Physio-chemical characteristics and bacterial diversity in copper mining wastewater based on 16S rRNA gene analysis

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Abstract:

Abstract The effects of seasonal change in temperature on the chemical compositions of water and bacterial diversity in copper mining wastewater reservoir (CMWR) located in Jiangxi province, China, was investigated. Wastewater samples were collected in December 2008 and May 2009 from different points of CMWR and analyzed for anions, heavy metals, and microbial community structure using standard procedures. Most of the parameters exceeded the limits set by the Chinese government. However, the concentrations of some selected parameters such as pH, BOD, DO, and DOC and heavy metals were significantly (P=0.05) varied and exhibited a reduction from the inlet to the outlet of CMWR. Bacterial diversity was studied by the combined polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE) and cloning approach. The PCR-DGGE profiles showed the presence of 10 common bands in the seasonal samples of the reservoir indicating the high similarities among the bacterial populations existing during the two seasons. Furthermore, the DGGE profiles also evidenced the existence of some unique bands suggesting that the differences in bacterial diversity may be caused by the different environmental conditions. 22 major bands from the DGGE profiles were further reamplified, cloned, and sequenced. The results of sequencing analysis indicated the presence of Rheinheimera sp., Acidithiobacillus ferrooxidans, Afipia sp. and Burkholderia sp. as the dominant bacterial species in the CMWR samples. The Afipia sp. and Burkholderia sp. were found in summer samples only while most of the other species were common in both the seasons. Finally, the Copper mine wastewater was deficient in nutrients but enriched with the bacterial diversity of the extremophiles.

Keywords:

Copper mining, heavy metals, bacterial diversity, polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE), 16S rRNA

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