



Experimental and theoretical investigations of rotating algae biofilm reactors (RABRs): Areal productivity, nutrient recovery, and energy efficiency

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Microalgal biofilms can simultaneously recover nutrients from wastewater and supply biomass for bioproducts, but there is a lack of a quantitative framework to guide design and operation.

In this talk, I will present a unified experimental–theoretical approach for rotating algal biofilm reactors (RABRs) that links controllable operating conditions to areal productivity, nutrient recovery, and energy use. Laboratory-scale RABRs are used for benchmarking and data collection. Then, we develop a differential–integral equation model of biofilm growth and substrate uptake. The model is calibrated and validated against measurements of biomass areal productivity and removal of ammonia and inorganic phosphorus.

The experiments and mathematical model quantify how operating parameters shape biofilm growth, nutrient uptake efficiency, and energy efficiency, and provide guidance for optimizing RABR operation for wastewater treatment and resource recovery.

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