

Quantitative bioimaging of selenium in rainbow trout by LA-ICP MS

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Abstract

In the context of sustainable aquaculture, fishmeal is replaced by vegetable meal supplemented with selenium (Se), an essential trace element known for its antioxidant properties. The localization and quantification of Se in supplemented fish would provide deeper insights into Se metabolism, not fully understood and depending on the Se form provided.

Thanks to its sensitivity and micrometer spatial resolution, laser ablation inductively coupled plasma mass spectrometry (LA-ICP MS) is a key technique for Se mapping into the various organs of trout following Se diet. However, the reliable quantification of trace elements by LA-ICP MS in biological tissues requires analytical challenges. Indeed, as bioimaging is carried out on a thin section (a few μm thick) of a heterogeneous matrix, the variation in the composition of biological tissues can lead to biases in the element response (commonly known as matrix effects). Furthermore, there are no certified reference materials suitable for all matrices and containing all elements of interest. Therefore, we developed a quantification method using an internal calibration and polymeric films spiked with elements of interest (Se and endogenous metals such as Cu, Zn, Mo, Hg) at different concentrations and deposited onto glass slides before analysis by LA-ICP MS. In parallel, trout tissue sections were deposited onto films spiked with internal standards. These internal standards were considered according to their mass, their ionization potential, and the stability of their signals during LA-ICP MS analysis.

To validate this method, matrix-matched standards were prepared from fish tissue (muscle, liver) spiked with elements of interest which concentration was determined by ICP MS. Thin sections of these matrix-matched standards were then analysed and quantified by LA-ICP MS using the calibration *via* polymeric films. This method allows the quantitative imaging of Se in trout fry fed with different levels and forms of Se.

Keywords

Analytical chemistry; Quantitative bio-imaging; Laser ablation; ICP-MS

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