



TwinPrebioEnz

International conference:

BIOCHEMICAL ENGINEERING & BIOTECHNOLOGY

For Young Scientists

BOOK of ABSTRACTS





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THE COORDINATION AND STORAGE OF MANGANESE IN THE MICROALGA *HAEMATOCOCCUS PLUVIALIS*

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Haematococcus pluvialis is a unicellular green alga of significant environmental and economic impact, well adapted to life in extreme conditions such as metal pollution. Manganese is a common pollutant of water bodies that is related to mining and industrial drainage, and microalgae have been applied in their bioremediation. To study changes in Mn redox and coordination form upon interaction with *H. pluvialis* cells, we exposed late exponential/early stationary green phase culture to 1 mM MnCl₂ (Mn²⁺) for 72 h. Applied concentration exceeds microalgal physiological quota but it was non-toxic. Structure of coordinated Mn in the cells was analyzed using X-ray absorption near edge structure (XANES) and extended X-ray Absorption Fine Structure (EXAFS) spectroscopy, while visualization and elemental mapping of Mn was performed by micro X-ray fluorescence (μXRF). XANES spectra showed that the oxidation form of Mn in *H. pluvialis* biomass remained 2+. However, EXAFS showed Mn coordination in microalgae is closer to hydrated MnSO₄ with minor deviation of the local geometry. The shorter Mn-O bonds in biomass, compared to crystal model, implies somewhat more stable complex in *H. pluvialis*. This suggests that *H. pluvialis* may use sulphated polysaccharides for Mn sequestration, which would be a newly proposed mechanism of metal coordination and storage. μXRF analysis showed co-localization of Mn with O and Na, with particularly good superimposition for Mn and O. O-rich regions may represent vacuoles, filled with organic acids including sulphates, or starch granules and accumulations of sulphated polysaccharides, which are known to be produced by *H. pluvialis*. In addition, vacuoles in plant cells are known to act as sinks for Na⁺ ions. These findings are in line with structural analysis that showed dark precipitates in vacuoles, which are likely accumulations of Mn.

Keywords: microalgae; *Haematococcus pluvialis*; manganese; XANES; μXRF

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