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Mass spectrometric imaging - Quantification strategies for created bio-images measured by LA-ICP-MS

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Mass spectrometric imaging (MSI) using laser ablation - inductively coupled plasma - mass spectrometry (LA-ICP-MS) has been an emerging methodology in the analysis of biological matrices. A challenging step is the quantification and data processing to generate quantitative displays (bio-images) by avoiding analytical artefacts derived from image processing. Moreover, the procedure gets more challenging when features to be monitored are in the range or even smaller as compared to the size of the laser spot as the spatial resolution of the laser ablation system typically lies in the μm range (2 – 300 μm spot size).

Here, we present the application of LA-ICP-MSI to biological tissues (bones) for the investigation of the distribution of alloying elements in bone material after the implantation of a Mg-based pin into the femur of rats. For the quantification of the elemental content, in-house standards were prepared by co-precipitation of the alloying elements (Mg, Ca, P, Mn, Zn, Zr, and Yb) in a hydroxyapatite matrix. The capability of this quantification approach was validated by comparative measurements of certified reference materials (SRM 1486, pressed into pellets for direct LA-ICP-MS analysis).

ArcGIS® was used for the first time as standard tool for the spatially distinct statistical analysis of chemical data in so called “zones of interest”.