

**Experiment title:**

Formation and Transformations of Zinc Sulfide Nanoparticles Under Environmentally Relevant Conditions

Experiment number:

30-02-1129

Beamline: FAME BM30B	Date of experiment: from: 2017 Nov 16 to: 2017 Nov 21	Date of report: 2019 Sept 03
Shifts: 15	Local contact(s): Mauro Rovezzi	<i>Received at ESRF:</i>
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Report:

The results of this experiment were published in october 2018 in the international peer-reviewed journal Environmental Science and Technology. The references of this published article are:

Drastic Change in Zinc Speciation during Anaerobic Digestion and Composting: Instability of Nanosized Zinc Sulfide

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Environ. Sci. Technol. 2018, 52, 12987-12996

Publication Date: October 19, 2018

<https://doi.org/10.1021/acs.est.8b02697>

Abstract :

Zinc (Zn) is a potentially toxic trace element that is present in large amounts in organic wastes (OWs) spread on agricultural lands as fertilizer. Zn speciation in OW is a crucial parameter to understand its fate in soil after spreading and to assess the risk associated with agricultural recycling of OW. Here, we investigated changes in Zn speciation from raw OWs up to digestates and/or composts for a large series of organic wastes sampled in full-scale plants. Using extended X-ray absorption fine structure, we show that nanosized Zn sulfide (nano-ZnS) is a major Zn species in raw liquid OWs and a minor species in raw solid OWs. Whatever the characteristics of the raw OW, anaerobic digestion always favors the formation of nano-ZnS (>70% of zinc in digestates). However, after 1 to 3 months of composting of OWs, nano-ZnS becomes a minor species (<10% of zinc). In composts, Zn is mostly present as amorphous Zn phosphate and Zn sorbed to ferrihydrite. These results highlight (i) the influence of OW treatment on Zn speciation and (ii) the chemical instability of nano-ZnS formed in OW in anaerobic conditions.