

Chromatographic Methods

The separation of compound mixtures into pure substances and their quantifying is of central importance for chemical lab work. Only so, the purity of a chemical or the composition of a mixture of different contents can be analyzed properly. Quality control, analytics of food and the environment, but also control and optimization of chemical reactions and processes base all on an analytic determination of material quantities. An important technology to the analytic and preparative separation of material mixtures is the chromatography. The principle of the chromatography, like it is used today, goes back on the botanist Michael Tswett (1872 - 1919). He published 1906 a procedure dealing with separation and isolation of green and yellow plant pigments from leaves through adsorption chromatography.



The illustration shows the thin film-chromatographic separation of the extracts from maple - (left) and linden leaves.

There are many recommendable books dealing with the topic. Important technologies are the thin-layer chromatography, the gas chromatography and the liquid chromatography. Physical separation principles, apparatus technologies and practical instructions are to be found in monographs, practical manuals and experiment instructions. We therefore concentrate on commenting on only a selection of some popular books, that are available in many libraries.

Books about thin-layer chromatography:

Introductory literature:

Dünnschicht-Chromatographie, Praktische Durchführung und Fehlervermeidung
Elke Hahn-Deinstrop; Wiley-VCH, 1998, ISBN 3-527-28873-2.

Applied Thin-Layer Chromatography. Best Practice and Avoidance of Mistakes
Elke Hahn-Deinstrop; Wiley-VCH, 2000, ISBN 3-527-29839-8.

Dünnschicht-Chromatographie, Volume 1a
H. Jork, W. Funk, W. Fischer, H. Wimmer; VCH, 1989, ISBN 3-527-26848-0

A purely application-oriented book, it contains many practical examples, the theory is not dealt with.

Dünnschicht-Chromatographie, Volume 1b,
H. Jork, W. Funk, W. Fischer, H. Wimmer; VCH, 1993, ISBN 3-527-26976-2

As a sequel to volume 1a it offers a composition of functional group-specific reagents with many practical examples.

Literature for advanced students:

Qualitative und quantitative Dünnschicht-Chromatographie, Grundlagen und Praxis

H.-P. Frey, K. Zieloff,; VCH, 1993, ISBN 3-527-28373-0.

A very thorough introduction to the theory of the thin-layer chromatography and high-performance thin-layer chromatography. The individual work steps as well as the separation phases (layer material, separation layer, solvents) are dealt with extensively. Only few examples from the laboratory practice.

Books about gas chromatography

Introductory literature

Gaschromatographie in Bildern – eine Einführung

Bruno Kolb; Wiley-VCH, 1999, ISBN 3-527-29880-0 or ISBN 3-7785-2589-1

Didactically well arranged, appliance description, corresponding illustrations and schemes are compared on each page. The basic theory is clearly presented without overtaxing the beginner. The most important separation phases, injection systems and detectors and their different suitability regarding separation problems, headspace and pyrolysis gas chromatography are discussed.

Basic Gas Chromatography

Harold M. McNair, James M. Miller,; Wiley-VCH, 1997, ISBN 0-471-17261-8 or ISBN 0-471-17260-X.

Literature about instrumentation, appliance maintenance, troubleshooting

A Practical Guide to the Care, Maintenance and Troubleshooting of Capillary Gas Chromatographic Systems

Dean Rood; Wiley-VCH, 1998, ISBN 3-527-29750-2.

Failures in the analysis, fault maintenance at the instruments, general maintenance at the appliance are treated.

Troubleshooting in der Kapillar-Gaschromatographie

Dean Rood; Hüthig-Verlag Heidelberg, 1991, ISBN 3-7785-2104-7.

GC-Tips. Problemlösungen rund um den Gaschromatographen

David, Walter, Kusserow, Burkhard, Hoppenstedt, ISBN 3-8203-0469-X.

Literature for advanced students

Gaschromatographie. Grundlagen, Praxis, Kapillartechnik

Gerhard Schomburg; Wiley-VCH, 1987, 2nd Edition, at present out of print

Despite the older edition, still a recommendable, easily comprehensible classic, including appliance description, physical-chemical bases (didactically well presented), chromatograph-interpretation, separation column description, qualitative and quantitative analytics, PCB and dioxin analytics, enantiomer separation, formula collection and troubleshooting.

Gaschromatography. A Practical Course

Gerhard Schomburg; VCH, 1990, at present out of print

Newly revised edition of the previously mentioned book with additional chapters about more recent injection technologies, LC-GC-coupling technology, suprafluid chromatography (SFC), extensive tips and problem solutions for practitioners.

Gaschromatographie: Eine anwendungsorientierte Darstellung

Peter J. Baugh, Werner Engewald, Hans G.Struppe (Ed.); Springer Verlag, 1997, ISBN 3-540-67009-2.

Contents: Introduction to the theory, instrumentation and capillaries. Main focuses are applications, derivatives, toxicology and clinical chemistry, environmental analytics, petrochemistry, enantiomer separation, GC-MS, GC-IR.

Modern Practice of Gas Chromatography

Robert L.Grob; John Wiley and Sons Inc., 3rd Edition, 1995, ISBN 0-471-59700-7.

Theory and basics: GC-theory, Packed Columns and Capillaries, Column Selection, Optimizing Separations. *Techniques and instrumentation*: Detectors, GC-MS, Qualitative and Quantitative Analysis by GC, Inlet systems. Suitable as reference work.

Stationary Phases in Gas Chromatography

H. Rotzsche; Elsevier, 1991, ISBN 0-444-987339.

Application-oriented literature

Capillary Chromatography - The Applications

Walter G. Jennings, Nikelly, John; Hüthig-HVS, 1998, ISBN 3-7785-2051-2.

Literature about particular GC techniques

Einspritztechniken in der Kapillar-Gaschromatographie

Konrad Grob; Wiley-VCH, 1995, ISBN 3-527-29700-6.

Split and Splitless Injection in Capillary Gas Chromatography

Konrad Grob; Hüthig-Verlag Heidelberg, 4th Edition, 1995, ISBN 3-7785-2318-X.

Split and Splitless Injection for Quantitative Gas Chromatography.

Concepts, Processes, Practical Guidelines, Sources of Error

Konrad Grob, Wiley-VCH, 2001, ISBN 3-527-29879-7.

Static Headspace-Gas Chromatography: Theory and Practice

Bruno Kolb, Leslie S. Ettre,; Wiley-VCH, 1998, ISBN 0-471-19238-4.

Gas Chromatographic Enantiomer Separations with Modified Cyclodextrins

Wilfried A. König; Hüthig-Verlag, 1992, ISBN 3-7785-2026-1.

Books about the High-Performance Liquid Chromatography (HPLC)

Introductory literature

Praxis der Hochleistungs-Flüssigchromatographie

Veronika R. Meyer; Otto Salle publishing house, 7th Edition, 1992, ISBN 3-7941-2792-7.

The book offers a compact, but well comprehensible introduction to the theoretical and apparatus bases of the HPLC. It offers many helpful tips to the avoidance of fault sources or the selection of the right column, selection criteria for the mobile phase etc. It is also dealt with HPLC-methods as well as specialties like enantiomer separation. With numerous exercises.

Practical High-Performance Liquid Chromatography

Veronika R. Meyer; John Wiley & Sons, 3rd Edition, 1999, ISBN 0-471-98373-X.

Well-balanced mixture of theory and practice (see also the aforementioned older German edition).

HPLC. A Practical User Guide

Marvin C. McMaster; John Wiley & Sons, 1st Edition, 1994, ISBN 0-471-18586-8.

Without much theory, but with much practical information about the appliance. Programmed introductory course for self studies as appendix.

Flüssigchromatographie. HPLC - Theorie und Praxis

G.J. Eppert; Springer Verlag, 3rd Edition, 1997, ISBN 3-540-67022-X.

Content: Theory, practice, troubleshooting, appliance procurement.

Einführung in die HPLC

Sandie Lindsay; Springer Verlag, 1996, ISBN 3-540-67016-5.

Instrumentation, appliance maintenance, troubleshooting

Fallstricke und Fehlerquellen in der HPLC in Bildern

Veronika R. Meyer; Wiley-VCH, 1999, 2nd Edition, ISBN 3-527-29794-4.

(In English: Pitfalls and Errors of HPLC in pictures, ISBN 3-527-29717-0.)

After a short, easily comprehensible introduction to the theoretical bases, most typical mistake sources are shown.

Handbuch der HPLC, Teil 1, Leitfaden für Anfänger und Praktiker

K. K. Unger (Ed.); GIT Verlag, 2nd reviewed Edition, 1989, ISBN 3-92886519-6.

(Newer edition in English:

A Guide to Practical HPLC, K.K. Unger, E.A. Weber; GIT-Verlag, 1999.)

The focus is on a detailed introduction to the methodology. From the sample preparation over solvents or separation materials and columns until the evaluation or troubleshooting, everything is described very clearly. The theoretical bases are dealt with comparatively shortly. On the basis of selected examples the procedure and solution of separation problems is mentioned.

RP-HPLC für Anwender

Wolfgang Gottwald; Wiley-VCH, from the series: Praxis der instrumentellen Analytik, 1993, ISBN 3-527-28518-0.

This extremely user-oriented book with many examples offers the theoretical bases in a concise form. The error analysis is discussed extensively on the basis of the chromatographs. Furthermore, an introductory practical course in the HPLC is to be found.

Literature for advanced students

Practical HPLC Method Development

Lloyd R. Snyder, Joseph J. Kirkland, Joseph L. Glajch; Wiley & Sons, 2nd Edition, 1997, ISBN 0-471-00703X.

Literature about specialties

The HPLC Solvent Guide

Paul C. Sadek; Wiley-VCH, 1st Edition, 1996, ISBN 0-471-11855-9.

The book gives an overview on the role of the solvent for the separation of mixtures with a detailed discussion of seven solvent classes.

HPLC Columns: Theory, Technology of and Practice

Uwe D. Neue; Wiley-VCH, 1997, ISBN 0-471-19037-3.

HPLC Detection. Newer Methods

Gabor Patonay; Wiley-VCH, 1st Edition, 1993, ISBN 0-471-18802-6.

Handbook of HPLC

S.E. Katz, R. Eksteen, P. Schoenmakers, N. Miller; Chromatographic Science Series Vol. 78, 2nd Edition, Marcel Dekker, 1998, ISBN 0-8247-9444-3.