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ENHANCEMENT OF MALDI OF PEPTIDES AND PROTEINS BY USING SYNCHRONIZED INFRARED AND ULTRAVIOLET LASER PULSES

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Improvement of the detection sensitivity for various biomolecules in mass spectrometry has helped the advances in the field of biological sciences. In this work, we devised and tested a more efficient method of ion formation in matrix-assisted laser desorption/ionization(MALDI) mass spectrometry. By irradiating the synchronized infrared(IR) and ultraviolet(UV) laser pulses onto the samples, ion signals of peptide and proteins formed in MALDI significantly increased.

The output pulses of a 337 nm pulsed nitrogen laser, which is built in a commercial MALDI-TOF mass spectrometer(Applied Biosystems Voyager DE-STR), and an external 2.94 μ m pulsed Er:YAG laser were synchronized with a delay pulse generator. The time delay was adjusted so that the IR laser pulse comes a few hundred nanoseconds earlier than the UV pulse. The IR pulse energy was attenuated below the threshold for ion formation and thus no ion signal was observed with the IR laser only. When the UV laser pulse hits the sample following the IR pulse, the threshold for ion production is exceeded and ions were generated. By systematically varying the time delay between the IR and UV laser pulses while measuring the ion signal, the optimal time delay for maximum ion yield was found. The weak IR laser pulses preceding the UV laser pulses were found to enhance the MALDI ion yield by a factor of 2-5 depending upon the analytes and matrices.

It seems like that the energy of IR pulse absorbed by matrix simply warms up the sample so that large fraction of the UV energy coming in later is consumed in ionization and produces more ions than in the case using UV laser only. Since the timing jitter of the Er:YAG laser pulse is about 100 ns, it was not easy to find the optimal delay between the IR and UV pulses. We are expecting improved results if more stable laser system is employed in this work.