Transformation and interaction of trace elements in soil-plant system under waterlogged and dry cultivation, southeastern China

XUYIN YUAN[1,2]*, TIANYUAN LI[2], AND JIZHOU LI[1,2]

[1]Key Laboratory of Integrated Regulation and Resource Development on Shallow Lakes, MOE, Nanjing, China, *yxy_hjy@hhu.edu.cn (* presenting author)

[2] Hohai University, College of Environment, Nanjing, China

Introduction

The yellow brown soil is a primary soil in the southeast China, which is cultivated for crop planting. The cultivation in waterlogged and dry fields is common manner in the study area. Trace elements of corps (rice and rape) and soils in two cultivated conditions were investigated to expound their transformation and interaction in soil-plant system. It is beneficial for risk assessment of trace metals in different land uses.

Results

The ratio of trace element concentration in crop shoot to that in soil is defined as an translocation coefficient (T), and the ratio of trace element concentration in grain to that in shoot as a allocation coefficient (A). These coefficients were researched in two soil-crop systems (rice-waterlogged field and rape-dry field). The results displayed $T > 1$ for Cd and Mo, $0.44 < T < 0.86$ for As, Hg, Se, Zn and Cu, $T < 1$ for Pb and Cr in soil- rice system. But the allocation coefficients for all trace elements in rice were less than 1. It showed $A > 0.5$ for Mo, $0.1 < A < 0.5$ for Hg, Se, Cu, Zn, Cd and Cr, $A < 0.1$ for As and Pb. In the dry field, it showed that the translocation coefficients of rape were larger than 1 for Cd, $0.14 < T < 0.55$ for Zn, Cu, Mo, Se and Hg, $T < 0.1$ for Pb and As. Meanwhile, the allocation coefficients of Zn and Mo were larger than 1, and those of other elements were between 0.01 and 0.57.

Based on correlation analyses, the significant affecting factors for metal translocation of rice were sulphur and pH value, and $CaCO_3$ showed a weak effect. Sulphur was also in the primary factor influencing the elemental allocation from shoot to grain, P and B were the secondary factors. Fe oxides took a important role in promoting translocation of trace elements, TOC and $CaCO_3$ also showed obviously effects on metal translocation of rape. The allocation coefficients of rape were significantly affected by iron. The other affecting factors included P, S, K and Na. It is indicated the nutrient elements are important for allocation of metals in crop[1].

Conclusions

Overall, the crop under waterlogged field shows high translocation ratios of trace elements, but trace elements under dry field are more easy to transport for shoot to grain. Relatively, the crop translocation and allocation show more affecting factors under dry field, which may due to redox and elemental characteristicss of soils[2].

[1] Lin et al (2010) *J. Hazard Mater*1**74**, 202-208. [2] Gupta et al. (2008) *Environ Geol* **55**, 731-739.

Transformation of marine wood-falls into anoxic-sulfidic environments: Voltammetric time series and kinetic modeling

MUSTAFA YUCEL[1*], LEONARDO CONTREIRA[2], PIERRE E. GALAND[3], SONJA FAGERVOLD[4] AND NADINE LE BRIS[5]

UPMC, Univ Paris 06, Observatoire Océanologique and CNRS, FRE 3350 Laboratoire d'Ecogéochimie des Environnements Benthiques / Benthic Ecogeochemistry Laboratory (LECOB), 66650 Banyuls-sur-mer, France

[1]yucel@obs-banyuls.fr (* presenting author)

[2]conteira@obs-banyuls.fr, [3]galand@obs-banyuls.fr,

[4]fagervold@obs-banyuls.fr, [5]lebris@obs-banyuls.fr

Seafloor wood-falls were recently found to support chemosynthetic communities, pointing to the development of reducing conditions and redox interfaces in these organic falls over time. This discovery was in contrast with the presumed sluggish degradation of woody substrates containing such recalcitrant organic polymers. Two major questions arise in this context: How and when wood-falls transform into anoxic-sulfidic environments and what biotic and abiotic processes regulate the concentrations of redox sensitive degradation products, particularly reduced sulfur, on wood-falls? In this communication we describe a 200-day chemical dynamics of redox species on the surface and the interior of a simulated marine wood-fall using continuous multi-analyte voltammetry with Au/Hg microelectrodes, and discuss the combined microbial and abiotic kinetics of possible sulfur transformations during marine wood-fall degradation. Our voltammetry results showed that after a 5-week suboxic period, the wood interior became sulfidic, and after 8 weeks, sulfide was detected at the surface for the first time. Steady-state sulfidic conditions in the wood interior were observed after about 13 weeks, following an unsteady period where sulfide concentration fluctuated between 1 mM and several μM. Sulfide oxidation seems to play an important part in the wood-fall sulfur cycle as evidenced by the surface biofilm bacterial composition and the relatively lower concentrations of sulfide on the wood surface. The succession of transient dynamic states, in otherwise physically and chemically stable experimental conditions, suggests a complex dynamic system linking microbial communities producing and consuming sulfide with the reactivity of wood components towards sulfide. These findings shed light on the dynamics of the transformation of wood-falls into anoxic-sulfidic environments and have implications for the fate of land-derived coarse woody debris in the marine environment.