Proceedings of the 10th World Congress on New Technologies (NewTech'24)
Barcelona, Spain - August 25-27, 2024
Paper No. ICEPR 127
DOI: 10.11159/icepr24.127

Improvement of Indoor Air Quality through CO^2 Capturing Algae-Integrated Architecture

Lâl Dalay[1], Gülşen Aytaç[2],
[1,2] Department of Landscape Architecture, Istanbul Technical University, Istanbul, Turkey
dalay19@itu.edu.tr; gulergu@itu.edu.tr

Extended Abstract

A large proportion of daily activities in urban civilization are performed in enclosed spaces, which can be recognized by complex and quantitatively ranged air quality. As cities continue to grow, indoor air pollution levels increase as a consequence, causing both economic damage and major health problems. In the field of urban health, the negative effects of exposure to indoor air pollution on individual and public health are of particular concern. The negative impact of indoor air pollution and high carbon dioxide levels on public health has been linked to a higher incidence of respiratory diseases and other linked health problems occurring at the workplace, in households, in the school environment, and in vehicles. Under this scenario, healthcare costs are likely to rise while society's well-being and productivity decline [1]. Therefore, research on the effects of indoor air purifier use on human health has shown that there are advantages, particularly with regard to respiratory health [2]. This indicates that interior air quality may be improved and that air filtration systems, such as those that use algae, could actually improve human health [3]. It is emphasised in the existing literature that a multi-dimensional set of interventions is necessary to improve indoor air quality. Those methods include both preventive measures, physical-chemical technologies, and biotechnologies [4].

The study's main emphasis, biotechnological advances serves as helpful instruments in this field. In nature-based treatment systems are capable of successfully eliminating hydrophobic indoor contaminants while simultaneously controlling the relative humidity of the purified air. Thus the scope of this study focuses on the architectural integration of photobioreactor systems in which algae are grown and their potential is analysed. By lowering carbon dioxide levels and raising oxygen contents, these systems not only increase thermal control but also minimize ecological footprints, enhance aesthetic appeal, and enhance thermal regulation. Beyond air cleaning, though, the algal biomass produced in this manner has other benefits, such as extraction of valuable chemicals and production of biofuels. It is obvious that further investigation will be required to investigate the particular air purification capabilities of indoor algal systems and to optimize the design and functionality of these systems. By integrating the use of photobioreactors, this research will demonstrate and explore the potential uses and studies regarding employing algae to improve indoor air quality.

References

[1] Kelly, F. J., & Fussell, J. C. (2019). Improving indoor air quality, health and performance within environments where people live, travel, learn and work. Atmospheric Environment, 200, 90-109.
[2] Wang, Y., Zhao, Y., Xue, L., Wu, S., Wang, B., Li, G., Huang, J. and Guo, X. (2021). Effects of air purification of indoor PM2.5 on the cardiorespiratory biomarkers in young healthy adults. Indoor Air, 31: 1125-1133. https://doi.org/10.1111/ina.12815
[3] Mata, T. M., Oliveira, G. M., Monteiro, H., Silva, G. V., Caetano, N. S., & Martins, A. A. (2021). Indoor air quality improvement using nature-based solutions: design proposals to greener cities. International Journal of Environmental Research and Public Health, 18(16), 8472.
[4] Gonzalez-Martin, J., Kraakman, N. J. R., Perez, C., Lebrero, R., & Munoz, R. (2021). A state–of–the-art review on indoor air pollution and strategies for indoor air pollution control. Chemosphere, 262, 128376.