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Membrane-Carbonation Photobioreactor

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Inventors

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Invention Description

Biofuel production from photoautotrophic biomass is a promising energy solution; also attractive is the carbon-neutral nature of resulting biofuels made with CO_2 fixation. Strains of the cyanobacterium *Synechocystis sp*. are promising candidates, with high biomass yield and robustness over a wide range of temperatures, salinity, and pH. For highest productivity, the nutrient supply rates must be matched with the rate of biomass synthesis.

Researchers at the Biodesign Institute of Arizona State University have developed a novel Membrane Carbonation Photobioreactor that uses a hollow-fiber membrane to transfer CO_2 into the photobioreactor without bubbling. This allows precise control of pH as well as concentration and speciation of the inorganic carbon, while simultaneously minimizing loss of CO_2.

Thus, this system maximizes both efficiency and the production rate of valuable products from photosynthesis, such as biofuel, and does so in a carbon-neutral fashion.

Potential Applications

- Highly efficient production of biofuel and other products from photoautotrophs

Benefits and Advantages

- Maximizes production and efficiency by matching nutrient supply rates to biomass synthesis
- Allows precise, on-demand control of CO_2 delivery (without waste), pH, and inorganic carbon concentration and speciation
- System can also be used to remove valuable metabolic byproducts such as H_2 and O_2
- Decouples gas delivery and removal from gravity, thereby imposing fewer constraints on reactor configuration and orientation
- Permits a truly closed system with a pure culture, without microbiological contamination
- Carbonation unit configuration and location can be varied to tailor gradients (CO_2 concentration, pH and biomass), promote or minimize biofilm formation, or to remove valuable products

Intellectual Property Status:
Patent Pending

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