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Investigation of Light Transmission Characteristics and CO2 Capture Potential of Microalgae Panel Bioreactors for Building Façade Applications

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Abstract : Algae-culture offers new applications in sustainable architecture with its continuous productive cycle, and a potential for high carbon dioxide capture. Microalgae itself has multiple functions such as carbon dioxide fixation, biomass production, oxygen generation and waste water treatment. Incorporating microalgae cultivation processes and systems to building design to utilize this potential is promising. Microalgae cultivation systems, especially closed photo bioreactors can be implemented as components in buildings. And these systems be accommodated in the façade of a building, or in other urban infrastructure in the future. Application microalgae bio-reactors of on building's façade has the added benefit of acting as an effective insulation system, keeping out the heat of the summer and the chill of the winter. Furthermore, microalgae can give a dynamic appearance with a liquid façade that also works as an adaptive sunshade. Recently, potential of microalgae to use as a building component to reduce net energy demand in buildings becomes a popular topic and innovative design proposals and a handful of pilot applications appeared. Yet there is only a handful of examples in application and even less information on how these systems affect building energy behavior. Further studies on microalgae mostly focused on single application approach targeting either carbon dioxide utilization through biomass production or biofuel production. The main objective of this study is to investigate effects of design parameters of microalgae panel bio-reactors on light transmission characteristics and CO2 capture potential during growth of Nannochloropsis occulata sp. A maximum reduction of 18 ppm in CO2 levels of input air during the experiments with a % light transmission of 14.10, was achieved in 6 day growth cycles. Heat transfer behavior during these cycles was also inspected for possible façade applications.

Keywords : building façade, CO2 capture, light transmittance, microalgae
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