Science of the Total Environment 649 (2019) 413–421

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Manipulation of the rhizosphere bacterial community by biofertilizers is associated with mitigation of cadmium phytotoxicity

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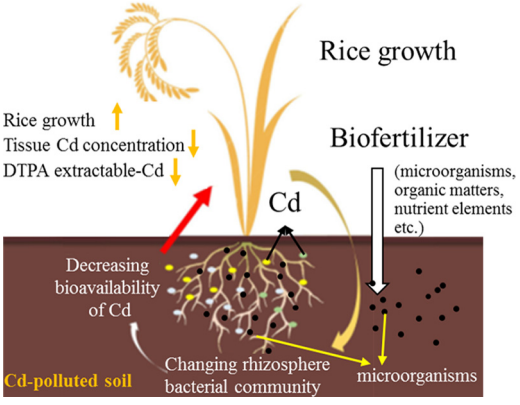
HIGHLIGHTS

- Biofertilizers were effective in mitigation of cadmium phytotoxicity.
- The rhizosphere bacterial community played critical roles in Cd stabilization.
- Effectiveness in mitigating Cd phytotoxicity was dependent on the type of biofertilizer applied.
- Soil physicochemical properties drove the structure of rhizosphere bacterial community.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 10 July 2018
Received in revised form 13 August 2018
Accepted 13 August 2018
Available online 16 August 2018

Editor: Xinbin Feng

Keywords:
Cadmium
Biofertilizer
Rhizosphere
Bacterial community
Remediation

ABSTRACT

The objective of this study was to understand the effect of biofertilizers on cadmium (Cd)-induced phytotoxicity and the rhizosphere bacterial community. The crop specie rice (*Oryza sativa* L.) was planted in Cd-contaminated soils, and Illumina high-throughput sequencing was performed to investigate how the composition of the rhizosphere bacterial community responded to the addition of biofertilizers. Biofertilizers were effective in alleviating Cd phytotoxicity as indicated by the significant increase in plant biomass (up to 85.2% and 48.4% for roots and shoots, respectively) and decrease in tissue Cd concentration (up to 72.2% in roots) of rice receiving fertilizer treatments compared with the CK (no treatment). These positive effects were likely due to the increase in soil pH, which can be attributed primarily to Cd immobilization, and the promotion of beneficial taxa such as Proteobacteria, Bacteroidetes, Gemmatimonadetes, and Firmicutes. In addition, autoclaved biofertilizers tended to have similar beneficial effects and similar bacterial community alpha diversities as the original biofertilizer treatments. This suggests that the change in soil physicochemical properties by biofertilizer addition might drive the structure of rhizosphere bacterial community, and not the biofertilizer microbes themselves. In both the original and sterilized biofertilizer treatments, the effectiveness in mitigating of Cd phytotoxicity was found to be dependent on the type of biofertilizer applied. Comparatively, the biofertilizer denoted as DY was more effective in mitigating Cd phytotoxicity than others. These results demonstrate that biofertilizer addition

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https://doi.org/10.1016/j.scitotenv.2018.08.174
0048-9697/