Increasing the Sustainability of a Heterotrophic Algae Biomass Production System: A Six Year Study of Chlorella vulgaris

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What is the feasibility of a sustainable heterotrophic Chlorella vulgaris growth system to become a replacement for the tertiary phase of a municipal wastewater treatment plant, and to successfully remove organic ions from the wastewater? Additionally, will algae cultures grown in this system produce sufficient biomass that could be used for biofuel, animal feed and nutraceuticals? The increasing amount of wastewater has become a serious problem worldwide, but it could become a valuable resource. If a sustainable heterotrophic bioreactor growth system uses recyclable wastewater for algae nutrition, then the algae will successfully remove pollutants (organic ions). The quality of the water at the end of the process will exceed federal safe-water limits, thus making this system a viable option for integration into wastewater treatment plants. Additionally, sufficient algal biomass will be produced that contain valuable metabolites. Chlorella vulgaris grew in 5 sustainable heterotrophic bioreactors that recycled wastewater after each growth cycle. Water quality was monitored and after 3 cycles, the algae successfully removed nitrates, nitrites, ammonia and phosphates, exceeding federal safe-water limits. Algae was microfiltered and massed after each cycle and lipids were extracted using a food grade, non-toxic solvent. The amounts of algae grown and lipids extracted were considerably higher than the previous years' data, indicating that valuable metabolites were available. The improved biomass system is a viable option for incorporation into a wastewater treatment plant. Further study would determine the suitability of using this system in the quaternary and disinfection phases of a wastewater treatment plant.

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