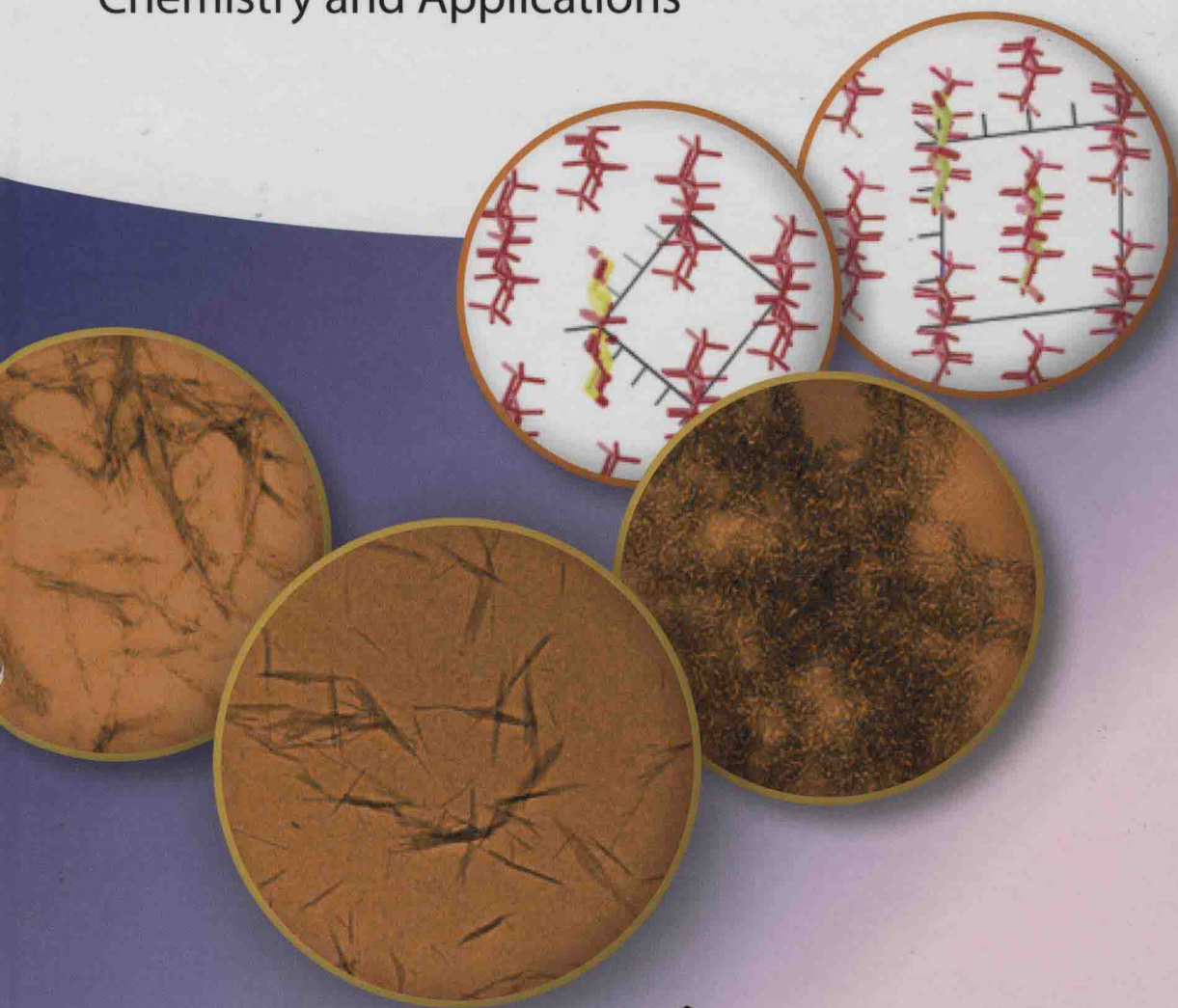


Edited by Jin Huang, Peter R. Chang,  
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# Poly saccharide-Based Nanocrystals

Chemistry and Applications

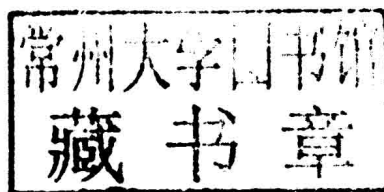


Chemical Industry Press

*Edited by Jin Huang, Peter R. Chang, Ning Lin, and  
Alain Dufresne*

## **Polysaccharide-Based Nanocrystals**

Chemistry and Applications



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## Foreword

Since the beginning of the new century, the development of advanced biobased nanomaterials has been of significant interest in both academia and industry. Polysaccharide nanocrystals, mainly including rod-like cellulose nanocrystals, chitin nanowhiskers, and platelet-like starch nanocrystals, are highly crystalline rigid nanoparticles extracted from biosourced polymers that possess numerous advantages over inorganic nanoparticles. It has been reported that the diverse materials derived from polysaccharide nanocrystals will cover a broad range of properties that are useful in a wide range of applications, for example, in composites, electronics (flexible circuits), energy (flexible batteries, such as Li-ion and solar panels), packaging, coatings, detergents, adhesives, construction, pulp and paper, inks and printing, filtration, medicine and life science (scaffolds in tissue engineering, artificial skin and cartilage, wound healing, and vessel substitutes), optical devices (including reflective properties for security papers and UV or IR reflective barriers), rheological modifiers, and cosmetics. Since the first study on the use of cellulose nanocrystals as a reinforcing filler in nanocomposites about 20 years ago, a huge amount of literature has been devoted to research on polysaccharide nanocrystals in more than 1000 scientific publications.

As a relatively new research area, it is imperative to systematically assemble state-of-the-art technical accomplishments on polysaccharide nanocrystals, particularly with respect to physics, chemistry, materials science, processing, and engineering. This book covers extraction, structure, properties, and surface modification pertaining to polysaccharide nanocrystals. It provides an in-depth description of plastics and composites containing this unique biosourced nanoingredient in terms of structures, properties, manufacturing, and product performance. This book also describes the concept of functional nanomaterials based on polysaccharide nanocrystals and their potential applications. All chapters are contributed by leading experts who have both academic and professional credentials.

It is interesting to note that commercialization/utilization of polysaccharide nanocrystals (especially for cellulose nanocrystals) is finally catching on and is being pursued vigorously by industrial groups, notably in the United States, Canada, and Europe.

Upcoming R&D and relentless pursuit represent well-justified challenges and opportunities for bringing the next generation of polysaccharide nanocrystal-based materials into reality.

## Preface

*Biobased Polysaccharide Nanocrystals: Chemistry and Applications* is the first book that systematically describes the chemistry, properties, processing, and applications of polysaccharide nanocrystals and the nanocomposites/nanomaterials thereby derived.

Development of biobased materials has experienced fast growth in the past two decades thanks to public concern over the environment, climate change, and the depletion of fossil fuels. Over the last 10 years or so, this team of authors has worked collectively and separately with these interesting and yet little known renewable and biodegradable polysaccharide nanocrystals in the cutting edge field of functional nanomaterials and nanocomposites. As such, we are eager to share our knowledge and experience with readers and stakeholders, particularly researchers from academia and industry, policy makers, and the business sector, to foster rapid exploitation and commercialization of these fascinating bioingredients and their derived products, including but not limited to nanocomposites/nanomaterials.

This book is intended to give the reader a comprehensive overview of the present knowledge relating to extraction, structure, properties, surface modification, and the newly derived material of polysaccharide nanocrystals. In addition, it provides an in-depth description of plastics, composites, and nanomaterials specifically procured from cellulose nanocrystals, chitin nanowhiskers, and starch nanocrystals. This is an excellent book for scientists, engineers, graduate students, and industrial researchers in the field of polymeric materials. This book also covers the most recent progress with respect to: (i) the development of a conceptual framework of polysaccharide nanocrystals; (ii) numerous applications in the design and manufacture of nanocomposites and functional nanomaterials; and (iii) the relationship between structure and properties.

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## Contents

**List of Contributors** *XIII*

**Foreword** *XV*

**Preface** *XVII*

### **1 Polysaccharide Nanocrystals: Current Status and Prospects in Material Science** *1*

*Jin Huang, Peter R. Chang, and Alain Dufresne*

#### **1.1 Introduction to Polysaccharide Nanocrystals** *1*

#### **1.2 Current Application of Polysaccharide Nanocrystals in Material Science** *3*

#### **1.3 Prospects for Polysaccharide Nanocrystal-Based Materials** *8*

**List of Abbreviations** *9*

**References** *9*

### **2 Structure and Properties of Polysaccharide Nanocrystals** *15*

*Fei Hu, Shiyu Fu, Jin Huang, Debbie P. Anderson, and Peter R. Chang*

#### **2.1 Introduction** *15*

#### **2.2 Cellulose Nanocrystals** *16*

##### **2.2.1 Preparation of Cellulose Nanocrystals** *16*

##### **2.2.1.1 Acid Hydrolysis Extraction of Cellulose Nanocrystals** *16*

##### **2.2.1.2 Effects of Acid Type** *19*

##### **2.2.1.3 Effects of Pretreatment** *24*

##### **2.2.2 Structure and Properties of Cellulose Nanocrystals** *26*

##### **2.2.2.1 Structure and Rigidity of Cellulose Nanocrystals** *26*

##### **2.2.2.2 Physical Properties of Cellulose Nanocrystals** *32*

#### **2.3 Chitin Nanocrystals** *41*

##### **2.3.1 Preparation of Chitin Nanocrystals** *41*

##### **2.3.1.1 Extraction of Chitin Nanocrystals by Acid Hydrolysis** *41*

##### **2.3.1.2 Extraction of Chitin Nanocrystals by TEMPO Oxidation** *42*

##### **2.3.2 Structure and Properties of Chitin Nanocrystals** *43*

##### **2.3.2.1 Structure and Rigidity of Chitin Nanocrystals** *43*

##### **2.3.2.2 Properties of Chitin Nanocrystal Suspensions** *45*

#### **2.4 Starch Nanocrystals** *47*

2.4.1	Preparation of Starch Nanocrystals	47
2.4.1.1	Extraction of Starch Nanocrystals by Acid Hydrolysis	47
2.4.1.2	Effect of Ultrasonic Treatment	49
2.4.1.3	Effect of Pretreatment	50
2.4.2	Structure and Properties of Starch Nanocrystals	50
2.4.2.1	Structure of Starch Nanocrystals	50
2.4.2.2	Properties of Starch Nanocrystal Suspensions	51
2.5	Conclusion and Prospects	52
	List of Abbreviations	53
	References	54
<b>3</b>	<b>Surface Modification of Polysaccharide Nanocrystals</b>	<b>63</b>
	<i>Ning Lin and Alain Dufresne</i>	
3.1	Introduction	63
3.2	Surface Chemistry of Polysaccharide Nanocrystals	63
3.2.1	Surface Hydroxyl Groups	63
3.2.2	Surface Groups Originating from Various Extraction Methods	65
3.3	Approaches and Strategies for Surface Modification	66
3.3.1	Purpose and Challenge of Surface Modification	66
3.3.2	Comparison of Different Approaches and Strategies of Surface Modification	67
3.4	Adsorption of Surfactant	70
3.4.1	Anionic Surfactant	70
3.4.2	Cationic Surfactant	71
3.4.3	Nonionic Surfactant	71
3.5	Hydrophobic Groups Resulting from Chemical Derivatization	72
3.5.1	Acetyl and Ester Groups with Acetylation and Esterification	72
3.5.2	Carboxyl Groups Resulting from TEMPO-Mediated Oxidation	77
3.5.3	Derivatization with Isocyanate Carboamination	79
3.5.4	Silyl Groups Resulting from Silylation	79
3.5.5	Cationic Groups Resulting from Cationization	81
3.6	Polymeric Chains from Physical Absorption or Chemical Grafting	81
3.6.1	Hydrophilic Polymer	82
3.6.2	Polyester	83
3.6.3	Polyolefin	85
3.6.4	Block Copolymer	90
3.6.5	Polyurethane and Waterborne Polyurethane	91
3.6.6	Other Hydrophobic Polymer	92
3.7	Advanced Functional Groups and Modification	92
3.7.1	Fluorescent and Dye Molecules	94
3.7.2	Amino Acid and DNA	95
3.7.3	Self-Cross-linking of Polysaccharide Nanocrystals	95
3.7.4	Photobactericidal Porphyrin Molecule	96
3.7.5	Imidazolium Molecule	97

3.7.6	Cyclodextrin Molecule and Pluronic Polymer	97
3.8	Concluding Remarks	98
	List of Abbreviations	98
	References	100
<b>4</b>	<b>Preparation of Polysaccharide Nanocrystal-Based Nanocomposites</b>	<b>109</b>
	<i>Hou-Yong Yu, Jin Huang, Youli Chen, and Peter R. Chang</i>	
4.1	Introduction	109
4.2	Casting/Evaporation Processing	110
4.2.1	Solution Casting/Evaporation Processing	110
4.2.2	Solution Casting in Aqueous Medium	111
4.2.2.1	Dispersion Stability of Polysaccharide Nanocrystals in Aqueous Medium	111
4.2.2.2	Blending with Hydrophilic Polymers	112
4.2.2.3	Blending with Hydrophobic Polymers	116
4.2.3	Solution Casting in Organic Medium	117
4.2.3.1	Dispersion Stability of Polysaccharide Nanocrystals in Organic Medium	117
4.2.3.2	Blending with Polymers in Organic Solvent	118
4.3	Thermoprocessing Methods	121
4.3.1	Thermoplastic Materials Modified with Polysaccharide Nanocrystals	121
4.3.2	Influence of Surface Modification of Polysaccharide Nanocrystals on Nanocomposite Thermoprocessing	122
4.4	Preparation of Nanofibers by Electrospinning Technology	127
4.4.1	Electrospinning Technology	127
4.4.1.1	Concepts	127
4.4.1.2	Formation Process of Nanofibers	128
4.4.1.3	Basic Electrospinning Parameters and Devices	129
4.4.1.4	Newly Emerging Electrospinning Techniques	130
4.4.2	Nanocomposite Nanofibers Filled with Polysaccharide Nanocrystals	132
4.4.2.1	Electrospun Nanofibers in Aqueous Medium	132
4.4.2.2	Electrospun Nanofibers in Non-aqueous Medium	134
4.5	Sol–Gel Method	135
4.5.1	Concepts of Sol–Gel Process	135
4.5.2	Polysaccharide Nanocrystal-Based or -Derived Nanocomposites Prepared by Sol–Gel Method	136
4.5.3	Chiral Nanocomposites Using Cellulose Nanocrystal Template	137
4.5.3.1	Inorganic Chiral Materials Based on Cellulose Nanocrystal Template	137
4.5.3.2	Chiral Porous Materials	138
4.5.3.3	Chiral Porous Carbon Materials	141
4.5.3.4	Metal Nanoparticle-Decorated Chiral Nematic Materials	143



4.6	Self-Assembly Method	144
4.6.1	Overview of Self-Assembly Method	144
4.6.2	Self-Assembly Method Toward Polysaccharide Nanocrystal-Modified Materials	145
4.6.2.1	Self-Assembly of Polysaccharide Nanocrystals in Aqueous Medium	145
4.6.2.2	Self-Assembly of Polysaccharide Nanocrystals in Organic Medium	148
4.6.2.3	Self-Assembly of Polysaccharide Nanocrystals in Solid Film	148
4.6.3	Polysaccharide Nanocrystal-Modified Materials Prepared by LBL Method	150
4.7	Other Methods and Prospects	152
	List of Abbreviations	153
	References	154
<b>5</b>	<b>Polysaccharide Nanocrystal-Reinforced Nanocomposites</b>	<b>165</b>
	<i>Hanieh Kargarzadeh and Ishak Ahmad</i>	
5.1	Introduction	165
5.2	Rubber-Based Nanocomposites	166
5.3	Polyolefin-Based Nanocomposites	175
5.4	Polyurethane and Waterborne Polyurethane-Based Nanocomposites	178
5.5	Polyester-Based Nanocomposites	192
5.6	Starch-Based Nanocomposites	200
5.7	Protein-Based Nanocomposites	204
5.8	Concluding Remarks	211
	List of Abbreviations	211
	References	213
<b>6</b>	<b>Polysaccharide Nanocrystals-Based Materials for Advanced Applications</b>	<b>219</b>
	<i>Ning Lin, Jin Huang, and Alain Dufresne</i>	
6.1	Introduction	219
6.2	Surface Characteristics Induced Functional Nanomaterials	220
6.2.1	Active Groups	220
6.2.1.1	Importing Functional Groups or Molecules	220
6.2.1.2	Template for Synthesizing Inorganic Nanoparticles	222
6.2.2	Surface Charges and Hydrophilicity	225
6.2.2.1	Emulsion Nanostabilizer	225
6.2.2.2	High-Efficiency Adsorption	226
6.2.2.3	Permselective Membrane	226
6.2.3	Nanoscale and High Surface Area	227
6.2.3.1	Surface Cell Cultivation	227
6.2.3.2	Water Decontamination	227
6.3	Nano-Reinforcing Effects in Functional Nanomaterials	228