Fate of biological selenium(0) nanoparticles at elevated temperature

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Selenium is toxic and thus its fate in the environment has to be ascertained. The bio-transformation of Se oxyanions by microorganisms will affect its (bio)availability in the environment. The microorganisms are known to reduce Se oxyanions to biological Se(0) nanoparticles (BioSe-Nanospheres) or biological Se(0) nanorods (BioSe-Nanorods) under mesophilic (30 °C) and thermophilic (55 °C) conditions, respectively. Though both types exhibit a coating of extracellular polymeric substances, their colloidal properties differs, leading to a different mobility in environmental waters. [1] Consequently, understanding the underlying mechanisms of the formation of amorphous BioSe-Nanospheres and trigonal BioSe-Nanorods is essential to understand the fate of selenium in the environment.

This study identified BioSe-Nanospheres produced by various microorganisms behaving differently when exposed to thermophilic conditions (55 °C). The bacteria strain *E.coli* K12 and the anaerobic granular sludge from a full scale Upflow Anaerobic Sludge Bioreactor were used to produce BioSe-Nanospheres at 30 °C. After purification (to separate the particles from the cells) the BioSe-Nanospheres were heated for 7 days at 55 °C with shaking. The Raman and Scanning Electron Microsocpy data evidenced a transformation of the anaerobic granular sludge Se(0) particles to trigonal BioSe-Nanorods upon heating, while the BioSe-Nanospheres of the bacteria strain *E.coli* K12 remained spherical and amorphous.

The CD-Spectrosopy data revealed that the proteins coating the anaerobic granular sludge BioSe-Nanospheres gets unstable during a heating time of 23 hours, suggesting a denaturating process. Such a behavior was not observed for particles produced via *E. coli*. Unravelling the differences in particles coating and selenium allotropy which results in changes of mobility and toxicity will further increase the knowledge on the environmental fate of selenium.

[1] Jain, R. *et al*., Environ. Sci.: Nano, 2017.