

Dynamic modelling of mixotrophic microalgal photobioreactor systems with time-varying yield coefficient for the lipid consumption

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Microalgae have been suggested as a promising feedstock for producing biofuel because of their potential for lipid production. In this study, microalgal photobioreactor systems under mixotrophic conditions were investigated, for the purpose of developing a mathematical model that predicts biomass and lipid production. The model was developed based on the Droop model, and the optimal input design using D-optimality criterion was performed to compute the system input profile, to estimate parameters more accurately. From the experimental observations, the newly defined yield coefficient was suggested to represent the consumption of lipid and nitrogen within the cell, which reduces the number of parameters with more accurate prediction. Furthermore, the lipid consumption rate was introduced to reflect the experimental results that lipid consumption is related to carbon source concentration. The model was validated with experiments designed with different initial conditions of nutrients and input changes, and showed good agreement with experimental observations.