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微囊藻毒素对水稻幼苗生长与叶绿素荧光的影响

Effects of microcystins on growth and chlorophyll fluorescence in rice seedlings

关键词: [微囊藻毒素](#) [水稻](#) [叶绿素荧光参数](#) [植物吸收](#) [生长](#)

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摘要: 为明确被微囊藻毒素(MCs)污染的灌溉水对农业生产的潜在危害,采用水培法研究了不同浓度(1、100、1000、3000 $\mu\text{g}\cdot\text{L}^{-1}$) MCs处理对胁迫期和恢复期内水稻叶片MCs积累量、叶绿素含量和叶绿素荧光参数的影响.结果表明,胁迫处理7 d后,MCs在叶片中的积累量随MCs处理浓度的增大而升高.与CK相比,1 $\mu\text{g}\cdot\text{L}^{-1}$ MCs处理组水稻叶片的各生长指标和叶绿素含量上升, F_0 下降, F_v/F_m 、ETR、qP和qN均未发生显著变化;高浓度($\geq 100 \mu\text{g}\cdot\text{L}^{-1}$)处理下,水稻叶片的生长受抑制,叶绿素含量下降, F_0 上升, F_v/F_m 、ETR、qP和qN显著下降.恢复7 d后各处理组水稻叶片MCs的积累量均低于胁迫期,100 $\mu\text{g}\cdot\text{L}^{-1}$ MCs处理组的 F_0 、qN均接近CK, F_v/F_m 、ETR和qP虽低于CK却高于胁迫期,表明MCs对光合系统的伤害有一定程度的恢复.1000和3000 $\mu\text{g}\cdot\text{L}^{-1}$ MCs处理组的 F_0 依然高于CK,且 F_v/F_m 、ETR、qP和qN不仅低于CK也低于胁迫期,表明高浓度MCs ($\geq 1000 \mu\text{g}\cdot\text{L}^{-1}$)降低了水稻叶片PS II 原初光能转换效率和PS II 潜在活性,对叶片光合功能造成不可逆的伤害.

Abstract: To evaluate the potential impact of irrigation water contaminated with microcystins (MCs) on agricultural production, we studied the accumulation of MCs, and changes in chlorophyll content and chlorophyll fluorescence parameters in rice seedlings treated with MCs at different concentrations (1, 100, 1000 and 3000 $\mu\text{g}\cdot\text{L}^{-1}$). The results show that MCs accumulation increased with the increase of MCs concentration. MCs at 1 $\mu\text{g}\cdot\text{L}^{-1}$ increased the growth and chlorophyll content in rice leaves whereas ETR, F_v/F_m , qP and qN had no change. High concentrations of MCs ($\geq 100 \mu\text{g}\cdot\text{L}^{-1}$) decreased the growth, chlorophyll content, F_v/F_m , ETR, qP and qN while increased F_0 . After a 7-day recovery, MCs accumulation in rice leaves was lower than those measured during the stress period. For the group treated with 100 $\mu\text{g}\cdot\text{L}^{-1}$ MCs, F_0 and qN had no obvious change whereas F_v/F_m , ETR and qP were higher than those measured during the stress period although they were still lower than those of the control. The results indicated that the damage caused by MCs on photosynthetic capacity was reversible. When rice seedlings were treated with higher concentrations MCs (1000 and 3000 $\mu\text{g}\cdot\text{L}^{-1}$), F_v/F_m , ETR, qP and qN were still lower than those of the control, even worse than those measured during the exposure period. It was indicated that high concentration MCs reduced the efficiency of primary light energy conversion and the potential activity of PS II. Furthermore, the damage caused by high concentration MCs on photosynthetic function in plants was irreversible.

Key words: [microcystins](#) [rice](#) [chlorophyll fluorescence parameters](#) [absorption](#) [growth](#)

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