Algae-based Biofilm Productivity and Treatment of Dairy Wastewater: Effects of Temperature and Organic Carbon Concentration | Biological Engineering

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Abstract

Biofilm-based microalgal growth was determined as functions of organic chemical loading and water temperature utilizing dairy wastewater from a full-scale dairy farm. The dairy industry is a significant source of wastewater worldwide that could provide an inexpensive and nutrient rich feedstock for the cultivation of algae biomass for use in downstream processing of animal feed and aquaculture applications.

Algal biomass was cultivated using a Rotating Algal Biofilm Reactor (RABR) system. The RABR is a biofilm-based technology that has been designed and used to remediate municipal wastewater, and was applied to treat dairy wastewater, through nutrient uptake, and simultaneously provide biomass for the production of renewable bioproducts.

Algal biomass was grown at temperatures ranging from 7-27 °C, and organic carbon concentrations ranging from 300-1200 mg/L of Total Organic Carbon (TOC). Aerial algal biofilm growth rates were calculated, and analysis of Variance (ANOVA) calculations indicated that both the temperature of the wastewater and the level of organic carbon contributed significantly to the rate of biomass growth in the system. However, the interaction of temperature and organic carbon content was not significantly related to the biofilm-based growth rate.

Equations were developed using an Arrhenius linearization and temperature correction coefficient that can be used to evaluate algal biomass productivity and nutrient removal rates in future experiments and designs for dairy wastewater.