <https://dictionary.cambridge.org/dictionary/english/drape>

Education, U. C. F. S. (n.d.). Biogeochemical Cycles | Center for Science Education. UCAR. <https://scied.ucar.edu/learning-zone/earth-system/biogeochemical-cycles>

emilie-palle-holm. (n.d.). ARTS THREAD. <https://www.artstthread.com/profile/emilie-palle-holm>

Emmi Pouta, Jussi Ville Mikkonen, and Antti Salovaara. 2024. Opportunities with Multi-Layer Weave Structures in Woven E-Textile Design. *ACM Trans. Comput.-Hum. Interact.* 31, 5, Article 62 (October 2024), 38 pages. <https://doi.org/10.1145/3689039>

Encarnaçã, T., Ramos, P., Mohammed, D., McDonald, J., Lizzul, M., Nicolau, N., Da Graça Campos, M., & Sobral, A. J. F. N. (2023). Bioremediation using microalgae and cyanobacteria and biomass valorisation. In *Environmental challenges and solutions* (pp. 5–28). https://doi.org/10.1007/978-3-031-17226-7_2

Engineering, T. (n.d.-b). TC2 Loom. Tronrud Engineering. <https://www.tronrud.no/en/industrialized-products/products/tc2-loom>

EuropaWire PR Editor. (2023, July 19). Brilliant Planet Partners with Schneider Electric and Platinum Electrical Engineering to Scale Algae-Based Carbon Capture Process. EuropaWire. https://news.europawire.eu/brilliant-planet-partners-with-schneider-electric-and-platinum-electrical-engineering-to-scale-algae-based-carbon-capture-process/eu-press-release/2023/07/19/15/02/44/1970/?utm_source=rss&utm_medium=rss&utm_campaign=brilliant-planet-partners-with-schneider-electric-and-platinum-electrical-engineering-to-scale-algae-based-carbon-capture-process

Fagorite, V. I., Onyekuru, S. O., Opara, A. I., & Oguzie, E. E. (2022). The major techniques, advantages, and pitfalls of various methods used in geological carbon sequestration. *International Journal of Environmental Science and Technology*, 20(4), 4585–4614. <https://doi.org/10.1007/s13762-022-04351-0>

Gigova L, Marinova G. 2016. Significance of microalgae areas and soils. *Genet Plant Physiol* 6: 85-100. https://www.researchgate.net/publication/306960016_Significance_of_microalgae_-_grounds_and_areas

Gries, T., Bettermann, I., Blaurock, C., Bündgens, A., Dittel, G., Emonts, C., Gesché, V., Glimpel, N., Kolloch, M., Grigat, N., Löcken, H., Löwen, A., Jacobsen, J., Kimm, M., Kelbel, H., Kröger, H., Kuo, K., Peiner, C., Sackmann, J., & Schwab, M. (2022b). Aachen Technology Overview of 3D textile materials and recent innovation and applications. *Applied Composite Materials*, 29(1), 43–64. <https://doi.org/10.1007/s10443-022-10011-w>

Hallak, M. A., Verdier, T., Bertron, A., Roques, C., & Bailly, J. (2023). Fungal contamination of building materials and the aerosolization of particles and toxins in indoor air and their associated risks to health: a review. *Toxins*, 15(3), 175. <https://doi.org/10.3390/toxins15030175>

Holly McQuillan and Elvin Karana. 2023. Conformal, Seamless, Sustainable: Multimorphic Textile-forms as a Material-Driven Design Approach for HCI. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems (CHI '23)*. Association for Computing Machinery, New York, NY, USA, Article 727, 1–19. <https://doi.org/10.1145/35444548.3581156>

hydrodynamics. (n.d.). In *Merriam-Webster Dictionary*. <https://www.merriam-webster.com/dictionary/hydrodynamics>

Huan Fang, Jihui Wang, Lin Li, Longquan Xu, Yuxuan Wu, Yi Wang, Xu Fei, Jing Tian, Yao Li, (2019). A novel high-strength poly(ionic liquid)/PVA hydrogel dressing for antibacterial applications. *Chemical Engineering Journal*, Volume 365, Pages 153-164, ISSN 1385-8947. <https://doi.org/10.1016/j.cej.2019.02.030>.

Hugo Barbosa, Marc Barthelemy, Gourab Ghoshal, Charlotte R. James, Maxime Lenormand, Thomas Louail, Ronaldo Menezes, José J. Ramasco, Filippo Simini, Marcello Tomasini, (2018). Human mobility: Models and applications, *Physics Reports*, Volume 734, Pages 1-74, ISSN 0370-1573, <https://doi.org/10.1016/j.physrep.2018.01.001>.

Ignacio Moreno-Garrido, (2008). Microalgae immobilization: Current techniques and uses, *Bioresource Technology*, Volume 99, Issue 10, 2008, Pages 3949-3964, ISSN 0960-8524, <https://doi.org/10.1016/j.biortech.2007.05.040>.

Industries, T. T. (2023, August 29). New research in 3D woven fabrics reveals the potential for higher performance textiles - Tex tech industries. *Tex Tech Industries*. <https://textechindustries.com/blog/new-research-3d-woven-fabrics-reveals-potential-higher-performance-textiles/>

In-Na, P., Lee, J., & Caldwell, G. (2021). Living textile biocomposites deliver enhanced carbon dioxide capture. *Journal of Industrial Textiles*, 51(4_suppl), 5683S-5707S. <https://doi.org/10.1177/15280837211025725>

In-Na, P., Sharp, E. B., Caldwell, G. S., Unthank, M. G., Perry, J. J., & Lee, J. G. M. (2022). Engineered living photosynthetic biocomposites for intensified biological carbon capture. *Scientific Reports*, 12(1). <https://doi.org/10.1038/s41598-022-21686-3>

Islam MR, Karim FE, Khan AN. Statistical analysis of Cotton-Jute blended ratio for producing good quality blended yarn. *Heliyon*. 2024 Jan 19;10(2):e25027. doi: 10.1016/j.heliyon.2024.e25027. PMID: 38312702; PMCID: PMC10835373.

Kaparapu, J. (2017). Micro algal Immobilization Techniques. In *J. Algal Biomass Utiln.* (Vol. 8, Issue 1, pp. 64–70). <https://storage.unitedwebnetwork.com/files/521/37e92165730327cd9d2b1493130db139.pdf>

Karana, E., Barati, B., Rognoli, V., & Zeeuw Van Der Laan, A., (2015). Material driven design (MDD): A method to design for material experiences. *International Journal of Design*, 9 (2), 35–54.

Kesari, S. (2019, September 24). Parallel prototyping. <https://ixd.prattsi.org/2019/09/parallel-prototyping/#:~:text=Parallel%20Prototyping%20is%20a%20method,to%20more%20effective%20design%20result>.

Kirchman, David L. (2018). *Microbial primary production and phototrophy. Processes in Microbial Ecology*. 10.1093/oso/9780198789406.003.0006. Oxford University Press. <https://doi.org/10.1093/oso/9780198789406.003.0006>

Koc, U., Eren, R., & Aykut, Y. (2020). Yarn-reinforced hydrogel composite produced from woven fabrics by simultaneous dissolution and cross-linking. *Polymers and Polymer Composites*, 29(2), 117–126. <https://doi.org/10.1177/0967391120903648>

Lasser, R. (2013, March 21). *Engineering Method – Electrical and Computer Engineering design Handbook*. [https://sites.tufts.edu/eeseniordesignhandbook/2013/engineering-method/#:~:text=The%20engineering%20method%20\(also%20known,problem%20definition%20to%20desired%20result](https://sites.tufts.edu/eeseniordesignhandbook/2013/engineering-method/#:~:text=The%20engineering%20method%20(also%20known,problem%20definition%20to%20desired%20result).

Laura Devendorf and Chad Di Lauro. 2019. Adapting Double Weaving and Yarn Plying Techniques for Smart Textiles Applications. In *Proceedings of the Thirteenth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '19)*. Association for Computing Machinery, New York, NY, USA, 77–85. <https://doi.org/10.1145/3294109.3295625>

Li, Y., Wu, X., Liu, Y., & Taidi, B. (2024). Immobilized microalgae: principles, processes and its applications in wastewater treatment. *World Journal of Microbiology and Biotechnology*, 40(5). <https://doi.org/10.1007/s11274-024-03930-2>

Lin, J., Jiao, G., & Kermanshahi-Pour, A. (2022). Algal Polysaccharides-Based Hydrogels: Extraction, synthesis, Characterization, and Applications. *Marine Drugs*, 20(5), 306. <https://doi.org/10.3390/md20050306>

Masojídek J, Torzillo G, Koblížek M. 2013. Photosynthesis in microalgae. In: Richmond A, Hu Q eds. *Handbook of microalgal culture: applied phycology and biotechnology*. John Wiley & Sons, p.21–36, <https://doi.org/10.1002/9781118567166.ch2>.

McGowan, T. (2016). *Capitalism and desire*. In Columbia University Press eBooks. <https://doi.org/10.7312/mcgo17872>

McQuillan, H. (2020). *Zero Waste Systems Thinking : Multimorphic Textile-Forms*. DIVA. <https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1478307&dswid=4102>

McQuillan, H., & Karana, E. (2023). Conformal, Seamless, Sustainable: Multimorphic Textile-forms as a Material-Driven Design Approach for HCI. *ACM DL DIGITAL LIBRARY*, 1–19. <https://doi.org/10.1145/3544548.3581156>

medium. (2025). In *Merriam-Webster Dictionary*. <https://www.merriam-webster.com/dictionary/medium>

Meina Han, Chaofan Zhang, Shih-Hsin Ho, (2023). Immobilized microalgal system: An achievable idea for upgrading current microalgal wastewater treatment, *Environmental Science and Ecotechnology*, Volume 14, ISSN 2666–4984. <https://doi.org/10.1016/j.es.2022.100227>.

Monique Ellen Torres da Silva, Kely de Paula Correa, Marcio Arêdes Martins, Sérgio Luis Pinto da Matta, Hércia Stampini Duarte Martino, Jane Sélia dos Reis Coimbra, (2020). Food safety, hypolipidemic and hypoglycemic activities, and in vivo protein quality of microalga *Scenedesmus obliquus* in Wistar rats, *Journal of Functional Foods*, Volume 65, 103711, ISSN 1756–4646. <https://doi.org/10.1016/j.jff.2019.103711>.

N. Shahrubudin, T.C. Lee, R. Ramlan, (2019). An Overview on 3D Printing Technology: Technological, Materials, and Applications, *Procedia Manufacturing*, Volume 35, 286–1296, <https://doi.org/10.1016/j.promfg.2019.06.089>.

Narasimman Kalaiselvan, Mysoon M. Al-Ansari, Thangavel Mathimani, (2024). Biodiesel production from the *Scenedesmus* sp. and utilization of pigment from de-oiled biomass as sensitizer in the dye-sensitized solar cell (DSSC) for performance enhancement. *Environmental Research*, Volume 251, Part 2, 118726, ISSN 0013–9351, <https://doi.org/10.1016/j.envres.2024.118726>.

Nguyen, P. Q., Courchesne, N. D., Duraj-Thatte, A., Praveschotinunt, P., & Joshi, N. S. (2018). Engineered Living Materials: Prospects and challenges for using biological systems to direct the assembly of smart materials. *Advanced Materials*, 30(19). <https://doi.org/10.1002/adma.201704847>

Oh, J., Ammu, S., Vriend, V. D., Kieffer, R., Kleiner, F. H., Balasubramanian, S., Karana, E., Masania, K., & Aubin-Tam, M. (2023). Growth, distribution, and photosynthesis of *Chlamydomonas reinhardtii* in 3D hydrogels. *Advanced Materials*, 36(2). <https://doi.org/10.1002/adma.202305505>

Oldenburg, C. M. (2019). *Geologic Carbon Sequestration: sustainability and environmental risk*. In Springer eBooks (pp. 219–234). https://doi.org/10.1007/978-1-4939-8787-0_200

Origami for Beginners: Easy Guide to Origami | Discount Art n Craft Warehouse - Discount Art n Craft Warehouse | Buy Art Supplies Online. (n.d.). <https://discountartncraftwarehouse.com.au/blog-2138/origami-folding-techniques-to-master#:~:text=Origami%20comes%20from%20the%20Japanese,the%20simple%20act%20of%20folding>.

Pauliuk, S., Heeren, N., Berrill, P., Fishman, T., Nistad, A., Tu, Q., Wolfram, P., & Hertwich, E. G. (2021). Global scenarios of resource and emission savings from material efficiency in residential buildings and cars. *Nature Communications*, 12(1). <https://doi.org/10.1038/s41467-021-25300-4>

Perera, Y. S., Muwanwella, R. M. H. W., Fernando, P. R., Fernando, S. K., & Jayawardana, T. S. S. (2021). Evolution of 3D weaving and 3D woven fabric structures. *Fashion and Textiles*, 8(1). <https://doi.org/10.1186/s40691-020-00240-7>

Photobioreactor. (2011, April 14). Chlorelle. <https://chlorelle.wordpress.com/2011/04/14/the-different-kinds-of-chlorellas-production/allemanne-016/>

Pichaya In-na, Abbas A. Umar, Adam D. Wallace, Michael C. Flickinger, Gary S. Caldwell, Jonathan G.M. Lee, (2020). Loofah-based microalgae and cyanobacteria biocomposites for intensifying carbon dioxide capture. *Journal of CO2 Utilization*, Volume 42, 101348, ISSN 2212-9820. <https://doi.org/10.1016/j.jcou.2020.101348>.

R. Gayathri, Shahid Mahboob, Marimuthu Govindarajan, Khalid A. Al-Ghanim, Zubair Ahmed, Norah Al-Mulhm, Masa Vodovnik, Shankar Vijayalakshmi, (2021). A review on biological carbon sequestration: A sustainable solution for a cleaner air environment, less pollution and lower health risks. *Journal of King Saud University - Science*, Volume 33, Issue 2, 1018-3647, <https://doi.org/10.1016/j.jksus.2020.101282>.

Rodrigo-Navarro, A., Sankaran, S., Dalby, M. J., Del Campo, A., & Salmeron-Sanchez, M. (2021). Engineered living biomaterials. *Nature Reviews Materials*, 6(12), 1175-1190. <https://doi.org/10.1038/s41578-021-00350-8>

Russell, S. (2023, November 28). The impact of cotton recycling on the future of sustainability. *Environment Co.* <https://environment.co/cotton-recycling/>

Sarkar, P. (2019, November 19). What is Crimp% in Fabric and How to Measure Warp and Weft Crimp%. *Online Clothing Study*. https://www.onlineclothingstudy.com/2014/06/what-is-crimp-in-fabric-and-how-to.html#google_vignette

Schmid, B., Navalho, S., Schulze, P. S. C., Van De Walle, S., Van Royen, G., Schöler, L. M., Maia, I. B., Bastos, C. R. V., Baune, M.-C., Januschewski, E., Coelho, A., Pereira, H., Varela, J., Navalho, J., & Cavaco Rodrigues, A. M. (2022). Drying Microalgae Using an Industrial Solar Dryer: A Biomass Quality Assessment. *Foods*, 11(13), 1873. <https://doi.org/10.3390/foods11131873>

Schuermans, R. M., Van Alphen, P., Schuurmans, J. M., Matthijs, H. C. P., & Hellingwerf, K. J. (2015). Comparison of the photosynthetic yield of cyanobacteria and green algae: Different methods give different answers. *PLoS ONE*, 10(9), e0139061. <https://doi.org/10.1371/journal.pone.0139061>

Scott, J. (2018). Responsive Knit: the evolution of a programmable material system Design as a catalyst for change - DRS International Conference 2018, Limerick, Ireland. <https://doi.org/10.21606/drs.2018.566>

Selvan, B. K., Pandiyan, R., Vaishnavi, M., Das, S., & Thirunavoukkarasu, M. (2022). Ameliorative biodegradation of hazardous textile industrial wastewater dyes by potential microalgal sp. *Biomass Conversion and Biorefinery*, 13(15), 13481-13492. <https://doi.org/10.1007/s13399-022-02725-5>

Shaikh Abdur Razzak, Khairul Bahar, K.M. Oajedul Islam, Abdul Khaleel Haniffa, Mohammed Omar Faruque, S.M. Zakir Hossain, Mohammad M. Hossain, (2024). Microalgae cultivation in photobioreactors: sustainable solutions for a greener future. *Green Chemical Engineering*, Volume 5, Pages 418-439, ISSN 2666-9528. <https://doi.org/10.1016/j.gce.2023.10.004>.

Sijia Wu, Hongxun Huo, Yixiao Shi, Feiran Zhang, Tingting Gu, Zhen Li, (2023). Chapter Three - Extraction and application of extracellular polymeric substances from fungi. Editor(s): Geoffrey Michael Gadd, Sima Sariaslani. *Advances in Applied Microbiology*. Academic Press. Volume 125. Pages 79-106. ISSN 0065-2164. ISBN 9780443192760. <https://doi.org/10.1016/bs.aambs.2023.08.001>.

Sleppy, J. (2021, April 22). Energy harvesting, storage, and management — Capacitech Energy. *Capacitech Energy*. <https://www.capacitechenergy.com/blog/energy-harvesting-storage-and-management>

Soumaya Grira, Hadil Abu Khalifeh, Mohammad Alkhedher, Mohamad Ramadan, (2023). 3D printing algae-based materials: Pathway towards 4D bioprinting. *Bioprinting*, Volume 33, ISSN 2405-8866. <https://doi.org/10.1016/j.bprint.2023.e00291>.

Sources of greenhouse gas emissions | US EPA. (2025, January 16). US EPA. <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

Structure and form | School of Materials Science and Engineering - UNSW Sydney. (n.d.). UNSW Sites. <https://www.unsw.edu.au/science/our-schools/materials/engage-with-us/high-school-students-and-teachers/online-tutorials/polymers/structure-and-form#:~:text=Polymers%20are%20a%20range%20of,to%20form%20complex%20compositional%20arrangements>.

Subburaj Suganya, Madhava Anil Kumar, Soumya Haldar, (2021). Chapter 27 - Effect of bacterial attachment on permeable membranes aided by extracellular polymeric substances. *Microbial and Natural Macromolecules*. Academic Press, Pages 733-749, ISBN 9780128200841. <https://doi.org/10.1016/B978-0-12-820084-1.00028-4>.

Supriya Pandey, Ishvarya Narayanan, Ramesh Vinayagam, Raja Selvaraj, Thivaharan Varadavenkatesan, Arivalagan Pugazhendhi, (2023). A review on the effect of blue green 11 medium and its constituents on microalgal growth and lipid production, *Journal of Environmental Chemical Engineering*, Volume 11, Issue 3. 109984, ISSN 2213-3437, <https://doi.org/10.1016/j.jece.2023.109984>.

Tajarudin, H. A., & Ng, C. W. C. (2022). Introduction to biocoating. In *SpringerBriefs in applied sciences and technology* (pp. 1-8). https://doi.org/10.1007/978-981-19-6035-2_1

The challenge of reducing industrial pollution. (n.d.). European Environment Agency. <https://www.eea.europa.eu/signals-archived/signals-2020/articles/the-challenge-of-reducing-industrial-pollution>

The Editors of Encyclopaedia Britannica. (2009, January 30). BitMap | Definition & Facts. *Encyclopedia Britannica*. <https://www.britannica.com/technology/bitmap>

The Editors of Encyclopaedia Britannica. (2023, April 11). Hydroxyl group | Definition, Structure, & Facts. *Encyclopedia Britannica*. <https://www.britannica.com/science/hydroxyl-group>

The Editors of Encyclopaedia Britannica. (2025a, January 3). Van der Waals forces | Intermolecular Interactions & Applications. *Encyclopedia Britannica*. <https://www.britannica.com/science/van-der-Waals-forces>

The Editors of Encyclopaedia Britannica. (2025, January 18). Adenosine triphosphate (ATP) | Definition, Structure, Function, & Facts. *Encyclopedia Britannica*. <https://www.britannica.com/science/adenosine-triphosphate>

The Editors of Encyclopaedia Britannica. (2025a, January 11). Biofilm | Microorganisms, bacteria, Microbial Communities. *Encyclopedia Britannica*. <https://www.britannica.com/science/biofilm>

Trans Tech Publications Ltd, Switzerland. (n.d.). Harvesting electrical energy from automatic sliding doors use - IJUM Repository (IRep). <http://irep.iium.edu.my/100273/>

Valdivia-Rivera, S.; Ayora-Talavera, T.; Lizardi-Jiménez, M.A.; García-Cruz, U.; Cuevas-Bernardino, J.C.; Pacheco, N. Encapsulation of microorganisms for bioremediation: Techniques and carriers. *Rev. Environ. Sci. Biotechnol.* 2021, 20, 815–838. https://www.researchgate.net/publication/352101296_Encapsulation_of_microorganisms_for_bioremediation_Techniques_and_carriers

Vasilieva, S., Lobakova, E., & Solovchenko, A. (2020). Biotechnological applications of immobilized microalgae. In *Environmental chemistry for a sustainable world* (pp. 193–220). https://doi.org/10.1007/978-3-030-48973-1_7

Vieira, M. V., Pastrana, L. M., & Fuciños, P. (2020). Microalgae encapsulation systems for food, pharmaceutical and cosmetics applications. *Marine Drugs*, 18(12), 644. <https://doi.org/10.3390/md18120644>

Vladan Koncar, (2019). 2 - Composites and hybrid structures. In *The Textile Institute Book Series, Smart Textiles for In Situ Monitoring of Composites*. Woodhead Publishing, Pages 153-215, ISBN 9780081023082. <https://doi.org/10.1016/B978-0-08-102308-2.00002-4>.

Vrenna, M., Peruccio, P.P., Liu, X., Zhong, F., & Sun, Y. (2021). Microalgae as Future Superfoods: Fostering Adoption through Practice-Based Design Research. *Sustainability*, 13(5), 2848. <https://doi.org/10.3390/su13052848>

Waresindo, W. X., Luthfianti, H. R., Priyanto, A., Hapidin, D. A., Edikresnha, D., Aimon, A. H., Suciati, T., & Khairurrijal, K. (2023). Freeze-thaw hydrogel fabrication method: basic principles, synthesis parameters, properties, and biomedical applications. *Materials Research Express*, 10(2), 024003. <https://doi.org/10.1088/2053-1591/acb98e>

Weeden, M. (2025, January 14). 8 Amazing bamboo Facts. One Tree Planted. <https://onetreepanted.org/blogs/stories/bamboo#:~:text=According%20to%20Guinness%20World%20Records,just%20grow%20before%20your%20eyes!>

Weisan Hua, Yishun Sha, Xuelai Zhang, Hongfen Cao, (2023). Research progress of carbon capture and storage (CCS) technology based on the shipping industry. *Ocean Engineering*, Volume 281, 0029-8018. <https://doi.org/10.1016/j.oceaneng.2023.114929>.

What is NADPH in photosynthesis? - full form, functioning. (2020, March 3). Toppr-guides. <https://www.toppr.com/guides/biology/cell-the-unit-of-life/what-is-nadph-in-photosynthesis/#:~:text=The%20full%20form%20of%20NADPH,the%20first%20level%20of%20photosynthesis.>

"What Is the Triple Planetary Crisis?" Unfccc.int, 13 Apr. 2022, unfccc.int/news/what-is-the-triple-planetary-crisis.

When the material grows: A case study on designing (with) mycelium-based materials. Available from: https://www.researchgate.net/publication/323749568_When_the_material_grows_A_case_study_on_designing_with_mycelium-based_materials.

Wei Xiong, Yiyang Peng, Weimin Ma, Xurong Xu, Yueqi Zhao, Jinhui Wu, Ruikang Tang, *National Science Review*, Volume 10, Issue 10, October 2023, nwad200, <https://doi.org/10.1093/nsr/nwad200>

What is NADPH in photosynthesis? - full form, functioning. (2020, March 3). Toppr-guides. [https://www.toppr.com/guides/biology/cell-the-unit-of-life/what-is-nadph-in-photosynthesis/#:~:text=Nicotinamide%20Adenine%20Dinucleotide%20Phosphate%20Hydrogen%20\(NADPH\)&text=NADPH%20is%20a%20product%20of,of%20the%20process%20of%20photosynthesis.](https://www.toppr.com/guides/biology/cell-the-unit-of-life/what-is-nadph-in-photosynthesis/#:~:text=Nicotinamide%20Adenine%20Dinucleotide%20Phosphate%20Hydrogen%20(NADPH)&text=NADPH%20is%20a%20product%20of,of%20the%20process%20of%20photosynthesis.)

Wikipedia contributors. (2024, December 10). Laminar flow cabinet. Wikipedia. https://en.wikipedia.org/wiki/Laminar_flow_cabinet#:~:text=A%20laminar%20flow%20cabinet%20or,or%20any%20particle%20sensitive%20materials.

Wikipedia contributors. (2025b, January 16). Shuttle (weaving). Wikipedia. [https://en.wikipedia.org/wiki/Shuttle_\(weaving\)#:~:text=A%20shuttle%20is%20a%20tool,to%20weave%20in%20the%20weft.](https://en.wikipedia.org/wiki/Shuttle_(weaving)#:~:text=A%20shuttle%20is%20a%20tool,to%20weave%20in%20the%20weft.)

Yajun Liu, Canyi Huang, Hong Xia, Qing-Qing Ni, (2021). Research on development of 3D woven textile-reinforced composites and their flexural behavior. *Materials & Design*, Volume 212, ISSN 0264-1275. <https://doi.org/10.1016/j.matdes.2021.110267>.

Yirgu, Z., Leta, S., Hussen, A., & Khan, M. M. (2020). Nutrient removal and carbohydrate production potential of indigenous *Scenedesmus* sp. grown in anaerobically digested brewery wastewater. *ENVIRONMENTAL SYSTEMS RESEARCH*, 9(1). <https://doi.org/10.1186/s40068-020-00201-5>

Zhao, S., Guo, C., Kumarasena, A., Omenetto, F. G., & Kaplan, D. L. (2019). 3D printing of functional microalgal silk structures for environmental applications. *ACS Biomaterials Science & Engineering*, 5(9), 4808–4816. <https://doi.org/10.1021/acsbomaterials.9b00554>