US-KOREA NANO FORUM
SEOUL, SEPTEMBER 26, 2016

Recent progress in microalgal biomass production coupled with wastewater treatment for biofuel generation

Byong-Hun Jeon
Hanyang University

Abstract

Microalgae are a potential source of sustainable biomass feedstock for biofuel generation and can proliferate under versatile environmental conditions. Mass cultivation of microalgae is the most overpriced and technically challenging step in microalgal biofuel generation. Wastewater is an available source of the water plus nutrients necessary for algae cultivation. Microalgae provide a cost-effective and sustainable means of advanced (waste)water treatment with the simultaneous production of commercially valuable products. Microalgae show higher efficiency in nutrient removal than other microorganisms because the nutrients (ammonia, nitrate, phosphate, urea and trace elements) present in various wastewaters are essential for microalgal growth. Potential progress in the area of microalgal cultivation coupled with wastewater treatment in open and closed systems has led to an improvement in algal biomass production. However, significant efforts are still required for the development and optimization of a coupled system to simultaneously generate biomass and treat wastewater. In this review, we systematically describe the technologies required for the successful integration of wastewater treatment and cultivation of microalgae for biomass production toward biofuel generation. It deeply reviews the microalgae-mediated treatment of different wastewaters (including municipal, piggery/swine, industrial, and anaerobic wastewater), and highlight the wastewater characteristics suitable for microalgae cultivation. Various pretreatment methods (such as filtration, autoclaving, UV application, and dilution) needed for wastewater prior to its use for microalgae cultivation have been discussed. We then consider the selection of potential microalgae species that can grow in wastewater and generate a large amount of biomass and discuss microalgal cultivation systems (including raceways, photobioreactors, turf scrubbers, and hybrid systems) that use wastewater, evaluating the capital expenditures (CAPEX) and operational expenditures (OPEX) of each system. In view of the limitations of recent studies, we suggest future directions for integrated wastewater treatment and microalgae biomass production for industrial applications.