Geophysical Research Abstracts
Vol. 17, EGU2015-15004, 2015
EGU General Assembly 2015

Application and further development of diffusion based 2D chemical imaging techniques in the rhizosphere

Christoph Hoefer (1), Jakob Santner (1), Sergey Borisov (2), Andreas Kreuzeder (1), Walter Wenzel (1), and Markus Puschenreiter (1)

(1) Department of Forest and Soil Sciences, Institute of Soil Research, University of Natural Resources and Life Sciences, Vienna (BOKU), Konrad-Lorenz-Strasse 24, A-3430, Tulln, Austria, (2) Institute of Analytical Chemistry and Food Chemistry, Graz University of Technology, Stremayrgasse 9, A-8010, Graz, Austria

Two dimensional chemical imaging of root processes refers to novel in situ methods to investigate and map solutes at a high spatial resolution (sub-mm). The visualization of these solutes reveals new insights in soil biogeochemistry and root processes.
We derive chemical images by using data from DGT-LA-ICP-MS (Diffusive Gradients in Thin Films and Laser Ablation Inductively Coupled Plasma Mass Spectrometry) and POS (Planar Optode Sensors). Both technologies have shown promising results when applied in aqueous environment but need to be refined and improved for imaging at the soil-plant interface. Co-localized mapping using combined DGT and POS technologies and the development of new gel combinations are in our focus.
DGTs are smart and thin (<0.4 mm) hydrogels; containing a binding resin for the targeted analytes (e.g. trace metals, phosphate, sulphide or radionuclides). The measurement principle is passive and diffusion based. The present analytes are diffusing into the gel and are bound by the resin. Thereby, the resin acts as zero sink. After application, DGTs are retrieved, dried, and analysed using LA-ICP-MS. The data is then normalized by an internal standard (e.g. 13C), calibrated using in-house standards and chemical images of the target area are plotted using imaging software.
POS are, similar to DGT, thin sensor foils containing a fluorophore coating depending on the target analyte. The measurement principle is based on excitation of the flourophore by a specific wavelength and emission of the fluorophore depending on the presence of the analyte. The emitted signal is captured using optical filters and a DSLR camera. While DGT analysis is destructive, POS measurements can be performed continuously during the application. Both semi-quantitative techniques allow an in situ application to visualize chemical processes directly at the soil-plant interface.
Here, we present a summary of results from rhizotron experiments with different plants in metal contaminated and agricultural soils.