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Maximum hydrogen production from genetically modified microalgae biomass[1] JOSE VARGAS, Florida State University, VANESSA KAVA, Universidade Federal do Paran, JUAN ORDONEZ, Florida State University — A transient mathematical model for managing microalgae derived H_2 production as a source of renewable energy is developed for a well stirred photobioreactor, PBR. The model allows for the determination of microalgae and H_2 mass fractions produced by the PBR in time. A Michaelis-Menten expression is proposed for modeling the rate of H_2 production, which introduces an expression to calculate the resulting effect on H_2 production rate after genetically modifying the microalgae. The indirect biophotolysis process was used. Therefore, an opportunity was found to optimize the aerobic to anaerobic stages time ratio of the cycle for maximum H_2 production rate, i.e., the process rhythm. A system thermodynamic optimization is conducted with the model equations to find accurately the optimal system operating rhythm for maximum H_2 production rate, and how wild and genetically modified species compare to each other. The maxima found are sharp, showing up to a ˜60% variation in hydrogen production rate within 2 days around the optimal rhythm, which highlights the importance of system operation in such condition. Therefore, the model is expected to be useful for design, control and optimization of H_2 production.

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