**A MECHANISTIC MODEL FOR ALGAL-BACTERIAL WASTEWATER TREATMENT**

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**ΠΕΡΙΛΗΨΗ**

Photosynthesis-based wastewater treatment using microalgae/bacteria consortia is a newly popularized process that could offer low-cost pollutant mitigation and reduced carbon footprint, coupled with a circular economy approach[1]. However, the co-existence of such vastly different microorganism groups with diverse metabolisms can create complex relationships that complicate the design and operation of these systems[2]. In this study, we propose a mechanistic integral model that attempts to shed light on the intricacies of algal-bacterial interactions. The model integrates microalgal growth kinetics and light distribution modelling into elements of IWA’s activated sludge models[3] (which are widely used in water resource recovery facilities[2]), while maintaining the same nomenclature and principles. Simulated N, P, C and biomass concentrations, as well as the microbial community composition were in good agreement with experimental results obtained using a mixotrophic *Leptolyngbya*-based microbial community for brewery wastewater treatment[4]. Further analysis of the model results revealed that the relationship between microalgae and aerobic heterotrophic bacteria is in most cases mutualistic; microalgae produce oxygen photosynthetically, which is rapidly consumed by heterotrophic bacteria to limiting concentrations, and receive inorganic carbon in exchange. Therefore, light attenuation and, by extension, photosynthesis rate, is the main limiting factor that drives pollutant removal and biomass production rates. These findings led to the indetification of optimal operating scenarios and photobioreactor design guidelines, and hint that this modeling approach could be a step towards overcoming the existing bottlenecks and standardizing this technology .

**ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ:** Microlgae, Cyanobacteria, COD, anoxic, photobioreactor

**ΑΝΑΦΟΡΕΣ**

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