A mathematicla model for a general microalgal behaviors under heterotrophic condition

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Microalgae is a promising source for renewable fuels and chemicals production. Many research works have been interested in autotrophically cultured microalgae due to its renewability and carbon-negative characteristic. However, its poor economics becomes an obstacle for the commercialization of autotrophically cultured microalgae as renewable biomass. Heterotrophic culturing is considered as an alternative. With its dominant performance (e.g., productivity), microalgae is taken into account for sources to produce not only lipids but also, high-value products, which is usually tiny quantities in microalgae. In the present study, a mathematical model, which can describe microalgae behaviors with possible internal components classified into nine products (nucleotide, amino acids, protein, polysaccharide, monosaccharide, structured lipids, non-structured lipids, and pigments) is proposed. Through the proposed heterotrophic model structure, experimentally verified phenomena are explained. Furthermore, since the proposed model has an excessive number of model parameters, model reduction and application are performed with example cases.