tography as a preparative technique. The development of practical methods for the determination of absorption energy has permitted identification that the surface of absorbents used in reversed-phase liquid chromatography (RPLC) are heterogeneous, which has consequences on the nature of the equilibrium isotherm. Thus, this second edition of *Fundamentals of Preparative and Nonlinear Chromatography* describes new methods of isotherm determination and how to use them to predict band profiles.

The first part of the book provides the fundamental information required to navigate the world of preparative chromatography, with the first chapter explaining the history of chromatography as a preparative technique, followed by an examination of the theoretical basis of chromatography, explaining the mass balance equation and its general properties and a detailed overview of the equilibrium isotherm and factors that can influence it (Chapter 2). Equilibrium isotherms are discussed in more detail for single components (Chapter 3), and for mixtures and competition for adsorption (Chapter 4). The fifth chapter deals with transfer phenomena in chromatography, such as diffusion, axial dispersion, mass transfer resistance and viscosity of liquids, which completes the first part of the book and the essential knowledge base necessary for the comprehension and discussion of preparative chromatography.

The second part of the book is devoted to the study of diverse chromatographic models. First, the book provides a complete description of the least difficult model to understand, namely linear chromatography (Chapter 6). In this model the influence of thermodynamics on the shape of band profiles disappears and only affects band positions, so it can be studied separately from the kinetics, which controls their profiles. This is important because most qualitative and quantitative analyses are based on this model. The next three Chapters (7–9) cover the non-linear chromatography ideal model for single-component systems, two-component systems, and displacement chromatography, respectively. This ideal model provides a good first approximation about the conduct of the band profiles under strongly non-linear behaviour of the isotherm.

However, when deviations from ideal behaviour occur, it is necessary to use a new model to predict band profiles, namely the equilibrium dispersive model. This model is very important since it permits calculation of the production rate of the required components at the stated degree of purity, and its achieved recovery yield, which are essential to the pharmaceutical and fine chemical industries in which preparative chromatography is used as a purification process. The next four Chapters (10–13) are therefore devoted to single component profiles, two-component profiles, frontal analysis and displacement, and system peaks, respectively. In cases in which the kinetics of the retention mechanisms is slow, other kinds of models are needed, kinetics ones, which are discussed in Chapters 14–16. Finally, in the last two Chapters (17 and 18), different models are applied for investigation of simulated moving bed chromatography properties, and optimisation of preparative chromatography batch processes.

This book is an ideal reference volume for all individuals with an interest in preparative chromatography wanting to understand band generation and separation mechanisms, as well as those actively involved in practical application of such techniques, who wish to improve or optimise their results.

John F. Kennedy *
Irene P. Garcia Rojas
Chembiotech Laboratories,
Institute of Research and Development,
University of Birmingham Research Park,
97 Vincent Drive, Edgbaston, Birmingham B15 2SQ, UK

Available online 10 May 2007

* Corresponding author.
doi:10.1016/j.carbpol.2007.05.003

S. J. Russell (Ed.), Handbook of Nonwovens, Woodhead Publishing Limited, Cambridge, UK, 2007 (xiii + 530 pp., £180.00, ISBN: 1-85573-603-9)

The term 'nonwoven' was originally applied to dry-laid carded web substitutes for traditional textiles were the yarn spinning stage was omitted, in favour of bonding (consolidation) of the web by various methods (chemical, mechanical, or thermal), thus replacing the weaving/knitting of yarns. However, the nonwoven industry as we know it today has grown from developments in the textile, paper, and polymer processing industries, and also has input from engineering and natural sciences. Nonwoven products have application in many diverse areas, including the medical, automotive, hygiene, and civil engineering industries. The nonwoven industry is therefore an important and rapidly expanding sector that involves intensive research and development and massive investments in new technology to provide materials with specific functionalities depending on the desired performance for a particular application area.

This 'handbook' begins with an overview of the development of the nonwovens industry (Chapter 1), providing information on the definition, classification, and fabrication of nonwovens, along with the market structure and the key companies involved. The following three chapters (Chapters 2–4) are specifically concerned with the main methods of nonwoven production, namely dry-laid, wet-laid, and polymer-laid, web formulation. Dry-laid web formation (Chapter 2) has its origins in the textile industry, and involves techniques such as carding/garnetting, cross-lapping, batt drafting, vertical lapping, airlayering, and bonding. Wet-laid web formation (Chapter 3) has its origins in the paper industry, and this chapter begins by reviewing the background and historical developments,

and the theoretical basis of wet forming. The differences between wet-laid nonwovens and wet-laid papers are presented, and the raw materials used for wet-laid nonwovens are discussed in detail. These include natural fibres, such as wood pulp cellulose, and man-made fibres, such as viscose rayon, solvent spun cellulose, polyolefin, synthetic wood pulp, polyester, poly ether ether ketone (PEEK), poly ether imide (PEI), poly phenylene sulphide (PPS), Nomex™, Kevlar™, aramid, polyamide, polyacrylonitrile, and inorganic (glass, ceramic, and carbon) fibres. Fibre preparation, web-forming process technology, bonding systems, finishing, and product applications are also covered. Polymer-laid web formation (Chapter 4) has its origins in polymer extrusion and plastics. In this chapter resins for spunbonding and meltblowing (polyolefins, polyester, polyamide, polyurethane, rayon, biocomponents, and mixed polymers) are discussed, along with spunbond and meltblown fabric production, process mechanics, characterisation, structure and properties, and applications.

A number of different bonding systems (namely, mechanical, thermal, and chemical) are defined and thoroughly described in the next three chapters (Chapters 5–7). Each of these chapters provides a historical and technical overview of these technologies, the nature of the equipment involved, the different resins and fibres associated to each bonding process, and examples of specific applications. Mechanical bonding techniques covered include stitch bonding, needlepunching, and hydroentanglement, whereas thermal bonding techniques covered include thermal radiation, infra-red, and ultrasonic bonding. The penultimate chapter (Chapter 8) is concerned with nonwoven finishing, which covers the procedures applied after nonwoven production to add value by increasing technical functionality, appearance or aesthetics to improve fitness for purpose. These include wet finishing actions such as washing (scouring), coloration, and printing; chemical finishes such as antistatic agents, antimicrobials/biocidals, lubricants, flameproofers, waterproofers, softeners, stiffeners, and UV stabilisers; mechanical finishing such as splitting and winding, perforating, drying, sanforising (compressive shrinking), and calendaring; surface finishing such as singeing, shearing, flocking, raising, and polishing, and developing technologies such as plasma treatment, microencapsulation, laser-etching, and biomimetic and electrochemical finishes.

The final chapter (Chapter 9) focuses on the methods used for characterisation of the physical and mechanical properties of nonwoven structures. This includes characterisation of fabric bond structure, and measurement of basic parameters (such as fabric weight, thickness, density, and other important dimensional parameters) in all microstructure fabrics of nonwoven fibres. Information on standards for testing nonwovens is also provided, along with methods for determination of fibre orientation distribution, porosity, pore size and distribution, tensile properties, permeability, water vapour transmission, liquid absorption, thermal conductivity and insulation, and the modelling of all such properties. In conclusion, this informative handbook provides a wealth of essential information for all individuals interested in the production, properties, and analysis of nonwovens, and their historical background resulting in their growing application in many diverse industrial fields.

Nadia Rebaya
John F. Kennedy *
Chembiotech Laboratories,
Institute of Research & Development,
University of Birmingham Research Park, 97 Vincent Drive,
Edgbaston, Birmingham B15 2SQ, UK

Available online 10 June 2007

* Corresponding author.
doi:10.1016/j.carbpol.2007.06.003