Journal of Research in Environmental Science and Toxicology
ISSN 2315-5698
2020
Vol.9 No.2

Seawater-to-Biomass: The Process and Mechanism of Efficiently Producing Limnetic Algal Biomass with Seawater and Wastewater

Haiyan Pei

Shandong University, China

Abstract

Microalgae are considered a promising feedstock for biofuel, but expansion of algal lipid production commercially is still on its way, blocking by its demand on chemical nutrients and freshwater. Inexhaustible seawater, with a little wastewater added, has great potential to optimize microalga production so that biodiesel production can thrive cost-effectively and sustainably. In comparison to regular medium, limnetic Chlorella SDEC-18 achieved fast growth, high lipid content, enlarged cells, fragile cell walls and efficient settling in this cultivation method referring seawater, together with anaerobically digestion effluent of kitchen waste. Among these advantages of lipid yield and extraction, the response of microtubles to salinity critically contributed to the regulation of carbon metabolites. In detail, osmotic stress depolymerized microtubule, followed by delocating cellulose synthase, which redirected carbon flow to lipid rather than starch or cellulose. Hence, the algal cells cultured in saline environments exhibited superiorities on lipid production and extraction showing as higher than 60% in lipid content and 80% in first extraction efficiency. The promoted settling behavior saved harvest energy input and was resulted from ions in seawater and extracellular polymeric substances secreted by algae. After clarifying the advantages of algal biomass produced from seawater, the follow-up research includes construct a transcriptomics and metabolomics network of algae in salinity ambience for concisely understanding algal cell metabolism and foundating the elaborate control of lipid synthesis in different conditions. Eventually, a scale-up process for algal biomass production could be established with the goal of sustainable and economic biodiesel generation.

Biography:

Haiyan Pei has completed her PhD in 2005 from Shandong University and postdoctoral studies from University of Melbourne. She is a professor of Shandong University, in charge of Shandong Provincial Engineering Center on Environmental Science and Technology. She has published more than 80 papers in reputed journals and has been serving as an editorial board member of repute in the last 5 years.

Speaker Publications:

1. Shasha Zhang, Haiyan Pei, Jielin Wei, et al., (2019). The seasonal and spatial variations in diatom communities and the influence of environmental factors on three temperate reservoirs in Shandong province, China. Environ Sci Pollut Res Int. 26(24):24503-24515.

2. Chunxia Ma, Haiyan Pei, Wenrong Hu, et al., (2016). The lysis and regrowth of toxic cyanobacteria during storage of achitosan–aluminium chloride composite coagulated sludge: implications for drinking water sludge treatment. RSC Advance.114.

3. Yaowen Zhu, Haiyan Pei, Wenrong Hu, Yan Jin, et al., (2016). Effect of chitosan quaternary ammonium salt on the growth and microcystins release of Microcystis aeruginosa. RSC Advance. 84.

4. Jiang Liqun, Zhang Lijie, Nie Changliang, Pei Haiyan (2018). Lipid productivity in limnetic Chlorella is doubled by seawater added with anaerobically digested effluent from kitchen waste. Biotechnology for Biofuels. 3/14/2018, Vol. 11, p1-1. 1p.

5. Tian Chang, Pei Haiyan, Hu Wenrong, Hao Daping, et al., (2015). Variation of phytoplankton functional groups modulated by hydraulic controls in Hongze Lake, China. Environmental Science & Pollution Research . Nov2015, Vol. 22 Issue 22, p18163-18175. 13.

15th World Bioenergy Congress and Expo; Berlin, Germany- April 20-21, 2020.

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Abstract Citation:

Haiyan Pei, Seawater-to-Biomass: The Process and Mechanism of Efficiently Producing Limnetic Algal Biomass with Seawater and Wastewater, Bioenergy 2020, 15th World Bioenergy Congress and Expo; Berlin, Germany- April 20-21, 2020

(https://bioenergy.insightconferences.com/speaker/2020/haiyan-pei-shandong-university-china)