

Preface

The emergence of matrix-assisted laser desorption ionization (MALDI) and electrospray ionization-mass spectrometry (ESI-MS) was a revolutionary event in the history of mass spectrometry. Both techniques allow the ionization of large biomolecules, which has been a big challenge for more than 20 years of the last century. MALDI as a mature “soft ionization” technique has been widely applied in the different disciplines of science with great success since 1988, especially in the field of life sciences. In general, the merits of MALDI are suitability for solid samples, high sensitivity, easy sample handling, salt tolerance, time-saving determination, and it is simpler to interpret than ESI-MS due to the singly charged ions. MALDI is an excellent complement to ESI.

New matrices and related techniques have emerged endlessly, and the applications have significantly increased. However, the mechanism of MALDI still remains unclear. The ionization-desorption principle of MALDI-MS is well accepted, based on the co-crystallization of analytes with so-called matrices, which are light-absorbing small organic molecules. When activated by a laser, the matrix ionizes the analyte due to the proton transfer reaction. In this volume, several chapters are addressed.

MALDI is referred to as a “soft” ionization technique, because the spectrum shows mostly intact, singly charged ions for the analyte molecules. However, sometimes and in some cases, MALDI causes minimal fragmentation so it is not as “soft” as ESI, depending on the characteristics of analytes and the conditions of laser used. In-source decay (ISD) MS shows significant fragmentation under certain conditions, which may be useful for structure determination. In this volume, some topics involve the principles and the applications of ISD. Typically, MALDI is coupled with time-of-flight (TOF) analyzers with rather high resolution and a good cost performance, therefore MALDI-TOF-MS has become a nice combination in MS analysis.

We invited eight recognized mass spectrometrists to contribute their reviews from different aspects in the field of MALDI-MS. All of these authors have published excellent papers in the leading MS journals. The volume is divided roughly into three parts, though there is some cross-linking. The first part involves large biomolecular analysis, the second part is the application to small molecule analysis, and the third focusses on bioinformatics. In the first part, the hot topic of the study of noncovalent complexes of biomolecules by using MALDI-MS is

discussed. Zenobi's review describes the major applications of MALDI-MS to investigate noncovalent complexes of biomolecules and highlights the strengths and the limitations of the approaches to detect and quantify them. The second chapter is the application of MALDI-TOF-MS to proteome analysis using stain-free gel electrophoresis given by Przybylski's group. The approach may be a useful complement to staining techniques for mass spectrometric proteome analysis. The third chapter is MALDI-MS for nucleic acid analysis, given by Tang's group. The next two chapters involve the application of the MALDI-MSD method to protein/peptide disulfide determination and the discussion of the principle in detail. These chapters are contributed by Liu's and De Pauw's groups, respectively.

The second part involves the application of MALDI-MS to small molecules. Cai's review describes the application of MALDI-TOF-MS in the analysis of traditional Chinese medicines (TCMs). This is a very complicated system, which requires a long time to separate the components, so the MALDI technique may become one of the promising methods in TCM study for some cases. Guo reviews recent advances and applications of MALDI-TOF-MS analysis for small molecule biochemical, organic, and organometallic compounds.

Finally, Qi's article focuses on bioinformatic methods used for analysis of MALDI-MS data, which is also important for mass spectrometrists.

Here we would like to express our sincerest thanks to all contributors and colleagues from the Springer; without their efforts and encouragement the publication of this volume would have been impossible. Of course, we cannot collect together all aspects of MALDI-MS in a single volume of *Topics in Current Chemistry*, and we regret that some renowned mass spectrometrists especially in the MALDI-TOF field were unable to contribute to this volume. We welcome comments regarding possible oversights from our peers and colleagues which we hope to be able to include in future volumes.

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