

A multi-vendor applicable LDI/MALDI target system for instruments with different performance characteristics

Edita Rados¹, Ernst Pittenauer¹, Johannes Frank², Kurt Varmuza³ and Günter Allmaier¹

¹ Institute of Chemical Technologies and Analytics, TU Wien (Vienna University of Technology), Vienna, Austria

² Joint Workshop of the Faculty of Technical Chemistry, TU Wien (Vienna University of Technology), Vienna, Austria

³ Institute of Statistics and Mathematical Methods in Economics, TU Wien (Vienna University of Technology), Vienna, Austria

Introduction

LDI/MALDI instruments manufactured by different vendors imply the use of the targets produced by those vendors, which means that a serious comparison of one and the same sample preparation on different instruments is typically not possible. Therefore, we developed a target system, which enables the use of only one target for three different LDI/MALDI-MS instruments. The target system consists of a modified Bruker target as universal target adapter with a standard Waters LDI/MALDI target plate for all instruments considered in this study. The focus of this work was on analyzing small organic molecules with LDI to ensure the proper use of this target system in subsequent investigations on precious meteorite samples analyzed on devices with different mass spectrometric performance characteristics.

Methods

Three small molecule analytes (tryptophan, 2-deoxy-D-ribose and triphenylene) were selected due to their potential presence in meteoritic chondrites and their different molecular ion generation. They were prepared and spotted onto the target with and without MALDI matrix. The analysis took place on three different mass spectrometers, namely an Axima TOF2 (LinTOF/curved field RTOF), an ultrafleXtreme (LinTOF/dual stage RTOF) and a Synapt G2 (Qq/dual stage RTOF). The ion sources of these instruments run at different vacuum regimes (high vacuum vs. intermediate pressure). The instruments are operated with different lasers (N₂ vs. Nd:YAG laser) at different wave length (337 nm vs. 355 nm) and different maximum repetition rates (20 Hz vs. 1 kHz vs. 2 kHz).

Results

The developed target system allowed comparison of data acquired on three differently performing mass spectrometers. Additionally, a comparison between data obtained by LDI- and MALDI-MS was made. In positive-ion mode we were able to detect different types of molecular ions (M⁺, radical cations, [M+H]⁺, [M+Na]⁺, and [M+2Na-H]⁺ ions) depending on the type of analyte. All sample molecules showed similar desorption/ionization behavior on all instruments in the positive-ion LDI mode. The problem of chemical noise arising from excess MALDI matrix in low m/z region was clearly visible in both desorption/ionization modes in all mass spectra when MALDI was used. This problem was specially expressed in the case of deprotonated tryptophan, which was almost completely obscured by matrix ions. On the other hand, the LDI-MS experiments yielded abundant deprotonated molecules. Using the Synapt G2 instrument, which allows accurate mass determination with a resolution up to RFWHM= 20,000, we were able to obtain for all m/z values of interest a mass accuracy of < ±4 ppm.

Innovative aspects

- One target system for multiple LDI/MALDI instruments
- LDI of small organic molecules
- LDI/MALDI with accurate mass for all ions detected