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太湖春季和秋季蓝藻光合作用活性研究

Photochemical vitality of cyanobacteria in Lake Taihu in spring and autumn season

关键词：蓝藻水华 光合作用活性 最大光量子产量 快速光响应曲线 太湖

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摘要：采用Phyto-PAM浮游植物分析仪测定太湖蓝藻光合作用活性的时空间分布.结果表明,太湖蓝藻光合活性具有显著的时空差异:春季蓝藻的最大光量子产量F_V/F_m (可变荧光和最大荧光之比)和实际光量子产量F_V'/F_m'分别在0.35~0.49和0.16~0.29之间,秋季蓝藻分别在 0.33~0.53和0.21~0.43之间,太湖秋季蓝藻的最大光合作用能力和实际光合作用能力大于春季蓝藻.春季和秋季蓝藻的非光化学淬灭NPQ(non-photochemical quenching)分别在0.012~0.17和0.035~0.26之间,秋季蓝藻的NPQ高于春季蓝藻,说明秋季蓝藻的自我保护能力高于春季蓝藻.快速光响应曲线(Rapid light curve, RLC)的特征参数表明春季蓝藻的光能利用效率、最大电子传递速率和光饱和强度点高于秋季蓝藻;从空间分布来看,蓝藻的最大光合作用能力、实际光合作用能力和光合作用效率在营养水平低和有水草分布的湖区相对较低,富营养化水平高的湖区则相对较高.因此,降低太湖营养盐浓度,恢复水生植物,能够抑制蓝藻的光合作用活性和生长,从而降低蓝藻水华强度.

Abstract: The temporal-spatial changes of photosynthesis activity of cyanobacteria in water column of Lake Taihu were measured with Phyto-PAM Phytoplankton Analyzer. The results showed that there were significant temporal and spatial differences in photosynthesis activity of cyanobacteria. The value of maximal and actual quantum yield in spring ranged from 0.35 to 0.49 and from 0.16 to 0.29, respectively, and ranged from 0.33 to 0.53 and from 0.21 to 0.43 in autumn, respectively. Obviously, the potential ability of photochemical vitality of cyanobacteria in autumn was higher than in spring. The value of NPQ (non-photochemical quenching) of cyanobacteria in spring and autumn varied from 0.012 to 0.17 and from 0.035 to 0.26, respectively, which indicated the potential ability of self-protection of cyanobacteria in autumn was higher than in spring. Characteristic parameters of rapid light response curve (RLC) suggested that the efficiency, maximum electron transport rate and saturating light intensity of cyanobacteria in spring were higher than in autumn;The maximal quantum yield, actual quantum yield and photosynthesis efficiency of cyanobacteria in Lake Taihu were relative low in water areas with low nutrient concentrations and aquatic plants distribution, and were higher in water areas with high eutrophication level. Therefore, reducing nutrient concentrations and recovery of aqutic plants can inhibit the photosynthesis activity and growth of cyanobacteira and further decrease the intensity of cyanobacterial bloom in Lake Taihu.

Key words: cyanobacterial bloom photosynthesis activity the maximum quantum yield rapid light curve Lake Taihu