Geophysical Research Abstracts,
Vol. 11, EGU2009-13065, 2009
EGU General Assembly 2009

Hybrid silica gel as a new tool for studying bio-dissolution of colloidal size mineral particles

M. GRYBOS (1), P. BILLARD (1), L. MICHOT (2), and Ch. MUSTIN (1)

(1) LIMOS (Laboratoire des Interactions Microorganismes-Minéraux-Matière Organique dans les Sols), UMR 7137 CNRS, BP 70239, Vandoeuvre-lès-Nancy Cedex, 54506, France, (2) LEM (Laboratoire Environnement et Minéralurgie), UMR 7569 INPL & CNRS, ENSG, BP 40, Vandoeuvre-lès-Nancy Cedex, 54501, France

Numerous studies have shown that mineral dissolution occurring in soils and sediments depends on physico-chemical conditions (pH, Eh, T°, ligands), crystallographic and textural properties of minerals as well as microbe-particle interactions. Although the reactivity of small-size particles has long been recognized as playing an important role in the geochemical cycling of elements, many experimental studies of mineral (bio)weathering have been carried out using micrometric particles to limit specific problems (particle flocculation, mineral adhesion to cells, solution recovery) encountered when dealing with colloidal suspensions. Immobilisation of colloids in an inorganic porous matrix (silica gel) could provide a solution to these problems.

In this study, we present a new tetraethylortosilicate (TEOS)-based sol-gel procedure for preparing biologically friendly hybrid silica gel (HSG). The proposed synthesis avoids the release of alcohol as a by–product, a feature which has, up to recently, limited the biological use of alkoxide-based gel materials. Various colloidal-size fractions of montmorillonite and nontronite were immobilized in the silica gel and then submitted to chemical and biotic dissolution using several bacterial soil isolates. The results showed (i) homogenous and stable dispersion of colloidal particles in the silica networks, (ii) phyllosilicates availability for (bio)weathering, (iii) efficient bacterial growth on HSG with mineral as a sole source of inorganic nutrients.

Hybrid silica gel therefore provides an original way to simulate mineral-bacteria interactions in nutrient-poor mineral environment and to study mineral weathering or nutrients acquisition from mineral by bacteria. Moreover, such impurity free and tuneable inorganic materials can be used to screen microbial strains able to weather a mineral target(s) for sustaining their growth. In addition, the associate optical conduction of the siliceous structure could be of great advantage for implementing environmental micro-spectroscopy studies on the (bio)weathering of minerals.