Geochemical modelling of inorganic foliar fertilizers

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PHREEQC code [1] has been demonstrated to be a suitable tool for modelling potential geochemical processes in nature and under laboratory conditions. Moreover, PHREEQC can also be a powerful means to solve scientific questions in fields different than geology, geochemistry and hydrogeology. Here, we present the first theoretical approach to examine the performance of foliar fertilizers of inorganic salts deposited onto leaf surfaces. The mechanisms of foliar penetration of ions are still poorly understood. In particular, it is currently not possible to know which elements and chemical species are more easily transported through plant cuticles, limiting our capacity to improve fertiliser efficacy [2]. For the first time, and following a geochemical approach, PHREEQC code was used to model the chemical behaviour of simple bulk mineral element solutions commonly used as foliar fertilizers (e.g. monocationic solutions with different compositions and concentrations). Furthermore, the dissimilar ion uptake rates, potentially resembling foliar absorption processes, were modelled with PHREEQC. This allows us to understand possible evolutions of foliar-applied nutrient solutions (i.e., changes in the pH and concentrations) depending on the cation-anion ratio uptake. This approach can be helpful to characterise the effectiveness of foliar fertilizers such as nanoparticulated calcium carbonate.

[1] Parkhurst & Appelo (2013) U.S. Geological Survey Techniques and Methods, book 6, chap. A43, 497 p. http://pubs.usgs.gov/tm/06/a43/ [2] Fernández & Eichert (2009) *Critical Reviews in Plant Sciences* 28(1), 36-68.