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HCO_3^- 碱度增加对铜绿微囊藻光合活性和超微结构的影响

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摘 要:研究了不同重碳酸盐(HCO_3^-)碱度2.3 mmol/L(ALK2.3)和12.4 mmol/L(ALK12.4)对铜绿微囊藻(*Microcystis aeruginosa* FACHB 905)生长、光合特性、丙二醛(MDA)含量和超微结构的影响。实验结果表明,与对照相比碱度增加对铜绿微囊藻生物量抑制率分别为7%(ALK2.3)和55%(ALK12.4)。对光合色素Chl a含量的抑制率分别为22%(ALK2.3)和88%(ALK12.4)。Chl a/PC与对照相比先升高后降低。ALK2.3前期显著抑制光合活性,其它时期没有明显影响。ALK12.4对铜绿微囊藻光合活性表现出抑制—促进—抑制的作用模式。碱度诱导MDA含量的增加,碱度越高MDA含量增加越显著。超微结构表明,碱度增加使胞内类囊体数目减少,脂质体增加。表明碱度增加抑制光合色素的合成,破坏光合机构,进而抑制藻的光合活性,增加膜脂过氧化程度,对细胞产生伤害。

关键词:碱度;光合活性;丙二醛(MDA);超微结构

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Effects of Alkalinity on Photosynthesis Activity and Ultrastructure of *Microcystis aeruginosa* FACHB 905

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Abstract: The effect of alkalinity on terrestrial plants has been studied extensively, but little is known for aquatic plants, particularly for its effect on freshwater bloom-algae. Therefore, the bloom forming blue-green alga *Microcystis aeruginosa* FACHB 905 was chosen in the current study and cultured in medium with 2.3 mmol/L HCO_3^- (ALK2.3) or 12.4 mmol/L HCO_3^- (ALK12.4) in order to compare the growth, photosynthetic performance, pigments, malondialdehyde (MDA) and ultrastructure at different alkalinity. Compared with the control, the biomass of ALK2.3 and ALK12.4 treatments decreased by 7% and 55% after 13 days culture, respectively. The contents of chlorophyll a of ALK2.3 and ALK12.4 treatments were also decreased by 22% and 88% during the same period, respectively. At ALK2.3, Chl a was decreased significantly from the 7th day except for the 9th day, while Chlorophyll a/phycocyanin (Chl a/PC) ratio did not change much except on the 7th day. At ALK12.4, Chl a began to increase after the 5th day and reached the maximum on the 7th day. Chl a became lower than that of the control after the 9th day. The Chl a/PC ratio increased on the 3rd day and then declined. At ALK2.3, photosynthetic activity was inhibited at the first 7 days of culture and then recovered to normal level. At ALK12.4, the photosynthetic activity also showed a similar inhibition-recovery mode, but it did not restore the normal level at the end of culture. The MDA contents of both ALK12.4 and ALK2.3 treatments were increased, but the degree was higher under ALK12.4 than under ALK2.3. The number of liposomes in ALK12.4 treatment was more than that of ALK2.3, which in turn was more than that of the control, while number of thylakoids was in a reverse order. In summary, the biomass was decreased by elevated alkalinity, which might be due to the decreased photosynthetic activity and damage of photosynthetic apparatus.

Key words: Alkalinity; Photosynthesis; Malondialdehyde(MDA); Ultrastructure

微囊藻是一类全球性分布的淡水蓝藻,极易在富营养化淡水水体中形成水华[1],严重破坏水生态环境。铜绿微囊藻(*Microcystis aeruginosa*)可产生藻毒素,由于其生理和生态特性,该藻的水华在淡水水

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