European Mineralogical Conference
Vol. 1, EMC2012-300, 2012
European Mineralogical Conference 2012

Catalytic effect of organic acids on the alteration of tremolite particles: salycilate case

M. Rozalen (1), M.E. Ramos (1), F. Gervilla (2), S. Fiore (3), and F.J. Huertas (1)

(1) I.A. Ciencias Tierra (CSIC-UGR), Armilla, Granada, Spain (javierhuertas@ugr.es), (2) Dpt. Mineralogía y Petrología (UGR) Granada, Spain (gervilla@ugr.es), (3) Laboratory of Environmental & Medical Geology, IMAA–CNR, Tito Scalo 8500, Italy (saverio.fiore@cnr.it)

Due to their fibrous morphology, tremolite as well as other asbestiform amphiboles are recognized by World Health Organization as carcinogenic materials by inhalation, causing mesothelioma, pleural cancer and other diseases. Their intensive use in manufacturing and industrial processes in the past makes the study of degradation process in human body conditions essential to understand the mechanisms of clearance of inhaled particles. The aim of this study is to evaluate tremolite dissolution rates using mimicked lung fluids, including salicylate as a proxy for organic acids in interstitial fluids. This study completes a series where the effect of citrate and oxalate were also evaluated.

Tremolite from Sierra Nevada (Granada, Spain) was used as starting material. The effect of salicylate on dissolution rates was measured at 37ºC (corporal temperature) in stirred flow-through reactors using modified Gamble's solutions at pH 4 (macrophages) and 7.4 (interstitial fluids) containing 0, 0.15, 1.5 and 15 mM of salicylate.

In absence of salicylate dissolution rates calculated from Si release increase when pH decreases, from (logarithmic units) -13.34 mol/g.s at pH 7.4 to -12.99 mol/g.s at pH 4. The results obtained point out that salicylate enhances dissolution rates at both pHs one order or magnitude in 15 mM salicylate solutions. Moreover salicylate modifies the measured Mg/Si ratio in solution. This effect is likely derived from the capacity of salicylate to form Mg complexes in solution. Solution speciation tests show that an 80% of Mg is complexed as MgHSal+ in the pH range 4-7. Comparing with other ligands the effectiveness as catalyst is citrate > oxalate > salicylate at pH 4 (macrophages) but for interstitial fluids the order is inverse salicylate > oxalate > citrate.

These results suggest that the ligand-promoted dissolution mechanism plays an important role and need to be considered in order to quantify asbestos dissolution in biological conditions. More studies are necessary to evaluate the species in solution, their interaction with mineral surfaces and their role in the dissolution process(es). Thus, multidisciplinary research including geochemistry of asbestos minerals is essential to assist decision-makers in environment and human health.