Microalgae cultivation in open raceway pond: Model development and dynamic optimization

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Although an open raceway pond(ORP) is considered as promising option due to its low cultivation cost, only a few ORP models and model based applications have been proposed to capture complex dynamic behavior. In this research, we propose numerical model of microalgae cultivation in ORP based on three different dynamics: microalgae growth, heat transfer and hydrodynamics. Also, reduced hydrodynamic model with the aim of the computational fluid dynamics(CFD) simulation, which is to be incorporated into microalgal growth and heat transfer, is proposed. Based on the proposed model, optimization problem to identify optimal dilution rate profile is formulated and solving through dynamic optimization with moving horizon.

Keyword: Microalgae cultivation, open raceway pond, computational fluid dynamics, dynamic optimization