Interaction of flow turbulence and nitrogen nutrients on the growth of Scenedesmu Quadricanda

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Although the effects of hydrodynamics and nutrients on algae growth have received considerable attention, many knowledge gaps remain. This talk will report the outcomes of the study on how flow turbulence and nitrogen nutrients influence the growth of Scenedesmu Quadricanda, which was cultured under different turbulence intensities and nutrient conditions. Furthermore, the improved logistic model was used to combine the effect of nutrient flux and hydraulic diffusion flux on algal growth. Algae cell integrity, chlorophyll-a concentration, and polysaccharide content were determined to assess the algal growth. We found that the high turbulence intensity (turbulent energy dissipation rate 3.25×10-3 m2/s3 ~ 8.93×10-3 m2/s3) and total nitrogen (TN) concentration increased algal density and chlorophyll-a. However, there was no significant correlation between the concentration of TN and turbulence intensity and the growth rate of algae. The polysaccharide estimates showed that the increase in TN concentration would reduce extracellular polymeric substances (EPS), which would reduce the aggregation of algal cells. Moreover, high turbulence intensity promoted the production and accumulation of intracellular polysaccharides (IPS) and inhibited the secretion of EPS. The analysis of the improved logistic model verified that the increase of both TN concentration and turbulent intensity enhanced the production of chlorophyll-a, maximum biomass, and the intrinsic rate of increase. The findings indicate that flow turbulence and nitrogen nutrients have a synergistic effect on algal growth, chlorophyll content, polysaccharide secretion, and nutrient uptake which can foster further investigations on the control of algal bloom and harvest of microalgae biomass.