

Tracking the fungus-assisted biocorrosion of lead metal by DRIFT and RISE

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Lead (Pb) metal is an important structural and industrial material, including the widespread use of Pb compounds in the automotive industry, land application of sewage sludge and Pb-containing paint pigments. However, the Pb metal is substantially subject to biocorrosion. The biocorrosion consequently transforms the Pb into dissolved and particulate species that enter the environment at a weathering rate of approximately 1–5% per year [1]. Fungi play a significant role in biological corrosion of metal materials. In particular, fungi are important geoactive agents and are actively involved in biogeochemical processes within pedosphere and lithosphere. *Aspergillus niger* (*A. niger*) can secrete large amount of organic acids. The secreted organic acids are able to directly react with Pb to form insoluble mineral. The acids can also enhance the dissolution of inorganic phosphates, and then react with Pb to form stable pyromorphite [2].

We studied the biocorrosion of lead foils by *A. niger* via incubation in the solid PDA medium. Multiple techniques, e.g., SEM, DRIFT, and RISE, were applied in this study. SEM & DRIFT confirmed normal growth of the fungus on Pb foil surface, either above or under the solid medium surface. In addition, SEM-EDS confirmed formation of the secondary Pb-mineral particles after incubation, which had different morphologies. However, SEM and DRIFT cannot exactly identify the mineral phase. RISE technology offered both morphological and spectral information of the formed Pb-mineral. Three dominant Raman peaks at ~1440, ~1480, and ~1590 cm⁻¹ indicated that the secondary mineral was lead oxalate. And the Raman mapping determines the distribution of the lead oxalate. This study firstly applied RISE to investigate the biocorrosion of metals by fungi.

[1] Rhee et al. (2014), *Chemosphere* 17-21, 113 [2] Da Tian, Zhongquan Jiang & Liu Jiang (2019), *Environmental Microbiology* 21, 471–479