Distribution of bacterial communities and sulfate-reducing bacteria diversity in a paddy soil irrigated with acid mine drainage

HAN WANG[1], CHENGFANG YANG[2], CHULING GUO[3] AND ZHI DANG[4]

[1]South China University of Technology, GuangZhou, PR China. olivia_wh@163.com
[2]South China University of Technology, GuangZhou, PR China. ycf0309@hotmail.com
[3]South China University of Technology, GuangZhou, PR China. Clguo@scut.edu.cn
[4]South China University of Technology, GuangZhou, PR China. Chzdang@scut.edu.cn

Dabaoshan mine is located in north Guangdong provine, China (24°34′28″N, 113°43′42″E). Large scale of mining activities for iron and copper ores has been carried out since 1970s. During the mining process of metal sulfides minerals, large volumes of AMD containing high concentration of heavy metals and sulphate are generated and discharged to surrounding environments. The impacted rivers have been used in agricultural areas to irrigate crops for some decades. Therefore, the objectives of the present study are to (1) investigate bacterial diversity in a typical AMD-irrigated paddy soil; (2) examine the diversity and abundance of sulfate-reducing bacteria (SRB) in the paddy soil.

Soil sample cores (~80cm) were taken from the long-term irrigated paddy soil. The soil cores were then divided into 9 vertical layers of 0~5cm, 5~10cm, 10~20cm, 20~30cm, 30~40cm, 40~50cm, 50~60cm, 60~70cm and 70-80cm. The bacterial community structures were investigated using 454 pyrosequencing. In total, 5771 to 12390 operational taxonomic units were obtained at 3 % distance cutoff in the soil samples. The dominant phyla in all samples were *Acidobacteria, Chloroflexi, Proteobacteria* and *Actinobacteria*. We further investigated the diversity of SRB in the surface layer which had the highest bacterial diversity index. The result showed that the uncultured SRB groups may play important roles in paddy soils. The other OTUs mainly belonged to six phylogenetic divisions: *Desulfobacca, Desulfovibrio*, *Syntrophobacter*, *Desulforhopalus*, *Desulfarculus* and *Desulfobulbus*. The distribution of the absolute abundance and the relative contribution of SRB along the vertical soil were investigated by RT-PCR assays based on dsrB gene. The average dsrB gene copy numbers of the SRB were decreased with the depth (copies g^{-1} dry soil): 1.92×10^{9} in 0~10cm, 1.63×10^{9} in 10~20cm, 1.20×10^{9} in 20~40cm, 8.59×10^{8} in 40~60cm and 2.13×10^{8} in 60~80cm.

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