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PII: S1385-8947(18)31056-8
DOI: https://doi.org/10.1016/j.cej.2018.06.019
Reference: CEJ 19230

To appear in: *Chemical Engineering Journal*

Received Date: 28 September 2017
Revised Date: 24 May 2018
Accepted Date: 4 June 2018

Please cite this article as: L. Zhao, M. Lv, Z. Tang, T. Tang, Y. Shan, Z. Pan, Y. Sun, Enhanced photo bio-reaction by multiscale bubbles, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.06.019

Enhanced photo bio-reaction by multiscale bubbles

Luhaibo Zhao[a, b],Min Lv[1[a]] ,Zhiyong Tang[*[a]] , Tao Tang[[a]], Ying Shan[[a]] , Zhicheng Pan[[c]], Yuhan Sun[*[a,d]]

[a]Key Laboratory of Low-Carbon Conversion Science and Engineering, Shanghai Advanced Research Institute (SARI), Chinese Academy of Sciences (CAS), Shanghai 201210, China

[b]University of Chinese Academy of Sciences, Beijing,100049, China

[c]Key Laboratory of Energy Thermal Conversion and Control of Ministry of Education, School of Energy and Environment, Southeast University, Nanjing 210096,China

[d]School of Physical Science and Technology, Shanghai Tech University, Shanghai 201210, China

[1]Contributed equally to this work ;Z.Y. Tang and Y.H. Sun are the corresponding authors for this article.Y.H. Sun Email: sunyh@sari.ac.cn.

Abstract

Based on experimental and computational fluid dynamics simulations, the scale effect between the bubbles and the algae for different sizes in the culture process were investigated in a photobioreactor column under single and combined gas intake conditions, including factors such as the bubble distribution, gas holdup and mass transfer coefficient of different scale bubbles (500 μm microbubbles and 5 mm bubbles). In general, microbubbles could improve mass transfer and photo bio-reaction. For microalgae cultures with large particle sizes or high biomass concentration, the mixing ability of microbubbles was weakened, and therefore, the culture efficiency decreased. However, this can be improved by using millimeter bubbles with the strong turbulent characteristic. Therefore, a multiscale bubble combination intake method was proposed. This method can significantly strengthen both the multiphase mixture and mass transfer