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Supporting Information

Microscale Gradients of Oxygen, Hydrogen Peroxide, and pH in Freshwater Cathodic Biofilms

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Manganese cycling in biofilms of manganese-oxidizing bacteria

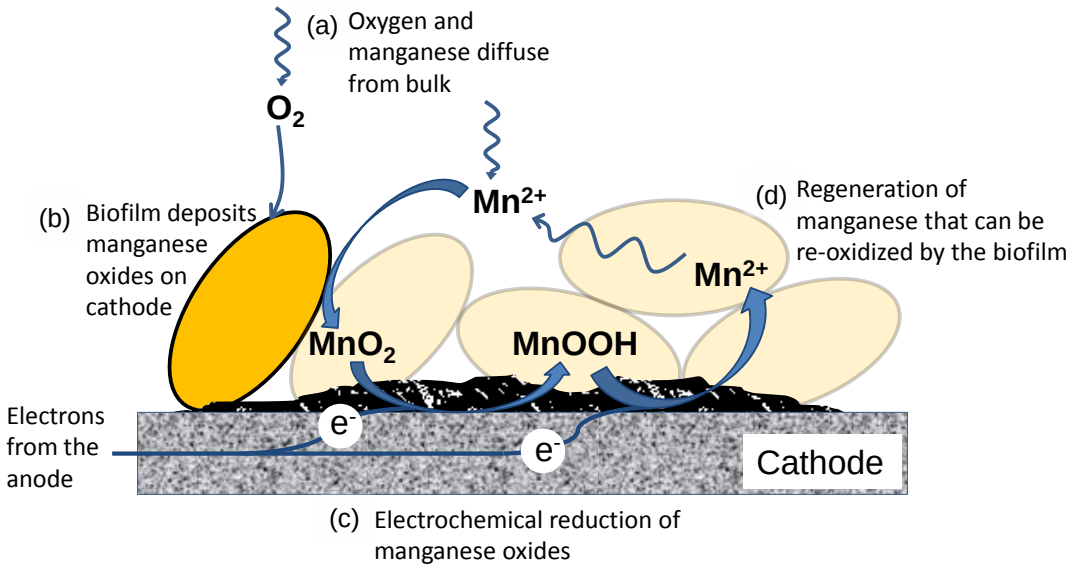

Figure SI-1. Schematic diagram of manganese cycling inside biofilms of manganese-oxidizing bacteria.

SEM and EDS of cathodes

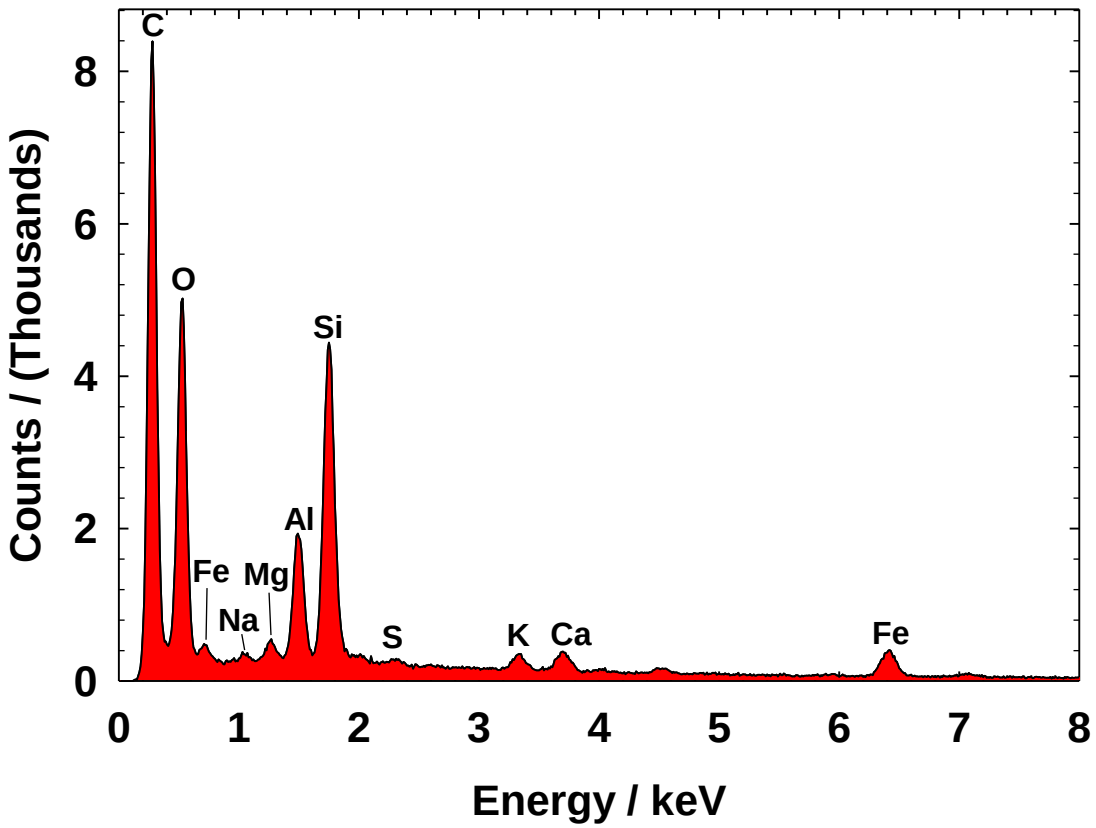

Figure SI-2. EDS spectrum for the river cathode Protocols for EDS were followed from Renslow et al. 2011 [1].

South Fork Palouse River water quality monitoring

The finalized river water quality in 2011 as reported by the Washington State Department of Ecology at water quality monitoring station 34B110 (less than a mile downstream from sampling site) were as follows: 7.64<pH<8.32, 1.62<NH_3 (mg L^{-1})<0.058, 1.62<NO_2/NO_3 (mg L^{-1})<6.76, 0.0701<organic phosphorous (mg L^{-1})<0.156, 5.8<dissolved oxygen(mg L^{-1})<13.13, 3<suspended solids(mg L^{-1})<40, 1.9<Temperature (in river; °C)<18.3, 3.7<total

organic carbon(mg L^{-1})<18.3, 0.119<total phosphorous(mg L^{-1})<5.6. Dissolved copper was measured at approximately 3×10^{-8} mol L^{-1} (Washington State Department of Ecology). Note that ranges may not represent the minimum or maximum values since daily sampling times varied during the year.

(http://www.ecy.wa.gov/apps/watersheds/riv/station.asp?theyear=&tab=final_data&scrolly=501&wria=34&sta=34B110)

References

[1] R. Renslow, C. Donovan, M. Shim, J. Babauta, S. Nannapaneni, J. Schenk, H. Beyenal, *Phys Chem Chem Phys* **2011**, *13*, 21573-21584.