2D image quantification of microbial iron chelators (siderophores) using DET method

S. LE HOUEDEC[1], A. THIBAULT DE CHANVALON[1, 3], A. MOURET[1], E. METZGER[1], P. LAUNEAU[2], P. GAUDIN[2], T. LEBEAU[2]

[1]1UMR CNRS 6112 LPG-BIAF, Université d'Angers, 49045 Angers Cedex, France. (sandrine.lehouedec@univ-angers.fr, edouard.metzger@univ-angers.fr, aurelia.mouret@univ-angers.fr)

[2] UMR CNRS 6112 LPG Nantes, Université de Nantes, 44322 Nantes, France. (thierry.lebeau@univ-nantes.fr, patrick.launeau@univ-nantes.fr, pierre.gaudin@univ-nantes.fr)

[3] University of Delaware, College of Earth, Ocean and Environment, Lewes, DE, USA. (aubintdc@udel.edu)

We present the first study identifying and quantifying the production of microbial siderophores in natural environments in 2 dimensions. The method used a slightly modified protocol (Andrews et al., 2016) of the universal CAS assay for siderophore detection (Schynn and Neilands 1986) combined with diffusive equilibrium in thin film (DET). The orange-pink colour CAS reagent complexes ferric iron to produce a blue color. When a stronger chelator such as siderophores removes iron from the CAS reagent, this one returns to its original colour. DET allows in situ sampling of sediment/soil porewaters based on a diffusive equilibrium between a sampling medium device (i.e., polyacrylamide hydrogels) and the natural water (Davison, 1991). By using the colorimetric property of the CAS assay and hyperspectral imaging, this new approach allows to identify the spatial variability of siderophores at millimetre scale as well as to quantify micro-molar concentrations. Calibration of the method was performed using the marketed desferrioxamine mesylate (DFOM) siderophore as well as pyoverdine produced by *Pseudomonas Fluorescens*.

We present results obtained from both artificial and natural environments. Firstly this method was validated in controlled conditions. Experiments were performed with sunflower (*H. annuus*) cultivated on agar plates and soils and inoculated with *P. fluorescens*. 2D DET probes designed in the laboratory were deployed and showed a decomplexation of iron from the CAS reagent in the vicinity of the root system of plants. The application of this new promising tool could be coupled to 2D DET Fe probes or to DGT devices in order to fully describe the microdistribution and fate of labile trace metals in soils and sediment. This opens a wide field of applications in the study of contaminated environments.