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Publisher *Taylor & Francis*

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Separation & Purification Reviews

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713597294>

A review of: “Chromatography of Synthetic and Biological Polymers R. Epton, Editor Ellis Horwood Ltd., Chichester, England; John Wiley and Sons/Halsted Press, New York 1978. Vol. 1: Column Packings, GPC, GF and Gradient Elution hardbound, 368 pages, \$42.50. Vol. 2: Hydrophobic, Ion-Exchange and Affinity Methods hardbound, 353 pages, \$47.50”

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To cite this Article van Oss, Corel J.(1978) 'A review of: “Chromatography of Synthetic and Biological Polymers R. Epton, Editor Ellis Horwood Ltd., Chichester, England; John Wiley and Sons/Halsted Press, New York 1978. Vol. 1: Column Packings, GPC, GF and Gradient Elution hardbound, 368 pages, \$42.50. Vol. 2: Hydrophobic, Ion-Exchange and Affinity Methods hardbound, 353 pages, \$47.50”, Separation & Purification Reviews, 7: 2, 273 — 278

To link to this Article: DOI: 10.1080/03602547808066066

URL: <http://dx.doi.org/10.1080/03602547808066066>

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BOOK REVIEW

CHROMATOGRAPHY OF SYNTHETIC AND BIOLOGICAL
POLYMERS

R. Epton, Editor

Ellis Horwood Ltd., Chichester, England;
John Wiley and Sons/Halsted Press, New York 1978.

Vol. 1: Column Packings, GPC, GF and Gradient Elution
hardbound, 368 pages, \$42.50

Vol. 2: Hydrophobic, Ion-Exchange and Affinity Methods
hardbound, 353 pages, \$47.50

These two volumes consist of chapters based on lectures given at a (British) Chemical Society International Symposium held at the University of Birmingham in July of 1976. Both volumes are subdivided into three parts.

Volume 1 comprises: Part 1 - General Developments: 1, Polysaccharide Supports: Synthesis, Derivatization and Application, by J. Porath; 2, Inorganic Packings for GPC, by J.V. Dawkins; 3, Polyacrylamide-Agarose Gels - Structure and applications, by M. Monsigny *et al.*; 4, Poly(acryloyl morpholine) (Enzacryl[®] Gel) Packings, by A.W.J. Brough *et al.*; 5, Poly-(hydroxyethyl methacrylate) Gels (Spheron[®]), by J. Borak *et al.*; 6, Cellulose Packings in Bead Form - Porous Structure, by J. Baldrain; 7, The Role of Polymer Structure in Fractionation by GPC, by D.J. Harmon; 8, Composite Polystyrene Packings for GPC, by T.J. Crighton and F.W. Peaker; 9, Theo-

retical and Experimental Aspects of Fractionation Mechanisms on Crosslinked Organic Polymers, by J. Lecourtier *et al.*; 10, Service Problems in GPC, by L.J. Maisey; 11, Thin Layer Gel Chromatography, by J. N. Miller.

Part 2 - Preparative and Industrial Scale Chromatography: 12, Preparative Gel Permeation Chromatography, by M.F. Vaughan and R. Dietz; 13, Continuous Chromatography of Macromolecular Solutes, by P.E. Barker *et al.*; 14, Column Fractionation of Macromolecules by Gradient Elution, by A. N. Cooper.

Part 3 - Specialized Applications, Theory and Techniques: 15, Application of Controlled Pore Glass Chromatography to Milk Proteins, by R.D. Kearney and T.C.A. McGann; 16, Assessment of Coagulants for Cheddar Cheesemaking by Gel Filtration, by M.L. Green; 17, Gel Chromatography of Horseradish Peroxidase-Antibody Conjugates, by D.M. Boorsma; 18, Partitioning between Aqueous Polymer Phases in Gel Filtration, by J. Brewer and L. Soderberg; 19, Gel and Glass Matrix Parameters Obtained from Chromatographic K_d versus Stokes Radius Plots by Assuming Defined Cavity Models, by H. Waldmann-Meyer; 20, Whole Polymer Reference Materials in Analytical GPC, by C.M.L. Atkinson; 21, Chain-Extended Polyethylene and GPC, by D.C. Bassett *et al.*; 22, Comparison of Branching Distribution of Low Density Polyethylene by Large Scale Precipitation Chromatography and Analytical GPC, by D. Constantin and M. Hert; 23, Gel Permeation Chromatography of Cyclic Siloxanes, by J. A. Semlyen and P.V. Wright; 24, Characterization of Non-Ionic Micelles by GPC, by C. Booth *et al.*; 25, Purification of Protected Peptides by GPC, by I.J. Galpin *et al.*; 26, Porous Silica Supports for High Performance Exclusion Chromatography, by J.D.F. Ramsay; 27, Porous Silica GPC Packings for Molecular Weights Exceeding One Million, by A.R. Cooper; 28, Ionic Strength Effects in Aqueous GPC with Porous Glass Packings, by A.R. Cooper and D.P. Matzinger.

Volume 2 comprises: Part 1 - Hydrophobic Chromatography: 1, Hydrophobic Chromatography, by S. Shaltiel; 2, Cooperative Phenomena in the Adsorption of Phosphorylase Kinase and Phosphorylase b on Hydrophobic

Agaroses, by H.P. Jennissen; 3, Hydrophobic Interaction on Chromatography on Non-Charged Sepharose Derivatives, by S. Hjerten and S. Pählmann; 4, Hydrophobic Interaction Chromatography on Phenyl- and Octyl-Sepharose C1-4B, by J.-C. Janson and T. Låås; 5, Protein Chromatography on Immobilized, Amphipathic Ampolytes, by R.J. Yon *et al.* Part 2 - Ion Exchange Chromatography: 6, Industrial Scale Gel Filtration and Ion Exchange Chromatography with Special Reference to Plasma Protein Fractionation, by J. Curling; 7, The Chromatographic Behaviour of some Plasma Proteins on DEAE-Sepharose Cl-6B, by J.H. Bergloff; 8, Industrial Ion Exchange, Chromatography of Proteins on DEAE - Dextran Derivatives of Porous Silica Beads, by J.-L. Tayot *et al.*; 9, Large Scale Purification of Human Plasma Enzymes for Clinical Use, by R. Hanford *et al.*; 10, Attainment of Optimum Resolution by Varying pH Conditions in the Separation of Proteins Using Ion Exchange Celluloses, by B.N. Brook. Part 3 - Affinity Chromatography: 11, Theory and Practice of Affinity Chromatography, by P. O'Carra; 12, Design of Affinity Chromatography Systems from Free Solution Kinetics, by I.P. Trayer; 13, The Influence of the Matrix and Spacer Arm on Group Specific Affinity Chromatography, by S.G. Doley *et al.*; 14, Immobilized Adenine Coenzymes in General Ligand Affinity Chromatography, by K. Mosbach; 15, Affinity Chromatography on Porous Inorganic Supports, by L. Jervis; 16, Biopolymer Chromatography with Expanded Polyacrylamide Networks, by A.J. Brough *et al.*; 17, Effect of the Nature of the Spacer Arm in Affinity Chromatography with Immobilized AMP, by C.R. Lowe; 18, Alternatives to the Cyanogen Bromide Activation for Ligand Immobilization on Agarose, by T.C. Gribnau; 19, Attachment of Polynucleotides to Agarose Under Different Experimental Conditions, by J.-M. Egly *et al.*; 20, Affinity Chromatography of the Enzymes of Myo-Inositol Phosphate Metabolism, by M. Breitenbach; 21, The Affinity Chromatography of Phenylalanine Degrading Enzymes, by G.W. Jack; 22, Purification of Lactate Dehydrogenase-Immunoglobulin A (LDH-IgA) Complexes from Human Serum, by J. Biewenga; 23, Separation of Human Albumin

by Affinity Chromatography, by R. Hanford et al.; 24, Haptoglobin Preparation by Affinity Chromatography, by K. Pommerening et al.; 25, Immuno-affinity Chromatography on Derivatives of Porous Silica Beads - Industrial Extraction of antitetanus Antibodies from Placental Blood and Plasma, by M. Tardy et al.; 26, Isolation of Human Kidney Tissue Antigens from Urine by Immunospecific Chromatography, by J.E. Scherberich et al.; 27, Purification of Lectins on Beaded Polysaccharide Materials, by R. Bywater; 28, Group Fractionation of Human Serum Glycoproteins Using Sepharose Bound Lectins, by R. Hjorth and P. Vretblad; 29, Elution of Immunoglobulins from Protein A - Sepharose CI-4B Columns, by R. Bywater.

At the end of each volume is a subject index to that volume; most chapters end with a list of references, generally up to date through 1975.

The Editor, in his excellent Introduction to Volume 1 describes the genesis of gel filtration (GF), which in its turn gave rise to gel permeation chromatography (GPF), succinctly and well: "The phenomenon of parallel development, albeit with valuable interchange of ideas, is evident in progress in the chromatographic fractionation of macromolecules. It is recognized generally that the introduction, by Porath and Flodin in 1959, of crosslinked dextran gels (Sephadex[®]) as column packings for the "gel filtration" of bio-polymers in aqueous media was an important milestone in this technology. This discovery stimulated a search by physical scientists to find molecular sieve packings of sufficiently high pore diameter for the fractionation of wholly synthetic polymers. The eventual result was the preparation, by Moore in 1964, of suitable macro-reticular polystyrenes, later commercialized as Styragel for "gel permeation chromatography". The adoption of the name gel filtration (GF), for the aqueous molecular sieve fractionation of bio-polymers, and of the name gel permeation chromatography (GPC), for the non-aqueous fractionation of synthetic polymers by a similar mechanism, is indicative of the gulf between the passively alien scientific cultures". The Introduction to Volume 1 also describes the contents and in addition serves as a useful chapter

on Packing Classification all by itself. The first volume mainly describes packing materials (mainly for GPC, some for GF), various small and large scale analytical and preparative applications, and some theoretical considerations.

The second volume also has a most useful introduction on column packings, on the structure of gels and on the organization of the volume. The first five chapters of volume 2 form a mini-symposium on hydrophobic chromatography, written by most of the originators of this brand of chromatography (with Hofstee as the major noticeable absentee). Shaltiel gives an ingenious (but in this Reviewer's opinion unlikely) theoretical explanation of the reasons why longer hydrocarbon chains generally bind proteins more tightly, involving "pockets" inside protein molecules that accomodate hydrocarbon chains. It should not be overlooked that, up to a point, the sepharoses coupled to hydrocarbons with the longer hydrocarbon chains also will have the lower surface tension, and thus more strongly bind proteins in aqueous media; see, e.g., *Sep. Sci. Technol.*, 14, #4, 479; *Sep. Purif. Meth.*, 7, #1, 478, by this Reviewer *et al.*). Part 2 comprises three chapters on the ion exchange purification of proteins. The third and largest part has 19 chapters on various aspects of affinity chromatography. Chapter 12 stresses the importance of using high salt concentrations in the affinity stage, in minimizing non-specific interactions between the affinity matrix and unwanted proteins. Chapters 13, 17 and 21 treat the influence of the spacer arm in affinity chromatography.

Notwithstanding the fact that the entire work is reproduced from a typewritten text (quite homogeneously and neatly typed, but rather densely spaced), its final publication took two years from the date of the Symposium so that the references are at least three years old. Nevertheless, with more than a hundred contributors to contend with, the Editor and the Publishers probably should be highly commended in achieving this publication within that period of time. The work will for some time to come remain a milestone in the field and is strongly recommended to all those involved in the analytical and preparative chromatography of synthetic and biological polymers (especially

polypeptides and proteins), by GPC, GF, hydrophobic, ion-exchange and affinity methods.

Carel J. van Oss