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Remediation of polluted waters by mineral precipitation strategies

ENCARNACIÓN RUIZ-AGUDO[1], SARAH BONILLA-CORREA[1], RICARDO MILLÁN BECERRO[2] AND MARIA P. ASTA[1]

[1]University of Granada

[2]Department of Earth Sciences and Research Center on Natural Resources, Health and the Environment (RENSMA), University of Huelva, Campus 'El Carmen', 21071

Presenting Author: encaruiz@ugr.es

The global demand for minerals and metals is foreseen to increase in a scenario of transition to a low carbon economy. Metals critical to the energy transition (e.g., Ni, Mn, Co, Li, Cu, Ti, Se, or Rare Earth Elements –REE-) are increasingly demanded for different aspects of electricity generation, transport, and storage from renewable sources. Also, metals such as those mentioned above may represent a problem for the remediation of polluted waters due to its high concentration in mining and industrial effluents. This work presents an experimental study on the remediation of metal-laden solutions with different concentrations of metals such as Zn, Sb, Se, As, or REE, using a co-precipitation strategy with minerals such as brucite ($Mg(OH)_2$) or gypsum ($CaSO_4 \cdot 2H_2O$), where those elements may be concentrated in its potential recovery. The specific objectives of the study were to (i) establish a potential mechanism of element removal, (ii) assess the effect of pH on the element removal yield and (iii) determine the preference of each metal for the different minerals tested and, iv) define the phases of these minerals that are generated during the assimilation of the different elements With this purpose, we carried out bulk (batch) precipitation experiments as well as *in situ* Atomic Force Microscopy experiments. After co-precipitation experiments, the fluids and the mineral phases were analyzed using ICP-MS, TEM, XRD, Raman, FTIR, SEM, and, TG-DSC, which allow determining the partition coefficient of the different elements into the studied minerals as well as changes in the characteristics of the precipitated phases. Our results show significant metal incorporation/adsorption in the precipitated brucite and gypsum, thus demonstrating the feasibility of this strategy for metal concentration and remediation of polluted waters.