The Effects of Uranium Speciation on the Rate of U(VI) reduction by *Shewanella oneidensis* MR-1

LING SHENG* AND JEREMY B. FEIN

Civil Engineering and Geological Sciences, University of Notre Dame, Notre Dame, IN USA

Some bacterial species can reduce soluble U(VI) species to a relatively insoluble U(IV) solid phase, and bioreduction of U represents a possible remediation approach for U in anaerobic groundwater systems. Although considerable research has focused on the mechanisms of U(VI) bioreduction, the controls on the kinetics of bioreduction are poorly defined. We measured the kinetics of U(VI) reduction by *Shewanella oneidensis* MR-1 under anaerobic conditions in the presence of variable concentrations of either EDTA or Ca. EDTA forms highly stable aqueous complexes with both U^{4+} and UO_2^{+2}, but the stability of the former are much greater; Ca affects the speciation of U(VI) through the formation of aqueous calcium-uranyl-carbonate aqueous complexes. We measured both total dissolved U and U(VI) concentrations in solution as a function of time. In separate experiments, we also measured the extent of U(VI) adsorption onto *S. oneidensis* MR-1 in order to quantify the thermodynamic stabilities of the important U(VI)-bacterial surface complexes. The overall objective of the research was to determine if bacterial U(VI) reduction rates relate to U speciation (aqueous or bacterial surface).

The rate of U (IV) production increased with increasing EDTA concentration. However, the total dissolved U concentrations remained constant and identical to initial U concentrations during the course of the experiments for all EDTA concentrations studied. We conclude that the U (VI) reduction rate increases with increasing EDTA concentrations, likely due to U^{4+}-EDTA aqueous complexation which removes U (IV) from the cell surface and prevents UO_2 precipitation. In the Ca experiments, the U (VI) reduction rate decreased as Ca concentrations increased. Our U (VI) adsorption experiments demonstrated the presence of Ca-uranyl-carbonate-bacterial surface complexes in addition to a number of other Ca-free uranyl surface complexes. The observed U (VI) reduction rates exhibit a strong negative correlation to the concentration of Ca-uranyl-carbonate complexes on the bacteria, but a strong positive correlation to the total concentration of all other uranyl-bacterial complexes. Our results demonstrate that U speciation, both of U (VI) before reduction and of U (IV) after reduction, controls the reduction kinetics, and that U speciation may be used to predict reduction kinetics in realistic geologic settings.

Assessment of carbon dioxide sequestration potential of ultramafic rocks in China

X.F. SHENG, J. CHEN AND J.F. JI

Institute of Surficial Geochemistry, School of Earth Sciences and Engineering, Nanjing University, Nanjing 210093, China (shenxuer@nju.edu.cn)

The global is facing a major challenge due to anthropogenic CO_2 emission from the utilization of fossil fuels. Several geological formations are envisaged as possible options to store CO_2 such as the deep sedimentary formations, saline aquifers, depleted oil or gas reservoirs and ultrabasic rocks. Ultrabasic rock storage is a potential one to reduce atmospheric CO_2, with high reactivity to form carbonates leading to a very stable sequestration.

In this abstract we present a preliminary investigation of a potential CO_2 storage capacity sequestrating in the ultrabasic rocks of China, totally 40×10^{12} t was estimated and is about 6450 times as against the total CO_2 emission of china in 2005. In order to select the preferential zones for commercial CO_2 storage in the near future, seven zones were divided as following: Northeast Area, North China, East China, South China, Westsouth Area, Central tectonic belts and Xinjiang Area. Considering the geological status and total CO2 emission from the large-scale industrial sources within different area, Northeast Area, North China, East China, South China and Central tectonic belts Area are the preferential zones for CCS in near future, with totally 5×10^{12} t CO_2 storage capacities, can sequestrate more than 800 times of 2005 emission CO_2 in China. The Westsouth Area and Xinjiang Area are the perspective potential storage candidates, enormously, more than 35×10^{12} t CO_2 storage capacities. In southeast coastal area and South China, with little CCS capacities, the other geological options such as the brine aquifer in sedimentary basins located on the continental shelf may be considered.

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