Microalgal biomass generation via electroflotation: a cost-effective dewatering technology

ABSTRACT

Microalgae are an excellent source of bioactive compounds for the production of a wide range of vital consumer products in the biofuel, pharmaceutical, food, cosmetics, and agricultural industries, in addition to huge upstream benefits relating to carbon dioxide biosequestration and wastewater treatment. However, energy-efficient, cost-effective, and scalable microalgal technologies for commercial-scale applications are limited, and this has significantly impacted the full-scale implementation of microalgal biosystems for bioproduct development, phycoremediation, and biorefinery applications. Microalgae culture dewatering continues to be a major challenge to large-scale biomass generation, and this is primarily due to the low cell densities of microalgal cultures and the small hydrodynamic size of microalgal cells. With such biophysical characteristics, energy-intensive solid–liquid separation processes such as centrifugation and filtration are generally used for continuous generation of biomass in large-scale settings, making dewatering a major contributor to the microalgae bioprocess economics. This article analyzes the potential of electroflotation as a cost-effective dewatering process that can be integrated into microalgae bioprocesses for continuous biomass production. Electroflotation hinges on the generation of fine bubbles at the surface of an electrode system to entrain microalgal particulates to the surface. A modification of electroflotation, which combines electrocoagulation to catalyze the coalescence of microalgae cells before gaseous entrainment, is also discussed. A technoeconomic appraisal of the prospects of electroflotation compared with other dewatering technologies is presented.

Keyword: Microalgae; Dewatering; Electroflotation; Biomass; Scale-up; Process economics