Migration and speciation of heavy metals in stream sediments of a mining-influenced basin, China

XUYIN YUAN, QUAN LIU AND QI ZHANG

School of the Environment, Hohai University, Nanjing 210098, China (*correspondence: yxy_hjy@hhu.edu.cn)

Tongling mine, located in the lower reaches of Yangtze River, is a multi-metal deposit with dominant Cu. Size fraction, the metal concentrations (Cu, Pb, Zn, Cr, Cd) and speciation, the acidic extractable metals (oxalic acid) were determined in order to investigate the impact of mining on stream sediments.

The enrichment factors (EFs) of heavy metals in the sediment nearby mine area were Cd(585) > Cu(289) >> Zn(81.9) >Pb(34.8) > Cr (2.3). The EFs of sediment in the site adjacent the Yangtze River decreased with Cd(15.3) > Pb(7.9) > Cu(5.4) > Zn (2.2) > Cr(1.3). It is indicated that heavy metals in sediments decrease obviously by transportation of about ten kilometers. The proportions of clay decreased and sand increased in sediments, which also altered the metal speciation in sediment by transportation. The oxidizable fraction (B2) decreased and the residual fraction (B4) increased for Cu. The exchangeable fraction (B1) and the reducible fraction (B3) of Cr descended. The significant variations of Pb speciation presented in the sediments. B1 and B2 ascended, but B4 descended. B3 notably increased and B4 decreased for Cd. The geochemical fractions of Zn showed the stable proportions in sediments of different sites. The acidic extractable fractions (oxalic acid) of five metals in sediments revealed different peculiarities. The proportion of extractable Cu decreased and the proportion of extractable Cr increased with distance from the mine site. But the proportions of extractable Zn, Pb, Cd showed less fluctuations during migration.

The stream sediments show different metal attenuation and removable metal variations during the transportation. These variations of metals depend on sediment size, mineral components and geochemical properties of metals.

Selenite reduction by *Bacillus L*

Y.-Q. YUAN[1,2], J.-M. ZHU[1]*, L. LEI[1,2], C.-Q. LIU[1] AND H.-B. QIN[1,2]

[1]The State Key Lab. of Environmental Geochemistry, Inst. of Geochemistry, CAS, Guiyang 550002, China (*correspondence: zhujianming@vip.gyig.ac.cn)

[2]Graduate University of Chinese Academy of Sciences, Beijing 100049, China.

A bacterium was isolated and purified from the selenium(Se)-high carbonaceous mudstone of Enshi, China. It was named as YTB-BL(*Bacillus L.*) in our lab. In order to investigate its potential tolerance and reduction for selenium oxyanions. This strain was inoculated in liquid medium (yeast extract and glucose)containing 5, 25, 100, 300, 500 and 800 mM of sodium selenite and selenate under aerobic, anaerobic and facultative anaerobic conditions, respectively. The results showed that this strain can be resistant to the SeO_3^{2-} and SeO_4^{2-} concentration of as high as 800 mM in the above three conditions. However, the doubling time(DT)of the strain was increased from 100.3h to 219.7h when SeO_3^{2-} concentration was changed from 500 mM to 800 mM under facultative cultivation, so did under the other two conditions. But this bacterium grew fastest under aerobic condition. Furthermore, it was able to reduce the soluble selenite anion(SeO_3^{2-}) to red elemental selenium(Se^0), which were present nanospheres distributed around or within the cells. The averagely transformed efficiency of Se^{+4} to Se^0 by YTB-BL was approximately 57% in the liquid medium containing 5-25 mM of sodium selenite. YTB-BL is a special kind of strain with wide adaptative and higher resistant selenite-reducing abilities, which would provide the better chance for microbial remediation of Se polluted areas.

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