Enhancing Natural BChl *a* Adsorption Capacity and Photoelectric Performance of BChl *a*-based DSSC by Improving TiO₂ Photoanode

Xiaobo Zhang¹, Xixiang Xiao^{1, 2}, Bitong Zhu¹, Chungui Zhao^{1,*}, Suping Yang^{1,*},
Qiaoming Fu¹

¹ College of Chemical Engineering, Huaqiao University, Xiamen 361021, China

² College of Ecological Environment and Urban Construction, Fujian University of Technology, Fuzhou 350118, China.

*E-mail: chungui@hqu.edu.cn; yangsuping@hqu.edu.cn

doi: 10.20964/2018.06.63

Received: 10 March 2018 / Accepted: 9 May 2018 / Published: 5 June 2018

Natural bacteriochlorophyll (BChl) *a* from purple bacteria possesses the near-infrared absorption, high extinction coefficient and excellent photoelectric properties. It is a promising natural pigment sensitizer candidate for fabricating near-infrared responsive dye-sensitized solar cell (DSSC). However, its low adsorption capacity on TiO₂ film limited its photoelectric performance. To enhance adsorption capacity of BChl *a* on the electrode, in this study, the TiCl₄ and acetic acid treatment were used to modify the TiO₂ film (named as T-TiO₂ film and A-TiO₂ film, respectively). The optimal adsorption parameters were examined by adsorption kinetic and adsorption isotherms of BChl *a* on the different types of TiO₂ films. The effects of TiO₂ film thickness and pigment concentrations on adsorption capacity and photoelectric properties of BChl *a* were systematically investigated. The results showed that T-TiO₂ film achieved the maximum adsorption capacity and adsorption rate for BChl *a*, the adsorption capacity of BChl *a* was increased gradually with increasing TiO₂ film thickness, but the best photoelectric performance was obtained at the moderate film thickness of 10 μm and 480 μg·ml⁻¹ of BChl *a*. The maximum short-circuits current and photoelectric conversion efficiency of DSSC obtained were 3.51 mA·cm⁻² and 1.67% at 100 mW·cm⁻², which were eight times and fifteen times higher than those of untreated TiO₂ films with thickness of 6 μm, respectively.

Keywords: Bacteriochlorophyll *a*; TiO₂ film; Adsorption properties, Dye-sensitized solar cell; Photoelectric properties

[FULL TEXT](#)

© 2018 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).