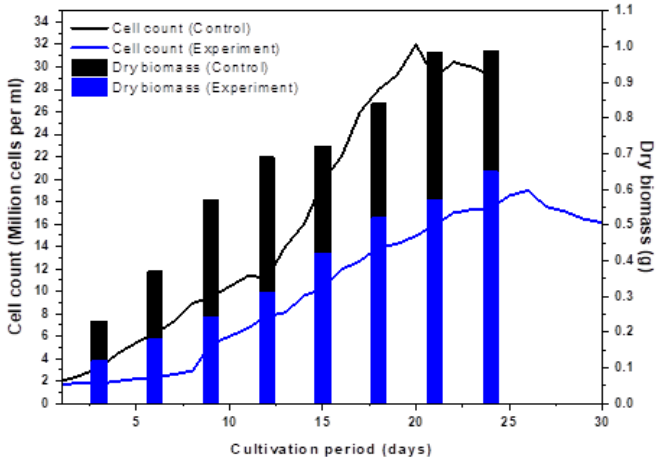

Figure 3 Comparison of cell count of local algae strain Dictyospharium iso 6-8 under control (BBM) and experiment conditions (FBM)

Conclusion

Local microalgae strain KKL-5 showed upright growth in both Bold's Basal Media and newly designed FBM. The productivity in FBM was found to be slightly lower than BBM. However, the low-cost FBM still makes a viable choice for large-scale microalgae production, such as in raceway ponds or photo-bioreactors. The fertilizer media cost is about half a dollar, while the synthetic Bold's Basal media cost about 3.4 US dollars. FBM can be commercially viable for the production of algae biomass for biofuel production.

Acknowledgement

The authors are grateful to the Biofuel Laboratory, Centre for Advanced Studies in Energy (CAS-EN) NUST, for providing facilities for this study. The authors also acknowledge Mr. Yawar Ikram and Mr. Aleemudin from Attock Group of Companies, Rawalpindi, Pakistan, for providing the necessary cooperation required to fulfill this research.

References

1. I. Capellán-Pérez, et al., "Fossil fuel depletion and socio-economic scenarios: An integrated approach," Energy, vol. 77, 2014, pp. 641-666; DOI 10.1016/j.energy.2014.09.063.
2. A.H. Khoja, et al., "Comparative study of bioethanol production from sugarcane molasses by using Zymomonas mobilis and Saccharomyces cerevisiae," African Journal of Biotechnology, vol. 14, no. 31, 2015, pp. 2455-2462.
3. M.S. Elshahed, "Microbiological aspects of biofuel production: Current status and future directions," Journal of Advanced Research, vol. 1, no. 2, 2010, pp. 103-111; DOI 10.1016/j.jare.2010.03.001.
4. M.I. ElGalad, et al., "Empirical equations and economical study for blending biofuel with petroleum jet fuel," Journal of Advanced Research, vol. 9, 2018, pp. 43-50; DOI 10.1016/j.jare.2017.10.005.
5. T.M. Mata, et al., "Microalgae for biodiesel production and other applications: A review," Renewable and Sustainable Energy Reviews, vol. 14, no. 1, 2010, pp. 217-232; DOI 10.1016/j.rser.2009.07.020.
6. A.M. Abdel-Aty, et al., "Biosorption of cadmium and lead from aqueous solution by fresh water alga Anabaena sphaerica biomass," J Adv Res, vol. 4, no. 4, 2013, pp. 367-374; DOI 10.1016/j.jare.2012.07.004.
7. P. Singh, et al., "Chapter 4 - Microalgae Isolation and Basic Culturing Techniques A2 - Kim, Se-Kwon," Handbook of Marine Microalgae, Academic Press, 2015, pp. 43-54.
8. T. Kolb, et al., "Wet Conversion of Methane and Carbon Dioxide in a DBD Reactor," Plasma Chem Plasma Process, vol. 32, no. 6, 2012, pp. 1139-1155; DOI 10.1007/s11090-012-9411-y.
9. S.A. Jambo, et al., "A review on third generation bioethanol feedstock," Renewable and Sustainable Energy Reviews, vol. 65, 2016, pp. 756-769; DOI 10.1016/j.rser.2016.07.064.
10. J.D. Kern, et al., "Using life cycle assessment and techno-economic analysis in a real options framework to inform the design of algal biofuel production facilities," Bioresour Technol, vol. 225, 2017, pp. 418-428; DOI 10.1016/j.biortech.2016.11.116.
11. R.R. Narala, et al., "Comparison of Microalgae Cultivation in Photobioreactor, Open Raceway Pond, and a Two-Stage Hybrid System," Frontiers in Energy Research, vol. 4, 2016; DOI 10.3389/fenrg.2016.00029.
12. P.J. Schnurr, et al., "Improved biomass productivity in algal biofilms through synergistic interactions between photon flux density and carbon dioxide concentration," Bioresource Technology, vol. 219, no. Supplement C, 2016, pp. 72-79; DOI https://doi.org/10.1016/j.biortech.2016.06.129.
13. T. Sarat Chandra, et al., "Evaluation of indigenous fresh water microalga Scenedesmus obtusus for feed and fuel applications: Effect of carbon dioxide, light and nutrient sources on growth and biochemical characteristics," Bioresource Technology, vol. 207, no. Supplement C, 2016, pp. 430-439; DOI https://doi.org/10.1016/j.biortech.2016.01.044.
14. A. Solovchenko, et al., "Phosphorus from wastewater to crops: An alternative path involving microalgae," Biotechnology Advances, vol. 34, no. 5, 2016, pp. 550-564; DOI https://doi.org/10.1016/j.biotechadv.2016.01.002.
15. J. Nohman, A. Elbaouchi et al., "Agriculture fertilizer-based media for cultivation of marine microalgae destined for biodiesel production." Journal of Energy Management and Technology 4,

no. 4 (2020): 49-56. DOI 10.22109/JEMT.2020.196949.1190
16. Covell, L., Machado, M., Vaz. et al.,. Alternative fertilizer-based growth media support high lipid contents without growth impairment in Scenedesmus obliquus BR003. Bioprocess and biosystems engineering, 43(6), 2020, pp.1123-1131. DOI https://doi.org/10.1007/s00449-020-02301-z
17. M.A. Ahmad "Parallel Evaluation of Algae for Sustainable Protein Production Using Microwell Photobioreactors," IChemE Research Bursary Summary 2011.
18. R.A. Andersen, Algal Culturing Techniques, Academic Press, 2005, p. 596.
19. D. Bilanovic, et al., "Freshwater and marine microalgae sequestering of CO2 at different C and N concentrations - response surface methodology analysis," Energy Conversion and Management, vol. 50, no. 2, 2009, pp. 262-267; DOI 10.1016/j.enconman.2008.09.024.
20. A.A. Ansari, et al., "Wastewater treatment by local microalgae strains for CO_2 sequestration and biofuel production," Applied Water Science, vol. 7, no. 7, 2017, pp. 4151-4158; DOI 10.1007/s13201-017-0574-9.
21. D. Simon and S. Helliwell, "Extraction and quantification of chlorophyll a from freshwater green algae," Water Research, vol. 32, no. 7, 1998, pp. 2220-2223; DOI https://doi.org/10.1016/S0043-1354(97)00452-1.
22. E.M.J. Jaspars, "Pigmentation of Tobacco Crown-Gall Tissues Cultured in vitro in Dependence of the Composition of the Medium," Physiologia Plantarum, vol. 18, no. 4, 1965, pp. 933-940; DOI 10.1111/j.1399-3054.1965.tb06990.x.
23. E.G. Bligh and W.J. Dyer, "A RAPID METHOD OF TOTAL LIPID EXTRACTION AND PURIFICATION," Canadian Journal of Biochemistry and Physiology, vol. 37, no. 8, 1959, pp. 911-917; DOI 10.1139/o59-099.
24. R. Ranjith Kumar, et al., "Lipid Extraction Methods from Microalgae: A Comprehensive Review," Frontiers in Energy Research, vol. 2, 2015; DOI 10.3389/fenrg.2014.00061.
25. S.-H. Goh, et al., "A Comparison of the Antioxidant Properties and Total Phenolic Content in a Diatom, Chaetoceros sp. and a Green Microalga, Nannochloropsis sp," Journal of Agricultural Science; Vol 2, No 3 (2010), 2010; DOI 10.5539/jas.v2n3p123.
26. M.T. Croft, et al., "Algae Need Their Vitamins," Eukaryotic Cell, vol. 5, no. 8, 2006, pp. 1175-1183; DOI 10.1128/EC.00097-06.