

CONTINUOUS-FLOW FAST ATOM BOMBARDMENT MASS SPECTROMETRY

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Extraordinary innovations and developments in mass spectrometry (MS) literally have revolutionized its breadth and utility during the past decade. This is mainly a result of the development of new analytically useful ionization techniques, such as fast atom bombardment (FAB), secondary ion mass spectrometry (SIMS), thermospray, electrospray, laser desorption, and plasma desorption. Analytical measurements that were unheard of 15 years ago are now performed routinely by MS. They include the direct introduction of water solutions by injection or spray for the analysis of charged organic compounds and the measurement of the molecular species of proteins of molecular weight of 100,000 daltons or more by laser desorption. Each of these techniques has particular advantages and provides specific information; no single technique provides all of the mass spectrometric capabilities needed in the modern analytical laboratory.

FAB has remained one of the more commonly used desorption/ionization techniques because it permits the analysis of polar and ionic compounds, often without the need for purification, isolation, and derivatization of these compounds (1, 2). Moreover, it is an easy-to-use technique that can be retrofitted on virtually any mass spectrometer at minimal cost. In particular, it has had an enormous impact on the use of MS in the biological sciences and has provided the bioanalyst with the ability to obtain mass-specific detection of individual compounds in complex mixtures (3).

Despite its utility, FAB has many shortcomings, most of which come from the need for rather high concentrations of a viscous organic liquid matrix (usually glycerol) to maintain the liquid nature of the sample inside the ionization chamber of the mass spectrometer. Typically, one mixes a small portion of sample solution with a viscous matrix liquid so that the latter comprises 80–90% of the sample solution to be bombarded. Poor sensitivity, ion suppression effects, and extraordinarily high background are among the more serious problems.

Continuous-flow FAB (CF-FAB) MS was devised to eliminate or at least minimize the drawbacks of the standard FAB technique while retaining its inherent advantages (4). A related technique, frit-FAB, originally introduced as an LC/MS interface (5), has demonstrated similar performance ad-

vantages. Basically, in CF-FAB, a direct insertion probe containing a fused-silica capillary transfer tube is introduced directly into the mass spectrometer ion source. The capillary terminates at the target of the probe, which is bombarded by xenon atoms having a translational energy of about 8 keV. The sample solution flows through the capillary and onto the target, where ions are produced as a result of the bombardment process. Liquid samples may be introduced into the spectrometer by flow injection, a process in which sample solution is injected into a carrier solvent that is flowing into the source.

Figure 1 shows the instrumental arrangement for CF-FAB operated in the flow injection mode. The carrier solution is typically composed of 80% water and 5% glycerol. Glycerol is required to provide a nonvolatile hydrophilic coat-

INSTRUMENTATION

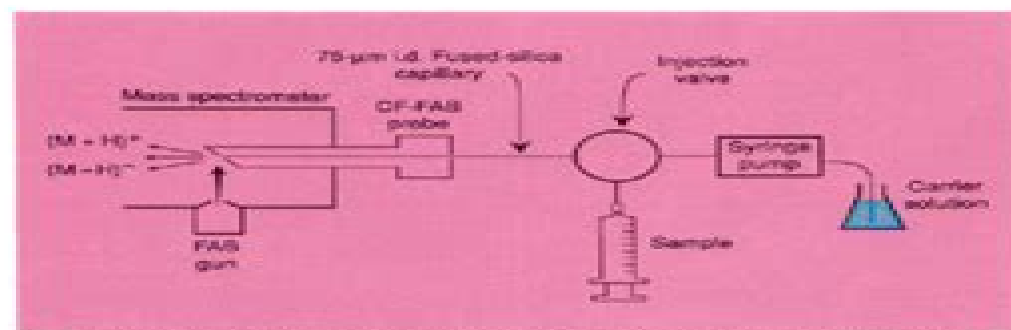


Figure 1. Instrumental arrangement for CF-FAB MS operated in the flow injection mode.

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Curt Einar Heine



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Continuous-flow Fast Atom Bombardment Mass Spectrometry R. M. Caprioli, 1998 **Continuous Flow Fast Atom Bombardment and Electrospray Ionization Mass Spectrometry in Natural Products Research** Katarzyna Janota, 1995

Continuous flow fast atom bombardment CF FAB has been applied as a liquid chromatography mass spectrometry LC MS and liquid chromatography mass spectrometry mass spectrometry LC MS MS interface in natural products research Initial studies concentrated on characterization of the interface optimization of operational parameters and sensitivity assessment Using a CF FAB interface femtomole quantities of different classes of compounds were detected which is two orders of magnitude more sensitive than by standard FAB Later CF FAB was applied to the analysis of didemnin streptovaricin and ecteinascidin mixtures in isocratic and or gradient modes The first application led to the discovery of acyclo desHIP didemnin A in a mixture of didemnins cyclic peptides of potent antitumor and antiviral activity Although related to didemnins the linear peptide was biologically inactive The second application project involved streptovaricins secondary metabolites of *Streptomyces spectabilis* In the streptovaricin mixture besides streptovaricins protostreptovaricins III and IV were detected by LC CF FABMS The presence of protostreptovaricins in the streptovaricin complex confirmed the biosynthetic pathway proposed for streptovaricin C Even though these precursors were known previously they were not observed as components of the mixture by standard FABMS When ecteinascidins were analyzed by LC CF FABMS the most significant difference was the amount of structural information generated in the low mass range in comparison to the standard FAB spectra The hydrates of structurally significant fragment ions were observed when the background was subtracted The use of a CF FAB interface was extended to on line high resolution mass measurements of different components in the mixture Mass measurements were within the range of acceptable error On line LC CF FABMS MS was performed on the ecteinascidin mixture using B E linked scans Observed ions were then classified as group characteristic or compound specific Finally CF FAB was compared to electrospray ionization ESI as an LC MS and LC MS MS interface with respect to sensitivity and structural information In the selected ion chromatogram mode the sensitivity of CF FAB is comparable to that of LC ESIMS However identification of unknowns is more feasible by LC ESIMS than by LC CF FABMS Also the daughter ion mass spectra can be produced even on trace amounts by LC ESIMS MS and are of better quality than by LC CF FABMS MS In LC ESIMS MS similar structural information is obtained however the main difference is the relative intensities of the fragment ions Several new ecteinascidins were observed by LC ESIMS Their structures are proposed on the basis of LC ESIMS MS data

Continuous-Flow Fast Atom Bombardment Mass Spectrometry R. M. Caprioli, 1990-12-31

Based on presentations made at a workshop on Continuous Flow Fast Atom Bombardment held in Annapolis Maryland in November 1989 Expanded and edited the papers presented at the workshop form a compact volume reflecting recent advances in a number of key areas in the field of continuous flow fast atom bombardment mass spectrometry Topics cover

non aqueous applications biological process monitoring trace analysis and design and operational conditions

Continuous-flow Fast Atom Bombardment Liquid Chromatography-mass Spectrometry in Bioanalysis Paula S.

Kokkonen,1991 **Mass Spectrometry of Peptides** Dominic M. Desiderio,1990-11-14 The purpose of this book is to collect into one volume the research done on the mass spectrometry of peptides It balances a range of topics including theory instrumentation analytical techniques and biological applications The scope of the work contains three major sections ionization methods instrumental developments and analysis of peptides It describes 252Cf plasma desorption and laser induced multiphoton ionization methodology This exciting resource covers many new areas including continuous flow FAB quantification of human neuropeptides and peptide mapping It also discusses Q FTMS cross links and metal ions **The**

Encyclopedia of Mass Spectrometry ,2015-12-04 Volume 9 Historical Perspectives Part A The Development of Mass Spectrometry of The Encyclopedia of Mass Spectrometry describes and analyzes the development of many aspects of Mass Spectrometry Beginning with the earliest types of Mass Analyzers Historical Perspectives explores the development of many different forms of analytical processes and methods The work follows various instruments and interfaces to the current state of detectors and computerization It traces the use of Mass Spectrometry across many different disciplines including Organic Chemistry Biochemistry and Proteomics Environmental Mass Spectrometry Forensic Science Imaging Medical Monitoring and Diagnosis Earth and Planetary Sciences and Nuclear Science Finally the book covers the history of manufacturers and societies as well as the professionals who form the Mass Spectrometry community Also available Volume 9 Historical Perspectives Part B Notable People in Mass Spectrometry briefly reviews the lives and works of many of the major people who carried out this development Preserves the history and development of Mass Spectrometry for use across scientific fields Written and edited by Mass Spectrometry experts Coordinates with Volume 9 Historical Perspectives Part B Notable People in Mass Spectrometry a collection of short biographies on many of the major people who carried out this development

Mass Spectrometry Jürgen H Gross,2011-01-19 This book offers a balanced mixture of practice oriented information and theoretical background as well as numerous references clear illustrations and useful data tables Problems and solutions are accessible via a special website This new edition has been completely revised and extended it now includes three new chapters on tandem mass spectrometry interfaces for sampling at atmospheric pressure and inorganic mass spectrometry

Capillary Electrophoresis Patrick Camilleri,1997-11-25 The importance of capillary electrophoresis CE as an analytical tool has increased dramatically over the last ten years It has changed from being an exploratory technique mainly of academic interest to one that is applied to solve real analytical problems CE is easily adapted to its various modes of operation often requiring little more than a change of the buffer solution and is quickly becoming the preferred technique when analyzing minute amounts of available material Featuring new chapters on CE analysis of inorganic ions and carbohydrates the new edition of Capillary Electrophoresis not only presents this method as an academic tool but also

provides applications for solving real world analytical problems This updated Second Edition reflects the increasing use of CE over the last 10 years how it is being applied and the basic theoretical aspects of the separation and detection methodology of CE Capillary Electrophoresis Theory and Practice will appeal to students and professionals of analytical chemistry physical chemistry biochemistry and biotechnology and includes suitable experiments designed to be attempted by university or college students or anyone else wishing to familiarize themselves with CE

Capillary Electrophoresis in Biotechnology and Environmental Analysis Hasan Parvez,Caudy,Roland-Gosselin,2023-01-06 This text aims to evaluate the actual impact of high performance capillary electrophoresis on analytical biotechnology and environmental analysis The first part of the book presents a survey of present innovations in instrument design and different methods of pre concentration techniques in order to obtain increased separations at higher sensitivities The second part contains articles on applications of HPCE to protein and peptide analysis In the third part applications of HPCE in the investigation of drug abuse and drug interactions are presented The last two parts of the book deal with the use of HPCE at low UV wavelengths and negative UV absorption The book should be of interest to those working in HPCE research and applications

Cumulated Index Medicus ,1989 *The Encyclopedia of Mass Spectrometry* Michael L. Gross,Richard Caprioli,2006-12-21 Volume 6 Ionization Methods captures the story of molecular ionization and its phenomenal evolution that makes mass spectrometry the powerful method it is today Chapters 1 and 2 cover fundamentals and various issues that are common to all ionization e g accurate mass isotope clusters and derivatization Chapters 3 9 acknowledge that some ionization methods are appropriate for gas phase molecules and others for molecules that are in the solid or liquid states Chapters 3 6 cover gas phase molecules dividing the subject into 1 ionization of gas phase molecules by particles e g EI 2 ionization by photons 3 ionization by ion molecule and molecule molecule reactions e g APCI and DART and ionization in Strong electric fields i e Electrohydrodynamic and Field Ionization Desorption Ionization in a Strong Electric Field illustrates the transition to ionization of molecules in the solid or liquid states covered in Chapters 7 9 1 spray methods for ionization e g electrospray 2 desorption ionization by particle bombardment e g FAB and 3 desorption by photons e g MALDI Electrospray and MALDI also lead to applications in biophysical chemistry the theme of Chapter 10 Chapter 11 reconsiders ionization from the view of choosing an ionization method The range of subjects is from ionization of organic and biomolecules to the study of microorganisms

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theoretical treatments instrumental design ionization methods analyzers detectors application to the qualitative and
quantitative analysis of various compounds or elements basic ionchemistry and structure studies ion energetic studies and
studies on biomolecules polymers etc **The Encyclopedia of Mass Spectrometry: Hyphenated methods** Michael L.
Gross,R. M. Caprioli,2003 **ASMS Conference on Mass Spectrometry and Allied Topics : [proceedings]** ,1987

The Encyclopedia of Mass Spectrometry Richard Caprioli,Michael L. Gross,2004-09-27 The focus of Volume 2 of the
Encyclopedia of Mass Spectrometry is on peptides and proteins separation techniques preparation protocols and the
fundamental characteristics as ionic gas phase species that lie within the breadth of the field of mass spectrometry This
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