



CO₂ Biofixation by Microalgae: Automation Process (Focus)

Sihem Tebbani, Rayen Filali, Filipa Lopes, Didier Dumur, Dominique Pareau

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Due to the consequences of global warming and significant greenhouse gas emissions, several ideas have been studied to reduce these emissions or to suggest solutions for pollutant removal. The most promising ideas are reduced consumption, waste recovery and waste treatment by biological systems. In this latter category, studies have demonstrated that the use of microalgae is a very promising solution for the biofixation of carbon dioxide. In fact, these micro-organisms are able to offset high levels of CO₂ thanks to photosynthesis. Microalgae are also used in various fields (food industry, fertilizers, biofuel, etc.). To obtain an optimal CO₂ sequestration using microalgae, their cultivation has to be carried out in a favorable environment, corresponding to optimal operating conditions (temperature, nutrients, pH, light, etc.). Therefore, microalgae are grown in an enclosure, i.e. photobioreactors, which notably operate in continuous mode. This type of closed reactor notably enables us to reduce culture contamination, to improve CO₂ transfer and to better control the cultivation system. This last point involves the regulation of concentrations (biomass, substrate or by-product) in addition to conventional regulations (pH, temperature). To do this, we have to establish a model of the system and to identify its parameters; to put in place estimators in order to rebuild variables that are not measured online (software sensor); and finally to implement a control law, in order to maintain the system in optimal conditions despite modeling errors and environmental disturbances that can have an influence on the system (pH variations, temperature, light, biofilm appearance, etc.).

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