A Thermodynamic Description of Microbial U(VI) Reduction

ADDIEN WRAY [1]*, DREW GORMAN-LEWIS[1]

[1]Earth and Space Sciences, University of Washington, Seattle, WA, 98195, USA (*correspondence: awray@uw.edu, dgormanl@uw.edu)

Radionuclide toxicity and the release of radionuclides into the environment from mining activities, nuclear weapons, and nuclear energy production make it essential to understand how these contaminants behave in the environment. Uranium is of particular concern given its high potential of environmental mobility under oxidizing conditions. The solubility difference between U(VI) and U(IV) can impact the potential mobility of U in the subsurface. Given that some microorganisms can reduce U(VI) to U(IV), a quantitative understanding of this process in thermodynamic terms is essential for understanding the potential mobility of U. To date, however, the bioenergetics of microbially induced U(VI) reduction has not been examined. This work quantifies the efficiency of catabolic U(VI) reduction by *Shewanella putrefaciens* CN32 through thermodynamic characterization of the bioenergetics driving this reaction using isothermal calorimetry and measurements of changes in composition of a chemically defined medium. Altering media composition permitted investigations of U bioavailability and impacts on reduction efficiency. This approach allowed us to define reduction efficiency in terms of energy consumption and the immobilization of U. Ultimately, this work advances our understanding of the potential impact microorganisms can have on U mobility in the subsurface.