

研究论文

菹草对Hg²⁺胁迫的生理和结构应答反应

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摘要 研究了不同处理浓度Hg²⁺对菹草叶片矿质营养吸收、叶绿素含量、可溶性蛋白、丙二醛含量、脯氨酸含量、谷胱甘肽含量以及细胞超微结构的毒害影响。结果表明, 随着Hg²⁺浓度的增加, (1)菹草叶片叶绿素含量和可溶性蛋白含量逐渐下降, 丙二醛含量和游离脯氨酸含量逐渐上升, 谷胱甘肽含量则先升后降; (2)Hg²⁺对菹草的矿质营养吸收也产生了影响, 主要是促进对Ca²⁺、Fe³⁺、Mg²⁺、Zn²⁺的吸收, 降低对大量元素P、K⁺的吸收; (3)SDS-PAGE蛋白电泳图的条带随Hg²⁺浓度增加而逐渐减少, 亮度也随之减弱, 并且在5mg/L和7mg/L Hg²⁺时导致了分子量为83.6kDa和51.3kDa多肽明显丢失; (4)电镜观察发现: 随Hg²⁺浓度的增加, 对细胞超微结构的损伤程度也加剧, 表现为被膜断裂、消失和叶绿体膨大、解体。Hg²⁺破坏了菹草正常生理活动的结构基础和离子平衡, 并造成功能紊乱。这些都是Hg²⁺对菹草产生毒害的重要原因。Hg²⁺对菹草的致死浓度范围应在1~3mg/L。

关键词 菹草; 超微结构; Hg²⁺; 胁迫

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Physiological and ultrastructural responses of Potamogeton crispus to Hg²⁺ stress

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Abstract Potamogeton crispus plants exposed to 1, 3, 5, 7mg/L Hg²⁺ for 7d were analyzed with reference to its toxic impact on mineral nutrition adsorption, total chlorophyll content, soluble protein, lipid peroxidation (MDA), proline, GSH and ultrastructure under lab conditions. The results revealed that, with the rise of Hg²⁺ concentration in culture medium, (1)the content of chlorophyll and soluble protein decreased gradually, while that of MDA and free proline increased and GSH content enhanced progressively up to 5 mg/L Hg²⁺ and followed by a decline at higher dose. (2)The addition of Hg²⁺ also affected the absorption of mineral nutrients; it mainly increased the absorption of Ca²⁺, Fe³⁺, Mg²⁺ and Zn²⁺, but reduced that of P and K⁺. (3) The amount and intensity of protein/peptide band decreased gradually with augment of Hg²⁺ concentration was observed in SDS-PAGE, respectively, and two polypeptides with apparent molecular weights 83.6 kDa and 51.3kDa disappeared significantly in fronds treated with 5 and 7 mg/L Hg²⁺. (4) Transmission electron microscope observation indicated that Hg²⁺ imposed injury action on ultrastructure of leaf cells, such as swelling of chloroplast, breakage and disappearance of chloroplast envelope and disaggregation in the end. The conclusion could be reached that the death of plant was resulted from destruction of structure foundation of physiological function, unbalance of ion equilibrium and disorder of physiological metabolism. The lethal concentration scope of Hg²⁺ to Potamogeton crispus was 1~3 mg/L based on the experiment results.

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