	Experiment title: Fate of inorganic and methyl mercury in the aquatic plant Elodea nuttallii	**Experiment number**: ES129
Beamline: BM30B	**Date of experiment**: from: April 30 to: May 6, 2014	**Date of report**: Nov 2015
Shifts: 15	**Local contact(s)**: Denis Testemale	*Received at ESRF:*

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Report:

Background and objectives

Mercury is a global pollutant of primary concern due to its volatility and long range transport. Both inorganic Hg (IHg) and organic (monomethyl-Hg; MMHg) forms are toxic, bioaccumulated and disturb ecosystems; however MMHg is in addition biomagnified in the food web (several millions times from the water column to fish) and therefore problematic for humans through consumption of fish. The first entry point of Hg into food web is generally accumulation in primary producers such as phytoplankton and macrophytes. Field sampling revealed that *Elodea nuttallii* – a submerged aquatic macrophyte- was able to accumulate higher concentrations of Hg than most other plants and was involved in biomagnification of MMHg in the trophic web. The speciation of Hg was shown to significantly influence uptake and root/shoot translocation of Hg in this plant. In this experiment, we have studied the speciation of Hg in shoots of *E. nuttallii* exposed to inorganic Hg (IHg) or MMHg through the shoots or roots, and in presence of different amino acids. The goal of these measurements was to gain information on the better understand the mechanisms of Hg uptake depending on its form (IHg or MMHg), to identify the ligands for MMHg and IHg in the extra and intracellular compartments, in order to explain the higher uptake of MMHg relative to IHg and higher transfer in the trophic web.

Shoots were exposed to IHg or MMHg at 20 µg/L or 2 mg/L for 24h, with or without addition of different amino acids or inhibitors of the metabolism in the aquatic medium. Shoots were split in two samples, and one

was used to purify cell walls . All samples were frozen and prepared as pellets in liquid nitrogen. Reference compounds were prepared in anoxic conditions and frozen as well (Fig. 1). All spectra were recorded at 10K using a helium cryostat, in fluorescence mode using a 30-element Canberra detector.

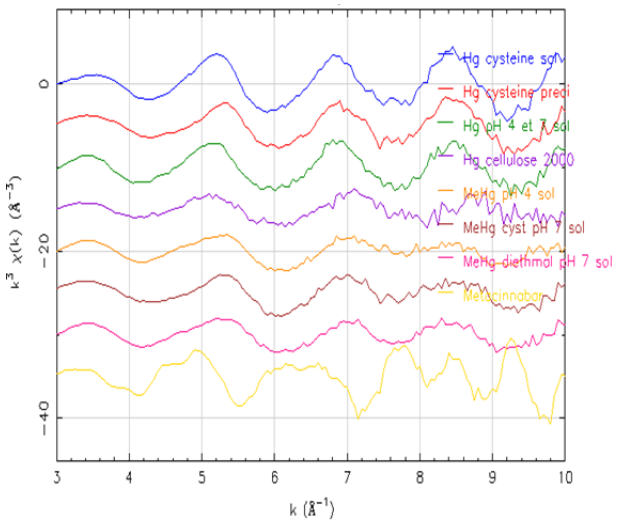

Figure 1: EXAFS spectra for the Hg reference compounds

The content in total Hg and MMHg in all plant and cell wall samples was determined by analytical chemistry. Plants and cell walls exposed to IHg contained less than 1% MMHg. For Plants and cell walls exposed to MMHg contained between 4 and 10% MMHg. The presence of amino acids induced a decrease or increase of this percentage.

EXAFS spectra for the plant and cell wall samples were noisier than expected. During data pre treatment, the signal of many individual detectors (at least 50%) had to be removed from the sum because of bad data. This may be due to the formation of ice crystals during sample preparation (although the usual procedure was used) since these plants have a very high water content, or to a dysfunction of the detector during this experiment. EXAFS spectra were treated by linear combination fits of reference spectra (examples of LCFs shown in Fig 2).

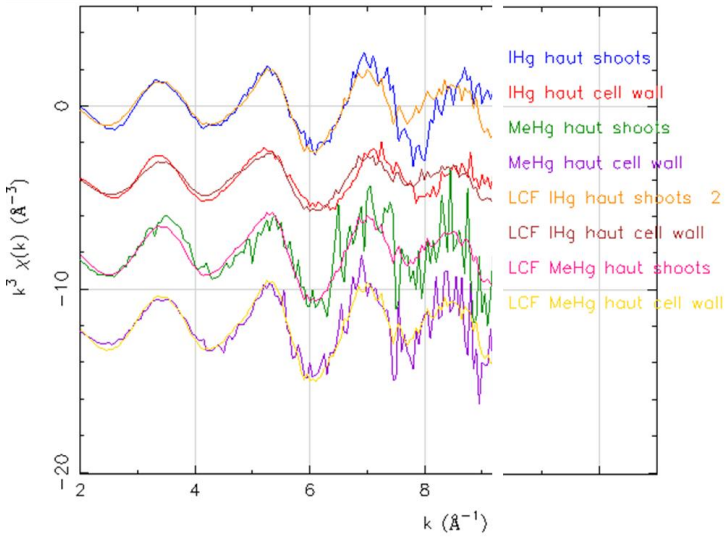

Figure 2: EXAFS spectra for the plants and cell walls exposed to IHg or MMHg and linear combination fits.

Results were not consistent with chemical analyses, and it was not possible to identify the binding agents for IHg and MMHg in each case because of the noisy character of the spectra, and also low sensitivity of EXAFS for different Hg species (other that IHg vs MMHg). These difficulties could be overcome with the use of crystal analyzers, recently installed on FAME.