Breakthrough in Wastewater Treatment: A New Model for Algae-Bacteria Interactions

ADBA Model: Enhancing Algae Growth in Anaerobic Digestion Effluent

NANJING, CHINA, March 20, 2025 /EINPresswire.com/ -- Microalgae have emerged as a promising solution for wastewater treatment and biofuel production due to their high metabolic efficiency and ability to utilize nutrients. However, large-scale algal cultivation faces challenges such as high production costs and the need for freshwater. A new study published in the Journal of Bioresources and Bioproducts presents a groundbreaking model that addresses these challenges by optimizing algal growth in anaerobic digestion effluent.

The ADBA model, developed by researchers at Washington State University, is the first to comprehensively describe the interactions between algae and bacteria in anaerobic digestion effluent under mixotrophic conditions. The model integrates key parameters, including algal and bacterial growth rates, nutrient consumption, and light inhibition due to effluent turbidity. It also introduces novel features such as the algae-bacteria interaction exponent and the growth inhibition coefficient due to effluent turbidity.

The study found that the model accurately predicted algal and bacterial growth dynamics, achieving an average R^2 value of 0.90 across all experimental conditions. The results showed that algal productivity was significantly affected by effluent turbidity and bacterial competition. However, increasing light intensity could counteract the inhibitory effects of turbidity, enhancing algal growth. The optimal conditions for algal heterotrophic growth were identified as ammonium-nitrogen concentrations between 100-1,000 mg/L and organic carbon concentrations between 5,000-10,000 mg/L.

The ADBA model not only provides a detailed understanding of algal-bacteria interactions but also offers practical solutions for wastewater treatment and biofuel production. By optimizing algal growth in anaerobic digestion effluent, the model could lead to sustainable and cost-effective wastewater treatment facilities, reducing environmental pollution while generating valuable biomass for biofuels and animal feed.

See the article:
DOI
https://doi.org/10.1016/j.jobab.2024.12.004

Original Source URL
https://www.sciencedirect.com/science/article/pii/S2369969824000847

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