DEVELOPMENT OF NOVEL CALIBRATION STRATEGIES FOR QUANTITATIVE LASER ABLATION ICP-MASS SPECTROMETRY (LA-ICP-MS) ANALYSIS

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Nowadays, laser ablation ICP-mass spectrometry (LA-ICP-MS) has become a powerful technique for the direct elemental and isotopic analysis of solid samples. However, the selection of an appropriate calibration strategy for quantitative LA-ICP-MS analysis still remains challenging. Quantification relying on the use of external calibration (EC) using (a) commercially available certified reference material(s) (CRM) in combination with internal standardization (IS) has always been considered the reference approach. However, LA-ICP-MS analysis is strongly affected by matrix effects, and thus, appropriate solid CRMs with similar matrix composition and certified concentrations of the analytes of interest at adequate concentration levels are required. Because there is a lack of suitable CRMs to cover a wide range of matrices, analytes and analyte concentrations, the development of novel calibration strategies aiming at more straightforward LA-ICP-MS analysis is of the utmost importance.

In this work, two new calibration strategies have been developed and compared to the reference approach (i.e., EC). The first one is based on a multi-signal calibration approach which relies on the monitoring of the signal intensities obtained upon variation of a specific LA setting (e.g., repetition rate or spot size),[1] while the second one is a solution-based calibration approach relying an adequate mixing of aqueous calibration standards and ablated material.[2]

The three different calibration strategies have been applied to the quantitative determination of relevant elements in catalyst samples. Catalysts are of particular interest in the context of petrochemistry, as they play a key role in petroleum refining. However, solution-based ICP-MS analysis of catalyst samples is hampered by the difficulty of sample decomposition via, e.g., acid digestion, and thus, LA-ICP-MS can be seen as a powerful alternative approach. The quantitative LA-ICP-MS results obtained for the analysis of catalyst samples using the two novel calibration strategies and the traditional EC approach will be presented, and the advantages and disadvantages of the different approaches will be discussed, aiming to select the best suited calibration strategy for straightforward quantitative LA-ICP-MS analysis, taking into account the specific needs of each specific case.