TiO2 nanoparticles alter iron homeostasis in Pseudomonas brassicacearum as revealed by PrrF sRNA modulation

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Abstract

We investigated whether TiO2 nanoparticles (NPs) with different size ranges and crystalline forms could affect iron homeostasis in *Pseudomonas brassicacearum*. In *Pseudomonas* species, regulation of iron homeostasis involves two sRNAs known as PrrF. We identified two sRNAs encoding genes *prrF1* and *prrF2* in the *P. brassicacearum* genome. To investigate the cytotoxicity of TiO2 NPs, we prepared two shapes of anatase titania particles for physico-chemical characterization before and after *in vitro* use. We determined their biological activity by analyzing the TiO2 NPs-bacterial interaction with hyperspectral microscopy, as well as their impact on intracellular iron content. Overall, our results demonstrate that under dark condition, TiO2 NPs do not have any impact on bacterial growth. We investigated the adaptive response of bacteria and showed that TiO2 NPs induced an oxidant stress and consequently altered iron homeostasis. Furthermore, bacterial iron content significantly decreased whereas adsorption of TiO2 NPs on bacterial cells increased. Although we used two different crystalline forms that differ in size and shape, they displayed nearly identical mechanisms of toxicity towards bacteria. Finally, we found that the expression of *prrF* sRNA represents a good indicator of intracellular iron status, yielding new insights into the mechanism underlying TiO2 NPs toxicity towards bacteria.

Keywords: TiO2 nanoparticles, iron homeostasis, Pseudomonas brassicacearum, sRNA modulation

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