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| | **Experiment title:** Transformation of $CeO_2$ during sewage sludge treatment and speciation of Ce reacted with humic acid using Ce K-edge XAS | **Experiment number**: 31-01-102 |
| **Beamline**: BM31 | **Date of experiment**: 5. November 2018 | **Date of report**: 27.2.2020 |
| **Shifts:** 2 | **Local contact(s)**: Hermann Emerich | *Received at ESRF:* |


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**Report:**

The two shifts of beamtime for proposal 31-01-102 served to complete Ce K-edge XANES and EXAFS datasets collected during our experiment 31-01-82 (6 shifts, February 2018) on two sets of samples:
- Sewage sludge spiked with $CeO_2$ and resulting ashes after sludge incineration.
- Humic acids reacted with Ce(III) at different pH values.

Measurements were run at the Ce K-edge (40'443 eV). At the respective high X-ray photon energies, photon absorption in the matrix was very low, which allowed to collect XANES and EXAFS data on rather dilute samples (sludge with ~1000 mg/kg Ce; humic acid suspensions with 500 mg/L Ce) in transmission mode.

The XAS data collected on sewage sludge and sewage sludge ash have been included in an article on the transformation of engineered $CeO_2$ nanoparticles during sewage sludge incubation and incineration (1). The findings of this work contribute to a better understanding of the fate of engineered $CeO_2$ nanoparticles in wastewater systems and in sewage sludge that may again be used as fertilizer in agriculture, and thereby support the assessment of the risks associated with the use of engineered $CeO_2$ nanoparticles.

The XAS data collected on Ce(III)-reacted humic acid at different pH values reveal that increasing solution pH drives the formation of nanoscale $CeO_2$ in the humic acid suspensions. It is foreseen to publish the spectroscopic results, in combination with wet chemical data, transmission electron microscopy data, and thermodynamic modelling, in a scientific article.

**Publications**


1. Gogos A, Wielinski J, Voegelin A, Emerich H, Kaegi R. *Transformation of cerium dioxide nanoparticles during sewage sludge incineration*. Environmental Science: Nano. 2019;6:1765-76.