

Advances in Pectin and Pectinase Research

Advances in Pectin and Pectinase Research

edited by

Fons Voragen

*Professor in Food Sciences,
Laboratory of Food Chemistry,
Wageningen University, The Netherlands*

Henk Schols

*Associate professor in Food Sciences,
Laboratory of Food Chemistry,
Wageningen University, The Netherlands*

and

Richard Visser

*Professor in Plant Sciences,
Laboratory of Plant Breeding,
Wageningen University, The Netherlands*



Springer-Science+Business Media, B.V.

A C.I.P. Catalogue record for this book is available from the Library of Congress.

ISBN 978-90-481-6229-1 ISBN 978-94-017-0331-4 (eBook)
DOI 10.1007/978-94-017-0331-4

Printed on acid-free paper

All Rights Reserved

© 2003 Springer Science+Business Media Dordrecht

Originally published by Kluwer Academic Publishers in 2003.

Softcover reprint of the hardcover 1st edition 2003

No part of this work may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission from the Publisher, with the exception of any material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work.

Contents

I. PECTIN (BIO)SYNTHESIS	1
Interaction of a stylar pectic polysaccharide and a basic protein (sca) mediates lily pollen tube adhesion J-C. Mollet, S-Y. Park, E.M. Lord	1
Towards unraveling the biological significance of the individual components of pectic hairy regions in plants R. Oomen, J.P. Vincken, M.S. Bush, M. Skj�t, C.H.L. Doeswijk-Voragen, P. Ulvskov, A.G.J. Voragen, M.C. McCann and R.G.F. Visser	15
Detergent-solubilisation of a homogalacturonan galacturonosyltransferase from mung bean H.J. Crombie, C. Scott and J.S.G. Reid.....	35
Pectin - the hairy thing: evidence that homogalacturonan is a side chain of rhamnogalacturonan I J.P. Vincken, H.A. Schols, R. Oomen, G. Beldman, R. Visser and A.G.J. Voragen.....	47
II. STRUCTURE, PHYSICAL AND CHEMICAL PROPERTIES OF PECTIN.....	61
Covalent cross-linking of primary cell wall pectic polysaccharides is required for normal plant growth M.A. O'Neill, S. Eberhard, B. Reuhs, W.D. Reiter, T. Ishii, T. Fujiwara, P. Albersheim and A. Darvill.....	61
Differences in the methyl ester distribution of pectins H.A. Schols, M.M.H. Huisman, E.J. Bakx and A.G.J. Voragen.....	75
Physico-chemical properties of pectins in the cell walls and after extraction J.F. Thibault and M.C. Ralet.....	91
A comparison of lime and orange pectin which were rapidly extracted from albedo M.L. Fishman, H.K. Chau, F.R. Coffin and A.T. Hotchkiss Jr.....	107
The hydration behaviour of pectin networks and plant cell walls A.J. MacDougall and S.G. Ring	123

Structural features of pectic substances from hemicellulose extracts of apples	
M.V. Lutz, R. Oechslin and R. Amado	137
Pectin cell biology: complexity in context	
W.G.T. Willats, L. McCartney and J.P. Knox	147
Pectic substances from soybean cell walls distinguish themselves from other plant cell wall pectins	
M.M.H. Huisman, H.A. Schols and A.G.J. Voragen.....	159
 III. MOLECULAR GENETICS AND REGULATION OF PECTINASE BIOSYNTHESIS	 169
Regulation of pectinolytic gene expression in <i>Aspergillus</i>	
R.P. de Vries and I. Pařenicová.....	169
Transgenesis with an antisense construct and a promoter-reporter fusion for the study of <i>lupme3</i> , a flax pectin methylesterase gene	
J. Lacoux, D. Roger, J.M. Domon, I. Duval, C. Burel, D. Klein-Eude, A.P. Balange, C. Morvan, E. Laine.....	183
Regulation and role of pectinases in phytopathogenic fungi	
C. Herbert, G. Boudart, C. Borel, C. Jacquet, M.T. Esquerre-Tugaye and B. Dumas	201
Synthesis of pectin fragments by modular design principle	
C. Vogel, B. Nolting, S. Kramer, W. Steffan and A.J. Ott.....	209
 IV. IDENTIFICATION, MODE OF ACTION, AND 3-D STRUCTURE OF PECTINASES	 221
Mechanistic lessons from structural studies of the pectate lyases	
S.R. Herron and F. Jurnak	221
Mode of action analysis and structure - function Relationships in <i>Aspergillus niger</i> pectinolytic enzymes	
J.A.E. Benen, G.J.W.M. van Alebeek, A.G.J. Voragen and J. Visser	235
Endo-xylogalacturonan hydrolase, a novel enzyme for fruit processing	
M. Herweijer, J.P. Vincken, P.J.A. Meeuwsen, C.J.B. van der Vlugt-Bergmans, G. Beldman, A.J.J. van Ooyen and A.G.J. Voragen.	257
The structures and active sites of pectinases	
R.W. Pickersgill and J.A. Jenkins.....	267

Recent observations on the specificity and structural conformation of the polygalacturonase - polygalacturonase inhibiting protein system
C.W. Bergmann, L. Stanton, D. King, R.P. Clay, G. Kemp, R. Orlando, A. Darvill and P. Albersheim.....277

Structure-function and molecular studies on fungal polygalacturonases and their inhibitors PGIPs
F. Cervone.....293

Rhamnogalacturonan acetylsterase, a member of the SGNH-Hydrolase family
A. Mølgaard.....299

Sequence analysis and characterisation of a novel pectin acetyl esterase from *Bacillus subtilis*
P.U. Bolvig, M. Pauly, C. Orfila, H.V. Scheller and K. Schnorr.....315

The tow secreted pectin acetylsterases of *Erwinia chrysanthemi* 3937, PAEY and PAEX
N. Hugouvieux-Pattat and V.E. Shevchik.....331

Development of a valencia orange pectin methylesterase for generating novel pectin products
B.J. Savary, A.T. Hotchkiss, M.L. Fishman, R.G. Camaron and R.G. Shatters345

Structure-function of a proteinaceous inhibitor of plant pectin methylesterase
L. Camardella, A. Giovane and L. Servillo.363

Degradation of pectins with different nature, amount and distribution of the substituents by endopolygalacturonase of *fusarium moniliforme*
E. Bonnin, A. le Goff and J.F. Thibault.373

V. PECTINASES IN BEVERAGE, FOOD AND FEED, AND NOVEL TECHNOLOGIES.....385

The role of pectins in plant tissue upon storage and processing: analysis and mathematical modelling in relation to firmness
C. van Dijk and L.M.M. Tijskens.....385

Kinetic information on thermal and high pressure-temperature inactivation of pectinesterases
A. van Loey, D. Fachin, B. Ly Nguyen, I. Verlent and M. Hendrickx. ...403

VI. DEVELOPMENTS IN PECTIN MANUFACTURE AND APPLICATION.....419

Characterisation of pectins extracted from fresh sugar beet roots under different conditions using an experimental design

S. Levigne, M.C. Ralet and J.F. Thibault.....419

Sol-gel transitions of high-esterified pectins and their molecular structure

S. Neidhart, C. Hannak and K. Gierschner.....431

Rheological characterization of gum and jelly products

H.U. Endress and F. Mattes.....449

Comparison of the stabilisation mechanism of acid dairy drinks (ADD) induced by pectin and soluble soybean polysaccharide (SSP)

P. Boulenguer and M.A. Laurent..467

Recent studies on possible functions of bioactive pectins and pectic polysaccharides from medicinal herbs on health care

H. Yamada, H. Kiyohara and T. Matsumoto.....481

Effect of pectolytic and cellulolytic enzyme treatments on functional and nutritional properties of cell wall materials from apples

G. Dongowski, S. Förster and H. Kunzek.....491

Preface

The second international symposium on Pectins and Pectinases was organized by Wageningen University and Research Centre and held in Rotterdam, May 6-10, 2001. This successful meeting was attended by around 130 participants from more than 20 countries representing almost all of the groups and industries working worldwide on pectins and pectinases. Following the first meeting on this subject held in December 1995, the symposium definitely forms a platform for researchers and industries working in the field, all within their own discipline and expertise. The symposium demanded a written account and this book is the result of that. It contains all keynote lectures and other oral presentations and provides an update about the current research. Significant progress has been made in the last 5 years.

This book provides an up-to-date insight into the research on pectin and pectic enzymes involved in their biosynthesis, degradation, modification or utilization. The progress in the elucidation of the chemical structure of pectin and mode of action and 3-D structure of the pectin degrading enzymes allows us to identify and influence the functionality of pectins and pectic enzymes, both *in vitro* after isolation as well in the plants themselves (*in planta*). Other contributions deal with new applications of both pectin and pectin-degrading enzymes, while more and more attention is paid to health and nutritional aspects of pectins.

The book provides a 'state of the art' account for both beginners and experienced researchers of almost all disciplines of pectin research.

We hope that it will satisfy your interests in this important and fast developing research field.

Fons Voragen, Henk Schols & Richard Visser, editors