

# 不同浓度盐胁迫对红砂渗透调节物质及抗氧化酶活性的影响

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**摘要:**【目的】为探究不同浓度盐胁迫下对荒漠灌木红砂 (*Reaumuria soongorica*) 渗透调节物质以及抗氧化酶活性的影响, 丰富红砂耐盐机理研究, 为干旱半干旱荒漠区生态修复工作提供参考依据。【方法】以当年生红砂幼苗作为试验材料, 对其进行盆栽试验, 该试验设置采用不同浓度梯度的 NaCl 溶液(0、0.1、0.2、0.3、0.4、0.5mol/L)浇灌红砂幼苗。分别于处理的 0、3、6、9d 对幼苗进行采样, 测定其脯氨酸、可溶性蛋白、Na<sup>+</sup>、K<sup>+</sup>含量以及 SOD 酶活性等生理指标。【结果】研究表明: 与无 NaCl 溶液的对照处理组相比, 不同浓度的盐胁迫均能使红砂渗透调节物质的含量与 SOD 酶活性有不同程度的增加。同一浓度不同时间的 NaCl 溶液处理下, 红砂根系 Na<sup>+</sup>含量呈现出先降低后增大的趋势, 而 K<sup>+</sup>含量则相反。在 9d 0.5mol/L NaCl 处理时, 红砂地上部分及根系 Na<sup>+</sup>含量达到最大, 而 K<sup>+</sup>含量最小, 与对照组相比差异显著。脯氨酸含量在 0.1mol/L NaCl 溶液处理下呈递增趋势, 在其余浓度下先增大后减小, 在 3d 0.4mol/L NaCl 处理时, 脯氨酸含量达到最大, 其余渗透调节物质呈现出递增趋势。9d 0.2mol/L NaCl 处理时, 可溶性蛋白含量达到最大。当 NaCl 溶液浓度为 0.1mol/L 时, SOD 酶活性呈现递增规律。0.2mol/L、0.3mol/L NaCl 处理下, SOD 酶活性呈现先增后减规律。而当 NaCl 溶液浓度为 0.4mol/L、0.5mol/L 时, SOD 酶活性呈现递减规律。同一时间不同浓度 NaCl 溶液处理下, 脯氨酸含量呈现递增趋势。第 9d 处理时, 可溶性蛋白含量先增大后减小, 各处理浓度与对照相比差异显著。随 NaCl 溶液浓度的增大, SOD 酶活性呈现先增大后减小的规律, 且在 NaCl 溶液浓度为 0.2mol/L 时 SOD 最大, 与其他浓度相比差异显著, 浓度为 0.5mol/L 时 SOD 最小。【结论】综合分析认为, 不同浓度盐胁迫对荒漠灌木红砂的渗透调节物质与抗氧化酶活性会产生不同程度的影响。当该灌木受到低盐浓度(0.1mol/L、0.2mol/L)胁迫时, NaCl 能够对红砂幼苗生长产生促进作用, 使其渗透调节物质及抗氧化酶活性增加, 以此来提高其对盐胁迫环境的适应性; 当受到高盐浓度(0.4mol/L、0.5mol/L)胁迫时, NaCl 能够对红砂幼苗生长产生抑制效果, 使其渗透调节物质及抗氧化酶含量减少, 则对盐胁迫环境的适应能力随之弱化。

**关键词:** 红砂; 盐胁迫; 渗透调节物质; 抗氧化酶活性

## Effects of different concentrations of salt stress on osmoregulatory substances and antioxidant enzyme activities in red sand

**Abstract:** 【Objective】 To investigate the effects of different concentrations of salt stress on osmoregulatory substances and antioxidant enzyme activities of the desert shrub *Reaumuria soongorica*, and to enrich the study of salt tolerance mechanism of *Reaumuria soongorica*, in order to provide a reference basis for ecological restoration of arid and semi-arid desert areas. 【Method】 Red sand seedlings of the current year were used as test materials for potting experiment, which was set up by using different concentration gradients of NaCl solution (0, 0.1, 0.2, 0.3, 0.4, 0.5 mol/L) to water the red sand seedlings. Seedlings were sampled at 0, 3, 6, and 9d of the treatments, respectively, and physiological indexes such as proline, soluble protein, Na<sup>+</sup>, K<sup>+</sup> content, and SOD enzyme activity were determined. 【Result】 The results showed that compared with the control treatment group without NaCl solution, different concentrations of salt stress could increase the content of osmoregulatory substances and SOD enzyme activity of red sand to different degrees. The Na<sup>+</sup> content of red sand root system showed a trend of decreasing and then increasing under the same concentration of NaCl solution treatment for different time, while the opposite was true for K<sup>+</sup> content. At 9d 0.5mol/L NaCl treatment, the Na<sup>+</sup> content of aboveground part and root system of red sand reached the maximum, while the K<sup>+</sup> content was the minimum, and the difference was significant compared

with the control. Proline content showed an increasing trend under the treatment of 0.1 mol/L NaCl solution, which first increased and then decreased under the remaining concentrations, and reached the maximum at 3d 0.4 mol/L NaCl treatment, and the rest of the osmoregulatory substances showed an increasing trend. Soluble protein content reached the maximum at 9d 0.2 mol/L NaCl treatment. When the concentration of NaCl solution was 0.1 mol/L, the SOD enzyme activity showed an increasing pattern. 0.2 mol/L and 0.3 mol/L NaCl treatment, the SOD enzyme activity showed an increasing and then decreasing pattern. When the concentration of NaCl solution was 0.4 mol/L and 0.5 mol/L, the SOD enzyme activity showed a decreasing pattern. The proline content showed an increasing trend under the treatment of different concentrations of NaCl solution at the same time. At the 9th d treatment, the soluble protein content first increased and then decreased, and the differences between the treatment concentrations and the control were significant. With the increase of NaCl solution concentration, SOD enzyme activity showed the law of increasing first and then decreasing, and SOD was the largest when the concentration of NaCl solution was 0.2 mol/L, and the difference was significant compared with other concentrations, and the SOD was the smallest when the concentration was 0.5 mol/L. **【Conclusion】** In summary, it is concluded that different concentrations of salt stress will have different degrees of influence on the osmoregulatory substances and antioxidant enzyme activities of the desert shrub red sand. When the shrub was subjected to low salt concentration (0.1 mol/L, 0.2 mol/L), NaCl could promote the growth of red sand seedlings and increase the activities of osmoregulators and antioxidant enzymes, so as to improve its adaptability to the salt-stressed environment; when subjected to high salt concentration (0.4 mol/L, 0.5 mol/L), NaCl could inhibit the growth of red sand seedlings and increase the activity of osmoregulators and antioxidant enzymes, so as to improve its adaptability to the salt-stressed environment; when subjected to high salt concentration (0.4 mol/L, 0.5 mol/L), NaCl could inhibit the growth of red sand seedlings, so as to improve its adaptability to the salt-stressed environment. When subjected to high salt concentration (0.4 mol/L, 0.5 mol/L), NaCl could inhibit the growth of red sand seedlings and reduce the content of osmoregulatory substances and antioxidant enzymes, and then the adaptive ability to the salt stress environment was weakened.

**Key words:** red sand; salt stress; osmoregulatory substances; antioxidant enzyme activities