

1. Record Nr.	UNINA9910861098803321
Autore	Bangar Sneh Punia
Titolo	Standardized Procedures and Protocols for Starch
Pubbl/distr/stampa	New York, NY : , : Springer, , 2024 ©2024
ISBN	9781071638668 1071638661
Edizione	[1st ed.]
Descrizione fisica	1 online resource (363 pages)
Collana	Methods and Protocols in Food Science Series
Soggetti	Starch Food science
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Preface -- Contents -- Contributors -- Chapter 1: Importance of Starch Characterization -- 1 Introduction -- 2 Materials -- 2.1 Importance of Starch in the Food Industry -- 2.1.1 Starch as Thickening -- 2.1.2 Starch as a Binding and Gelling Agent -- 2.1.3 Starch as Fat Replacement -- 2.2 Composition and Structure of Starch -- 3 Methods -- 3.1 Methods and Techniques for Starch Characterization -- 3.2 Characterization Methods -- 3.2.1 Differential Scanning Calorimetry -- 3.2.2 X-Ray Diffraction -- 3.2.3 Scanning Electron Microscopy -- 3.2.4 Fourier-Transform Infrared Spectroscopy -- 3.3 Starch Characterization in Industrial Applications -- 3.3.1 Papermaking and Textiles -- 3.3.2 Bioplastics and packaging Materials -- 3.4 Starch Characterization in Nutritional Studies -- 3.4.1 Digestibility of Starch and Glycemic Index -- 4 Notes -- References -- Chapter 2: Morphological Characterization of Starches -- 1 Introduction -- 2 Materials -- 2.1 Optical Microscopy -- 2.2 Scanning Electron Microscopy -- 2.3 Transmission Electron Microscope -- 2.4 Polarizing Microscope -- 2.5 Confocal Laser Scanning Microscopy -- 2.6 Atomic Force Microscopy -- 3 Methods -- 3.1 Optical Microscopy -- 3.1.1 Starch Powder -- 3.1.2 Liquid Starch Sample -- 3.2 Scanning Electron Microscopy -- 3.2.1 Powder Samples -- 3.2.2 Block Samples -- 3.3 Transmission Electron Microscope -- 3.4 Polarizing Microscope -- 3.5 Confocal Laser Scanning Microscopy --

3.6 Atomic Force Microscopy -- 4 Notes -- 5 Conclusion -- References -- Chapter 3: Characterization Methods of Amylose and Amylopectin -- 1 Introduction -- 1.1 AM and AP: Characterization and Functional Role -- 1.1.1 Overview of AM -- 1.1.2 Characterization of AM -- 1.1.3 Overview of AP -- 1.1.4 Characterization of AP -- 2 Materials and Methods -- 2.1 Sample Preparation -- 2.1.1 Starch Isolation from Wheat. 2.1.2 Starch Isolation from Barley Kernels -- 2.1.3 Starch Extraction from Potato Flour -- 2.1.4 Fractionation of AM and AP -- 2.1.5 Separation and Purification of AM and AP [30] -- 2.2 Determination of AM and AP Structure -- 2.2.1 Spectrophotometric Method -- 2.2.2 Potentiometric Titration Method -- 2.3 Determination of AM Content -- 2.4 Molecular Weight Determination of AM and AP -- 2.5 Chain Length Distribution Analysis of AM and AP -- 2.6 Rheological Analysis of AM and AP [37] -- 2.7 Thermal Characterization of AM-AP Using Differential Scanning Calorimeter (DSC) -- 2.8 Thermogravimetry Analysis (TGA) -- 2.9 Morphological Characterization Using Scanning Electron Microscopy (SEM) -- 2.10 Functional Characterization Using FTIR -- 2.11 Pasting Properties of AM and AP -- 3 Methods -- 3.1 Protocol for Starch Isolation from Wheat -- 3.2 Protocol for Starch Isolation from Barley Kernels -- 3.3 Protocol of Starch Extraction from Potato -- 3.4 Protocol Fractionation of AM and AP from Barley Starch -- 3.5 Protocol for Separation and Purification of AM and AP from Rice Starch -- 3.6 Protocol for the Determination of AM and AP Structure Using Spectrophotometer Method -- 3.7 Protocol for the Determination of AM and AP Structure Using Potentiometric Titration Method -- 3.8 Protocol for Determination of AM Content Using GPC -- 3.9 Protocol for Molecular Weight Determination of AM and AP -- 3.10 Protocol for Chain Length Distribution Analysis -- 3.11 Protocol for Rheological Analysis of AM and AP -- 3.12 Protocol for DSC Analysis of AM and AP -- 3.13 Protocol TGA Analysis of AM and AP -- 3.14 Protocol for Morphological Characterization Using Scanning Electron Microscopy (SEM) -- 3.15 Protocol for Functional Characterization Using FTIR -- 3.16 Protocol for Pasting Properties Evaluation of AM and AP -- 4 Conclusion -- 5 Notes -- References. Chapter 4: Molecular Structure Characterization of Starch -- 1 Introduction -- 1.1 Overview of Size Exclusion Chromatography (SEC) and Asymmetrical Flow Field-Flow Fractionation (AF4) for Molecular Charact... -- 2 Materials -- 2.1 Buffers and Solutions -- 2.2 Enzymes and Standards -- 2.3 Equipment -- 3 Methods -- 3.1 Sample Preparation Methods -- 3.1.1 Milling of Grains -- 3.1.2 Starch Isolation from Barley Flour -- 3.1.3 Starch Extraction from Normal, High Amylose, and Waxy Corn Flour -- 3.1.4 Starch Extraction from Millets -- 3.1.5 Dimethyl Sulfoxide Treatment and Starch Solubilization -- 3.1.6 Debranching -- 3.1.7 Modified Starch -- 3.2 Molecular Characterization of Starch Using SEC-PAD -- 3.3 Molecular Characterization of Modified Starch Using SEC-MALS/MALLS-DRI -- 3.4 Molecular Characterization of Starch Using HPSEC-MALS-RI System -- 3.5 Molecular Characterization of Starch Using the AF4-MALS-RI System -- 3.6 Conclusion -- 4 Notes -- References -- Chapter 5: Starch Paste Properties -- 1 Introduction -- 2 Materials -- 3 Methods -- 3.1 Rapid Viscosity Analyzer -- 3.2 Protocol -- 3.3 For RVA Analysis -- 3.4 Analysis of Starch Pasting Properties -- 3.5 Viewing Results During a Test -- 3.6 Interpretation of RVA Data -- 3.7 Factors Affecting the Starch Sticking Curve -- 4 Notes -- 5 Conclusion -- References -- Chapter 6: Rheological Characterization -- 1 Introduction -- 1.1 Rheology Basics and Characterization -- 1.1.1 Static Methods -- 1.1.2 Dynamic Methods: Oscillatory Testing Methods

-- 1.1.3 Dynamic Methods: Wave Propagation Method -- 1.1.4 Dynamic Methods: Steady Flow Method -- 1.1.5 Determining Key Measurements -- 1.1.6 Rheology Fitting Models -- 1.1.7 Pasting Properties and Gel Strength -- 1.2 Rheometry Experimental Methods -- 1.2.1 Flow Viscometers used in Production Floor in Industrial Settings -- 1.2.2 Rotational Instrument Methods. Concentric Cylinder -- Cone and Plate -- Parallel Plate -- Selecting Geometry -- Rheometry Calibration and Considerations -- 1.2.3 Capillary and Slit Viscometers -- 1.2.4 Rheoscope -- 1.2.5 Systemic Rheology -- 2 Materials -- 2.1 Starch Overview -- 2.1.1 Starch Sources and Rheological Behaviors -- 2.1.2 Investigating Phase Transition in Starch -- 2.1.3 Materials to Minimize Evaporation Losses -- 2.1.4 Advanced Equipment -- 3 Methods -- 3.1 Standard Procedures and Protocols -- 3.1.1 Rheological Properties of Non-Newtonian Materials by Rotational Viscometer -- 3.1.2 Cone/Plate Viscosity at a 500/s Shear Rate -- 3.1.3 High-Shear Viscosity Using a Cone/Plate and Capillary Viscometer -- 3.1.4 General Principles of Rotational and Oscillatory Rheometry -- 3.1.5 Dynamic Mechanical Properties Melt Rheology -- 3.1.6 Powder Rheology -- 3.1.7 Dough Rheology -- 4 Notes -- 5 Conclusion -- References -- Chapter 7: X-Ray Diffraction Analysis for Starch -- 1 Introduction -- 1.1 Application of XRD in the Characterization of Different Starches -- 1.1.1 Cereal Starches -- 1.1.2 Tuber Starches -- 1.1.3 Legume Starches -- 1.2 XRD Principle -- 1.2.1 X-Ray Generation and Imaging -- 2 Materials -- 2.1 Sample -- 2.2 Instrumentation -- 2.3 Sample Preparation -- 3 Methods -- 3.1 For Powder XRD Analysis (Fig. 5) -- 3.1.1 Relative Crystallinity of Starch Polymorphs -- 3.1.2 Selection of the Peaks for the Fitting Procedure -- 3.1.3 Selection of the Most Suitable Fitting Function -- 3.1.4 Estimating Starch Crystallinity -- 3.1.5 For Investigating the Gelatinization of Starch -- 3.1.6 For Retrogradation of Starch -- 3.2 Interpretation of XRD Data -- 3.2.1 Millet Starch Representation -- 4 Notes -- 5 Conclusion and Future Direction -- References -- Chapter 8: Starch Digestibility Protocols -- 1 Introduction -- 1.1 Overview of Starch Hydrolysis and Digestibility. 1.2 Starch Structure and Its Influence on Digestibility -- 2 Starch Digestibility and Protocols -- 2.1 Overview and Significance of Estimation of In Vivo Digestibility of Starch -- 2.2 Overview and Significance of Estimation of In Vitro Digestibility of Starch -- 3 Materials -- 3.1 For In Vivo Studies -- 3.1.1 The Human Ileostomy Model -- 3.1.2 Combined CO₂/H₂ Breath Test -- 3.1.3 In Vivo Glycemic Index Method -- 3.1.4 In Situ Mobile Nylon Bag Method -- 3.1.5 Starch Digestibility Using In Vivo Digesta -- 3.1.6 In Vivo Glycemic Response Using Mice -- 3.2 For In Vitro Studies -- 3.2.1 Using Pepsin Enzyme -- 3.2.2 Using Amylase Enzyme -- 3.2.3 Using Combination of Enzymes Pepsin: Amylase -- 4 In Vivo Starch Digestibility Methods and Protocols -- 4.1 Human Model -- 4.1.1 The Human Ileostomy Model -- 4.1.2 Combined CO₂/H₂ Breath Test -- 4.1.3 In Vivo Glycemic Index Method -- 4.2 Animal Model -- 4.2.1 In Situ Mobile Nylon Bag Method -- 4.2.2 Starch Digestibility Using In Vivo Digesta -- 4.2.3 In Vivo Glycemic Response Using Mice -- 5 In Vitro Starch Digestibility Methods and Protocols -- 5.1 Using Pepsin Enzyme -- 5.1.1 Processed Foods -- 5.1.2 Whole Grains (Rice and Barley) -- 5.1.3 For Pasta Products -- 5.2 Using Amylase -- 5.3 Using Combination of Enzymes Pepsin-Amylase -- 6 Conclusion -- 7 Notes -- References -- Chapter 9: Physically Modified Starch -- 1 Introduction -- 2 Materials -- 3 Methods -- 3.1 Heat-Moisture Treatment (HMT) -- 3.1.1 Principle -- 3.1.2 Procedure -- 3.1.3 Effect on Starch Properties -- 3.2 Annealing (ANN) -- 3.2.1 Principle -- 3.2.2

Procedure -- 3.2.3 Effect on Starch Properties -- 3.3 Osmotic Pressure Treatment (OPT) -- 3.3.1 Principle -- 3.3.2 Procedure -- 3.3.3 Effect on Starch Properties -- 3.4 Microwave Heating (MWH) -- 3.4.1 Principle -- 3.4.2 Procedure -- 3.4.3 Effect on Starch Properties -- 3.5 Extrusion -- 3.5.1 Principle. 3.5.2 Procedure.

Sommario/riassunto

This book, 'Standardized Procedures and Protocols for Starch', edited by Sneh Punia Bangar, is a comprehensive resource dedicated to the methodologies and protocols involved in the study and application of starch in the food industry. It offers detailed procedures and insights into the functional properties of starch, including its chemical, physical, and enzymatic modifications. The book is structured into 11 chapters, each authored by experts, covering topics such as starch granule morphology, amylose and amylopectin analysis, and the rheological and pasting properties of starch. Aimed at researchers and professionals in food technology and academia, it provides a robust knowledge base for understanding starch's role in enhancing food product quality and meeting industrial demands.
