University of Zabol
Graduate school
Faculty of Basic Sciences
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The Thesis Submitted for the Degree of M.Sc (in the field of plant physiology)

Title
The interaction effect of manganese nanoparticles and chitosan on reducing the adverse effects of salinity stress in tomato (*Solanum lycopersicum* L.)

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Abstract

Salinity stress is one of the strongest stresses that affects living and non-living environments. High salinity disrupts the growth and development of plants and challenges food security. Tomato (*Solanum lycopersicum* L.) belongs to the *Solanaceae* family. In this research, the effect of different concentrations of manganese and chitosan nanoparticles in stress and non-stress conditions, as well as the mutual effect of manganese and chitosan nanoparticles on reducing the harmful effects of salinity stress in tomato plants at three levels of 0, 40, 80 mM salt in stress conditions and Non-tension was checked. Morphological properties such as fresh weight and length of shoot and root, biochemical traits such as photosynthetic pigments, total phenol, flavonoid, antioxidant activity (DPPH), lipid peroxidation (MDA), protein, proline and activity of antioxidant enzymes (guaiacol peroxidase and polyphenol oxidase) was measured by spectrophotometric method. The results showed that salinity stress decreased the length and weight of roots and shoots, the amount of chlorophyll a, b, total and carotenoid and protein. The treatments of manganese nanoparticles (10 mg/liter) and chitosan (150 mg/liter), as well as the effect the combination of manganese nanoparticles and chitosan increased these properties both under stress and non-stress conditions. Salinity stress increased the amount of metabolites such as total phenol, flavonoid, antioxidant activity (DPPH), proline, and antioxidant enzyme activity, and the treatments of manganese nanoparticles and chitosan alone, as well as the combined effect of manganese nanoparticles and chitosan, also increased these properties both under stress and non-stress conditions (except for proline). The increase in the activity of antioxidant enzymes under the influence of salt stress caused a decrease in the content of malondialdehyde (MDA). Based on the results of this research, the combined treatment of manganese nanoparticles and chitosan is suggested as a suitable stimulus to improve growth and reduce stress properties in tomato plants under salt stress.

Key words: phenolic compounds, salinity stress, antioxidant activity, chitosan, tomato, manganese nanoparticles