

水葫芦、三七和菠菜光系统Ⅱ颗粒的分离及超快光谱 的研究

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摘要 分离了三七、水葫芦和菠菜植物光系统Ⅱ富集的颗粒,并且采用吸收光谱和低温荧光光谱及皮秒荧光单光子计数技术进行了研究。结果显示,它们的吸收光谱图具有相似性。采用三指数动力学模型对三种光系统Ⅱ颗粒实验测定的光系统Ⅱ荧光衰减曲线拟合。水葫芦植物PSⅡ颗粒光系统三个组分荧光寿命分别是:157ps,415ps和1661ps;菠菜体系的相应荧光寿命分别是:198ps,677ps和1244ps;三七体系的相应荧光寿命分别是:14ps,272ps和184ps。慢速度荧光衰减由叶绿素堆积造成的,中等速度荧光衰减源于PSⅡ反应中心重新结合电荷组分,快速度荧光衰减归属于PSⅡ反应中心组分。基于20ps模型计算出三七植物PSⅡ颗粒的光系统Ⅱ反应中心转能效率为41%,水葫芦为89%,菠菜为91%,数值结果表明三七植物生长慢的特性可以表现在光合作用原初过程中,大量的被植物吸收的光子产生的激发态能量以荧光发射和非辐射形式消耗了,而没有被有效地利用,进一步验证了我们提出的观点:植物生长速度与它们的荧光性质和荧光寿命有相关性,生长慢的植物对激发态能利用效率则较低。

关键词 水葫芦 三七 菠菜 转能效率 荧光衰减 光系统Ⅱ颗粒 单光子计数 荧光寿命 光合作用

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Ultrafast spectroscopic studies on the isolated PS Ⅱ particles from pseudo ginseng, water hyacinth and spinach leaves

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Abstract We have studied the spectroscopic characteristics and the fluorescence lifetime for the PS Ⅱ partifcles from pseudo ginseng, water hyacinth and spinach plant leaves by absorption spectra, low temperature steady-state fluorescence spectroscopy and single photon cunting measurement under the same conditions. The absorption spectra for the PS Ⅱ particles at room temperature are similar, which suggests that different plants can efficiently absorb light of the same wavelength. The fluorescence decays in PS Ⅱ measured at the natural QA state for the PS Ⅱ particles have been fitted by a three- exponential inetic model. The three fluorescence lifetimes are 14 ps , 272 ps and 1840 ps for the pseudo ginseng PS Ⅱ particles; 157 ps, 415 ps and 1661 ps for the water hyacinth PS Ⅱ particles; 198 ps, 677 ps and 1244 ps for the spinach PS Ⅱ particles, respectively. The slow lifetime fluorescence component is assigned to a collection of associated light harvesting Chl a/b proteins, the fast lifetime component to the reaction center of PS Ⅱ and the middle lifetime component to the delary fluorescence of recombination of P680⁺ and Pheo⁻. The excited energy conversion efficiency (η) in PS Ⅱ RC is 41%, 89%, 91% calculated on the 20 ps model for the pseudo ginseng, water hyacinth and spinach PS Ⅱ particles, respectively. This interesting result is not consistent with what is assumed that the efficiency is 100% in PS RC. Our result in this paper also presents a support for the 20 ps electron transfer time constant in PS Ⅱ being more reasonable. However, our results show those plants can perform highly efficient transfer of photo-excitation energy fromthe light-harvesting pigment system to the reaction center (near 100%). The results in this paper further demonstrate that the characteristics with slow growth for pseudo ginseng plant is disceinable in the primary processes of photosynthesis, plant growth is related with its spectroscopic characteristics and the fluorescence lifetime, an水葫芦、三七和菠菜光系统Ⅱ颗粒的分离及超快光 谱 的研究

Key words COMMON WATERHAYACINTH. PANAX PSEUDOGINSENG VAR. NOTOGINSENG. SPINACH. FLUORSCENCE DECAY. FLUORESCENT LIFETIME. PHOTOSYNTHESIS

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