Sequestration of copper and lead during iron mineral transformation under the impact of humic substances

YANG LU[1], SHIWEN HU[1],ZHENQING SHI[1*]

[1]School of Environment and Energy, South China University of Technology, Guangzhou, Guangdong 510006, PR China ([*] correspondence: zqshi@scut.edu.cn)

Iron minerals in soil play an important role on the sequestration of heavy metals. Coprecipitation of Cu and Pb with Fe (hydr)oxides and organic matter is an important process which controls the retention and speciation of Cu and Pb in soil. However, it is still not clear about the mechanisms of the squestration of Cu and Pb during the iron mineral transformation under the impact of organic matter.

In this study, coprecipitation of Cu or Pb with ferrihydrite and its transformation to hematite under the impact of humic acid (HA) was studied with batch experiments, spherical aberration-corrected scanning transmission electron microscopy (Cs-STEM), and stirred-flow kinetic experiments. The transformation of ferrihydrite to hematite was slower in experiments with HA than that without HA, indicating that the presence of organic matter significantly slowed down the crystallization of iron minerals. Batch extraction, stirred-flow experiments, and STEM results, collectively, indicated that ferrihydrite tranformation to hematite reduced the percentage of both Cu and Pb release from the copreciptates due to the incorporation of Cu and Pb into the hematite particles. Less Cu and Pb was extracted when humic acid was added in the coprecipitation process, due to the complexation of Cu and Pb by HA. Our results help, at both quantitative and mechanistic levels, to under the sequestration of heavy metals during iron mineral transformation processes with organic matter.