Chapter 14
Sustainable Nanosystem Development for Mass Spectrometry:
Applications in Proteomics and Glycomics

Laurentiu Popescu
West University of Timişoara, Romania & Research and Development National Institute for Electrochemistry and Condensed Matter (INCEMC) Timişoara, Romania

Adrian C. Robu
West University of Timişoara, Romania & Research and Development National Institute for Electrochemistry and Condensed Matter (INCEMC) Timişoara, Romania

Alina D. Zamfir
Research and Development National Institute for Electrochemistry and Condensed Matter (INCEMC) Timişoara, Romania & Aurel Vlaicu University of Arad, Romania

ABSTRACT

Nowadays, considerable efforts are invested into development of sustainable nanosystems as front end technology for either Electrospray Ionization (ESI) or Matrix-Assisted Laser Desorption/Ionization (MALDI) mass spectrometry (MS). Since their first introduction in MS, nanofluidics demonstrated a high potential to discover novel biopolymer species. These systems confirmed the unique ability to offer structural elucidation of molecular species, which often represent valuable biomarkers of severe diseases. In view of these major advantages of nanofluidics-MS, this chapter reviews the strategies, which allowed a successful development of nanotechnology for MS and the applications in biological and clinical research. The first part will be dedicated to the principles and technical developments of advanced nanosystems for electrospray and MALDI MS. The second part will highlight the most important applications in clinical proteomics and glycomics. Finally, this chapter will emphasize that advanced nanosystems-MS has real perspectives to become a routine method for early diagnosis of severe pathologies.

DOI: 10.4018/978-1-5225-0492-4.ch014

INTRODUCTION

General Principles of Mass Spectrometry

Mass spectrometry (MS), one of the most sensitive and powerful analytical methods, is based on the determination of the molecular masses, being frequently called "the smallest scale in the world''. Hence, the fundamental difference between mass spectrometry and the rest of spectral techniques is that MS does not involve electromagnetic radiation (de Hoffmann et al., 2007).

Although in the last years a tremendous number of MS configurations were conceived, produced and released on the market by specialized companies, the basic elements of all mass spectrometers are the same (Figure 1):

1. The ion source that produces the ionization of the analyte;
2. The mass analyzer, which separates the ions according to their mass-to-charge ratio (*m/z*) and
3. The ion detector, a device for measuring the current of the ionic beam.

Figure 1. Mass spectrometer – block diagram