



REVIEW

Thin-Layer Chromatography–Flame Ionization Detection

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Abstract

Thin layer chromatography–flame ionization detection (TLC–FID) is a versatile analytical technique that can be used for fast analysis of organic compounds. It has been implemented in past decades for the analysis of lipids and petrochemical products, but rarely in other fields. Despite the improvement in the latest Iatroscan model and the introduction of an automatic programmable sample spotter, this system is still struggling to gain acceptance in universities and major research laboratories. The reason behind this might be a lack of awareness on the potential application of this system to other fields of analytical chemistry. This review presents TLC–FID as a mature and reliable, state of the art technique that combines the separation power of TLC with FID as a universal detector, which can be applied to the analysis of a wide variety of organic compounds. Basic operational procedures and previous literature, including its potential for ultrafast analysis of commercial samples, are discussed in order to create awareness on the potentials of this piece of equipment to other fields.

Keywords TLC–FID · Iatroscan · Lipids · Petrochemicals · Chromarods

Introduction

Thin-layer chromatography–flame ionization detection (TLC–FID) is a unique system that combines the advantages of FID as a universal detector and the separation capability of TLC to make it a powerful analytical separation technique that can be used for a wide range of component analyses. The introduction of FID as a direct-detection mode for TLC for fast analysis of compounds is a significant improvement over conventional TLC, as it provides both qualitative and quantitative information without any need for the laborious use of a visualization agent. The system is now being marketed as Iatroscan TLC–FID. It has the advantage of analyzing compounds with low volatility as compared to

conventional GC. Compounds without chromophore can effectively be detected by this equipment without any need for chemical derivatization. The principle of separation is the same as that of classical TLC, but its stationary phase is made up of quartz rods (chromarods) exclusively designed for Iatroscan TLC–FID equipment. It is a simple and flexible analytical setup that can easily be adapted to handle difficult matrices.

The concept of using FID as an alternative detector for TLC was first introduced by Padley [1] from Unilever research laboratories in the late 1960s. He used a flame ionization detector and amplifier taken from a gas chromatograph for the analysis of lipids after separation on self-made thin silica glass rods. A relative standard deviation of 1.22% for a standard mixture of cholesterol, methyl palmitate and triolein was reported at that time. Okumura et al. [2] later developed reusable silica gel sintered glass ceramic sticks called chromarods for TLC–FID, which gave birth to what is known today as Iatroscan TLC–FID, after Iatron laboratories obtained the license to manufacture the equipment. This initial work reported the qualitative analysis of various classes of organic compounds after separation on chromarods. This technique was then seen to have potential over a wide range of applications in the field of clinical, biological, medicinal, pharmaceutical and synthetic chemistry, but the non-reproducibility of values and the uncertainty

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Thin Layer Chromatography With Flame Ionization Detection

**Richard E. McDonald, Magdi M.
Mossoba**



Thin Layer Chromatography With Flame Ionization Detection:

Thin-Layer Chromatography with Flame Ionization Detection M. Ranny, 1987-06-30 Thin layer chromatography TLC has become a common and much favoured separation technique in laboratories in widely varied fields in recent years Much of the credit for the introduction of this technique into analytical practice at the end of the 1950s is due to E Stahl This method is simple and is characterized by high separation ability and sufficient sensitivity³ however some analysts feel that it has passed the peak in its development and will gradually be replaced by the more modern high performance liquid chromatography HPLC This is undoubtedly a very important analytical technique utilizing the specific separation properties of a large number of sorbents and the possibility of regulating the flow rate of the mobile phase by adjusting the pressure Standardization of the experimental conditions is simpler in HPLC than in TLC where the activity of the sorbent and flow rate of the eluent in the thin layer depend markedly on the relative humidity of the laboratory atmosphere and on the composition of the gaseous phase in the elution chamber In addition systems for quantitative detection of the separated ones are better developed for HPLC than for classical TLC where until recently cumbersome and often even insufficiently reproducible chemical or gravimetric analysis of the extracts of scraped off spots or densitometry of the separated zones located first by pyrolysis or reactions with suitable detection agents were the predominant determination methods

Thin-Layer Chromatography with Flame Ionization Detection M. Ranny, 2012-12-06 Thin layer chromatography TLC has become a common and much favoured separation technique in laboratories in widely varied fields in recent years Much of the credit for the introduction of this technique into analytical practice at the end of the 1950s is due to E Stahl This method is simple and is characterized by high separation ability and sufficient sensitivity³ however some analysts feel that it has passed the peak in its development and will gradually be replaced by the more modern high performance liquid chromatography HPLC This is undoubtedly a very important analytical technique utilizing the specific separation properties of a large number of sorbents and the possibility of regulating the flow rate of the mobile phase by adjusting the pressure Standardization of the experimental conditions is simpler in HPLC than in TLC where the activity of the sorbent and flow rate of the eluent in the thin layer depend markedly on the relative humidity of the laboratory atmosphere and on the composition of the gaseous phase in the elution chamber In addition systems for quantitative detection of the separated ones are better developed for HPLC than for classical TLC where until recently cumbersome and often even insufficiently reproducible chemical or gravimetric analysis of the extracts of scraped off spots or densitometry of the separated zones located first by pyrolysis or reactions with suitable detection agents were the predominant determination methods

New Trends in Lipid and Lipoprotein Analyses J.-L. Sebedio, Edward George Perkins, 1995 This book should prove a valuable resource for food scientists chemists researchers technicians quality assurance persons and those who wish to acquire a working knowledge of lipid analysis

Thin-Layer Chromatography, Revised And Expanded Bernard Fried, Joseph Sherma, 1999-01-04 The

fourth edition of this work emphasizes the general practices and instrumentation involving TLC and HPTLC as well as their applications based on compound types while providing an understanding of the underlying theory necessary for optimizing these techniques The book details up to date qualitative and quantitative densitometric experiments on organic dyes lipids antibiotics pharmaceuticals organic acids insecticides and more **Handbook of Thin-Layer Chromatography** Joseph Sherma, Bernard Fried, 2003-04-18 In this third edition more than 40 renowned authorities introduce and update chapters on the theory fundamentals techniques and instrumentation of thin layer chromatography TLC and high performance thin layer chromatography HPTLC highlighting the latest procedures and applications of TLC to 19 important compound classes and coverage of TLC applications by compound type Easily adaptable to industrial scenarios the Handbook of Thin Layer Chromatography Third Edition supports practical research strategies with extensive tables of data offers numerous figures that illustrate techniques and chromatograms and includes a glossary as well as a directory of equipment suppliers

Asphaltene Particles in Fossil Fuel Exploration, Recovery, Refining, and Production Processes Mahendra K. Sharma, Teh Fu Yen, 2012-12-06 THE CURRENT STATE OF THE ART of several aspects of asphaltene is presented in this volume It documents the proceedings of the International Symposium on Asphaltene Particles in Fossil Fuel Exploration Recovery Refining and Production Processes sponsored by the Fine particle Society FPS This meeting was held in Las Vegas Nevada July 13 17 1992 The symposium upon which this volume is based was organized in four sessions emphasizing various basic and applied aspects of research on asphaltene technology Major topics discussed involve surface phenomena of asphaltene processed and unprocessed bitumen asphaltene effect on natural and accelerated ageing of bitumens asphaltene conversion theoretical aspects of asphaltenes and interactions of asphaltene colloids in organic solvents This edition includes eighteen selected papers presented at the symposium These papers are divided in four broad categories 1 Bitumen and Coal Derived Asphaltenes 2 Asphalt and Asphaltene conversion 3 Surface and Colloidal Aspects of Asphaltenes and 4 Thermodynamic and Molecular Aspects of Asphaltenes Lipid Analysis in Oils and Fats R.J. Hamilton, 2012-12-06 This book focuses on the developments in the field of lipid analysis providing an up to date review of the analytical techniques available to chemists and technologists to identify complex molecules The requisite theoretical background will be provided for individual techniques together with their strengths and weaknesses and a guide to the enormous range of commercial applications It will be an invaluable reference source to all sectors of the oils and fats industry where accurate labeling of foods food contamination and adulteration are issues of increasing interest and concern **New Techniques and Applications in Lipid Analysis** Richard E. McDonald, Magdi M. Mossoba, 1997 New Techniques and Applications in Lipid Analysis provides an informative and comprehensive reference book covering the latest and most important analytical topics in lipid chemistry Researchers in biomedicine food industry food processing product development nutrition and dietetics oil processing fat substitutes and lipid technology as well as students in the fields of food science and nutrition will greatly

benefit from this book Practical Thin-Layer Chromatography Bernard Fried, 2017-11-22 Practical Thin Layer Chromatography provides thorough coverage of the principles practices and applications of thin layer chromatography TLC for important sample and compound types This information is directed specifically at workers in the most active scientific fields **Instrumental Thin-Layer Chromatography** Colin Poole, 2023-01-14 Instrumental Thin Layer Chromatography Second Edition offers a comprehensive source of authoritative information on all aspects of instrumental thin layer chromatography The use of short topic focused chapters facilitates identifying information of immediate interest for familiar or emerging uses of thin layer chromatography The book gives those working in both academia and industry the opportunity to learn refresh or deepen their understanding of fundamental and instrumental aspects of thin layer chromatography as well as the tools to interpret and manage chromatographic data The book serves as a practical consolidated guide to the selection of separation conditions and the use of auxiliary techniques This fully updated new edition restores the contemporary character of the book for those involved in advancing the technology analyzing data produced or applying the technique to new application areas Some chapters have been consolidated to make room for topics not covered in the first edition reflecting general changes in the field of thin layer chromatography especially in effects directed detection convenient interfaces for advanced spectroscopic detection and greater automation possibilities This book is a valuable reference for anyone who needs to acquire fundamental and practical information to facilitate progress in research and management functions utilizing information acquired by thin layer chromatography Features individual chapters written by recognized authoritative and visionary experts in the field Provides an overview and focused treatment of a single topic Provides tables and diagrams with commonly used data to facilitate practical work comparison of results and decision making Places modern developments in the research literature into a general context not always apparent to inexperienced users of the technique Offers comprehensive updates to all chapters Includes new chapters on instrument platforms effects directed detection data analysis tools small scale and microfluidic planar separation systems and applications to the separation of amino acids and peptides the analysis of saccharides and lipids and forensic analysis **Quantitative TLC and its Industrial Applications** Treiber, 1986-12-09 Examines the fundamental theoretical aspects and a wide variety of practical applications of quantitative thin layer chromatography TLC The book details the mathematical treatment of photometry in light scattering media highlights the characteristics of sorbents for TLC discusses computer assisted TLC and delineates the utility of flame ionization detectors Annotation c by Book News Inc Portland Or **Practice of Thin Layer Chromatography** Joseph C. Touchstone, 1992-08-04 This Third Edition provides all the basic applications needed to practice thin layer chromatography TLC New material includes the latest techniques on sample preparation and zone detection the hybridization of TLC with high performance liquid chromatography HPLC as it s been developing in the last few years emphasis on numerous applications of HPTLC involving pharmaceuticals and drugs plus the fundamental studies of mechanisms theories and the

optimization of TLC **Food Lipids** Casimir C. Akoh, David B. Min, 2002-04-17 Highlighting the role of dietary fats in foods human health and disease this book offers comprehensive presentations of lipids in food Furnishing a solid background in lipid nomenclature and classification it contains over 3600 bibliographic citations for more in depth exploration of specific topics and over 530 illustrations tables and equa

Bio-Based and Bio-Inspired Pavement Construction Materials Elham H. Fini, Pouria Hajikarimi, 2024-11-19 Bio Based and Bio Inspired Pavement Construction Materials explores various production techniques experimental characterization methods applications and numerical modeling and simulation approaches for bio based and bio inspired pavement materials The book demonstrates how bio based and bio inspired materials can be used in pavements to solve problems related to sustainability while simultaneously enhancing the mechanical properties of asphalt and cementitious materials Supply chain management life cost cycle analysis and environmental assessment of using these materials are all covered as well Examples of these materials being used in real life settings are included throughout Covers applications of bio based and bio inspired materials supply chain management life cycle analysis and environmental assessments Outlines production methods experimental characterization techniques numerical modeling and simulation approaches for bio based and bio inspired materials Discusses various sources of bio materials including animal waste wood plants and other natural resources Studies fabrication procedures such as pyrolysis hydrothermal liquefaction thermal carbonation and thermochemical reaction

Role of Fats in Human Nutrition Bozzano G Luisa, 2013-07-19 Dietary fats and carbohydrates represent some eighty to ninety percent of food energy uptake in man fatty acids play a critical role in human development health and disease In affluent populations high fat consumption contributes to heart disease obesity and type II diabetes mellitus while in non affluent groups the generally poor nutritional state found in young children can be partially attributed to a low fat intake This book reviews our current understanding of essential fatty acids and their role in human nutrition The topics addressed include the analysis of dietary fatty acids dietary fats and fish oils in health and in the prevention of heart disease linoleic acid in the treatment of diabetes and the role of essential fatty acids in early human development

Thin Layer Chromatography in Drug Analysis Lukasz Komsta, Monika Waksmundzka-Hajnos, Joseph Sherma, 2013-12-20 Used routinely in drug control laboratories forensic laboratories and as a research tool thin layer chromatography TLC plays an important role in pharmaceutical drug analyses It requires less complicated or expensive equipment than other techniques and has the ability to be performed under field conditions Filling the need for an up to date

Asphaltenes and Asphalts, 2 T.F. Yen, G.V. Chilingarian, 2000-08-16 This is the second volume in the series of Asphaltenes and Asphalts Since the publication of the first volume in 1994 there has been a significant advancement in our knowledge Knowledge of both asphaltenes and asphalts is needed by several disciplines and often the progress is dictated by interdisciplinary sciences and technology This includes material sciences fuel sciences chemical engineering civil engineering environmental engineering polymer sciences transportation engineering petroleum

engineering chemistry geological sciences physics geochemistry rheology biological sciences tribology soil sciences petroleum science The development in this field is not based on our knowledge of chemistry or petroleum engineering alone as many chemists and petroleum engineers believe In this volume therefore significant contributions from different disciplines have been included **Thin-Layer Chromatography** Dieter Janchen,1993 A comprehensive bibliography of publications on modern planar chromatography **Thin-Layer Chromatography for Binding Media Analysis** Mary F. Striegel,Jo Hill,1997-04-24 In the study and conservation of art and artifacts natural organic materials are frequently encountered in components such as coatings binders and adhesives The identification of these materials is often crucial to the attempt to characterize the technologies employed by artists or craftspeople understand the processes and causes of deterioration and plan appropriate conservation treatments Yet the limited resources of many conservation laboratories put many analysis techniques beyond their reach Thin layer chromatography can help fill this gap The volume consists of a handbook protocols and guide to reference materials The handbook serves as a primer for the basic application of thin layer chromatography to the analysis of binding media adhesives and coatings found on cultural objects the protocols provide step by step instructions for the laboratory procedures involved in typical analyses and the guide to reference materials aids in the understanding of the types of materials and documentation needed for accurate analyses by thin layer chromatography

Chemical and Functional Properties of Food Lipids Zdzislaw Z. E. Sikorski,Anna Kolakowska,2010-12-12 Chemical and Functional Properties of Food Lipids provides a concise straightforward treatment of the present state of knowledge of the nomenclature content composition occurrence distribution chemical and biological reactivity functional properties and biological role of lipids in food systems Written by a team of international researchers and based on the available world literature this book examines the nature technological properties reactivity and health related concerns and benefits of food lipids It covers the effects of storage and processing conditions on all aspects of quality of lipid containing foods and reviews the current state of techniques for lipid analysis The volume also discusses the importance of lipids in the human diet and includes a comparison of dietary recommendations for lipid intake This is a valuable reference for researchers and graduate students in food chemistry and nutrition

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