A close-up photograph of several cotton bolls on a brown branch. The bolls are white and fluffy, with some showing the dark brown seed heads. The background is a soft, out-of-focus light blue.

design

FASHION

**THE GLOBAL TEXTILE  
COMPLEX** | CHAP. 1

**FABRICS  
FROM FIBERS** | CHAP. 15

**CARE OF TEXTILE  
PRODUCTS** | CHAP. 20

ELEVENTH  
EDITION

**SARA J. KADOLPH**

# TEXTILES

ELEVENTH EDITION

# Textiles

**Sara J. Kadolph**  
Iowa State University

PEARSON

Boston Columbus Indianapolis New York San Francisco Upper Saddle River  
Amsterdam Cape Town Dubai London Madrid Milan Munich Paris Montreal Toronto  
Delhi Mexico City Sao Paulo Sydney Hong Kong Seoul Singapore Taipei Tokyo

Editor in Chief: Vernon Anthony  
Editorial Assistant: Doug Greive  
Director of Marketing: David Gesell  
Senior Marketing Manager: Alicia Wozniak  
Marketing Assistant: Les Roberts  
Associate Managing Editor: Alexandrina Benedicto Wolf  
In-house Production Liaison: Alicia Ritchey  
Operations Specialist: Deidra Skahill  
Art Director: Diane Ernsberger  
Cover Designer: Diane Lorenzo

Image Permission Coordinator: Silvana Attanasio  
Cover Art: Photo Researchers, Inc.  
Lead Media Project Manager: Karen Bretz  
Full-Service Project Management: Thistle Hill Publishing Services, LLC  
Copy Editor: Thistle Hill Publishing Services, LLC  
Composition: S4Carlisle Publishing Services  
Printer/Binder: Courier Kendallville, Inc.  
Cover Printer: Lehigh-Phoenix Color  
Text Font: 45 Helvetica Light

Credits and acknowledgments borrowed from other sources and reproduced, with permission, in this textbook appear on appropriate page within text.

**Copyright © 2010, 2007 Pearson Education, Inc., publishing as Prentice Hall, One Lake Street, Upper Saddle River, NJ 07458.** All rights reserved. Manufactured in the United States of America. This publication is protected by Copyright, and permission should be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. To obtain permission(s) to use material from this work, please submit a written request to Pearson Education, Inc., Permissions Department, Prentice Hall, One Lake Street, Upper Saddle River, NJ 07458.

Many of the designations by manufacturers and seller to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations have been printed in initial caps or all caps.

#### Library of Congress Cataloging-in-Publication Data

Kadolph, Sara J.  
Textiles / Sara J. Kadolph.—Eleventh ed.  
p. cm.  
Includes bibliographical references and index.  
ISBN-13: 978-0-13-500759-4 (casebound)  
ISBN-10: 0-13-500759-3 (casebound)  
1. Textile industry. 2. Textile fibers. 3. Textile fabrics. I. Title.  
TS1446.K33 2009  
677—dc22

2009050124

10 9 8 7 6 5 4 3 2 1

**Prentice Hall**  
an imprint of



[www.pearsonhighered.com](http://www.pearsonhighered.com)

ISBN-13: 978-0-13-500759-4  
ISBN-10: 0-13-500759-3



## Philosophy of This Book

*Textiles* provides students with a basic knowledge of textiles so that they understand how textiles are produced and how appropriate performance characteristics are incorporated into materials and products. With this knowledge, they have the foundation they need to make informed decisions regarding textile materials and products and to communicate effectively with team members in the workplace, suppliers, contractors, and buyers. A solid understanding of textile components (fibers, yarns, fabrics, and finishes), the interrelationships among these components, and their impact on product performance is necessary to fulfill day-to-day responsibilities in many careers in the textile, apparel, and interior segments of the global textile complex.

Serviceability of textiles and textile products is the fundamental principle emphasized throughout the book. I discuss the contributions of each component as it is incorporated in or combined with other components in a textile product. I stress interrelationships among the components. Basic information regarding how each component is processed or handled helps in understanding product performance and cost. Production of textiles is a complex process dealing with a wide variety of materials and techniques. To understand textiles, students need a basic understanding of the choices and technology involved.

This book will help students:

- use textile terminology correctly;
- know laws and labeling requirements regulating textile distribution;
- understand the impact of production processes and selection of components on product performance, cost, and consumer satisfaction;
- recognize the forces that drive product and process developments;
- identify fiber type, yarn type, and fabrication method;
- predict fabric or product performance based on a knowledge of fibers, yarns, fabrication methods, and finishes in conjunction with informative labeling;
- select textile components or products based on specified end uses and target market expectations for performance and serviceability;
- select appropriate care for textile products;
- understand some of the issues related to sustainability and environmental quality related to textiles, their production, use, care, and disposal;
- develop an interest in and appreciation of textiles.

Understanding textiles cannot be achieved only by studying this book; it also requires working with fabrics. Numerous learning activities included in the

chapters make use of fabric swatches. The numbers in the activities refer to the swatches in the Basic Swatch Kit available with this book.

## Organization of This Book

Each section of the book focuses on a basic component or aspect of fabrics and textile products or on general issues important to the use of, production of, or satisfaction with textile products. Sustainability and environmental issues are included in almost every chapter. Each section is complete and can be used in any order desired. The four main sections follow the normal sequence used in the production of textiles: fiber, yarn, fabrication, and finishing.

The first section of the book introduces the study of textiles and the global textile complex and approaches product development from a textile perspective. Section Two focuses on fibers and their production, serviceability, effect on product performance, and use. Several new fibers and new generic classifications have been added to this section. Smart textiles and nanotechnology have been added. Section Three focuses on yarn production, yarn types, the relationship of yarn type to product performance and serviceability, sewing and embroidery threads, and rope. More types of novelty or fancy yarns have been added. Section Four examines fabrication methods. These chapters are organized by basic fabrication method, standard or classic fabric names and types, and the relationships between fabrication and product performance. Areas that were confusing have been clarified. Section Five deals with finishes, grouped by type or effect. Dyeing and printing are also included, as well as problems that consumers and producers experience with dyed or printed fabrics. Section Six deals with other issues related to textiles. One chapter focuses on care of textile products, new cleaning products and processes, and associated sustainability and environmental concerns. Another chapter investigates legal, sustainability, and environmental concerns. The final chapter discusses career opportunities requiring knowledge of textiles and has been extensively revised to reflect the ever-changing career opportunities in the textile and apparel industries.

This book assumes that the student requires basic information regarding textiles in order to perform professional responsibilities and communicate with other professionals in an intelligent and informed manner. Hence, the book is designed to be of use as a textbook and to become a valued component of a professional's reference library. Key terms are defined in both the text and the glossary. The glossary includes more than basic or classic fabric names as well

as a pronunciation guide. Fiber modifications, finishes, and terminology related to performance have been incorporated. The extensive index will help individuals locate information needed for class or on the job. Appendix A lists fiber names in several languages that may be encountered in the global textile complex. Appendix B lists fibers that are no longer produced in the United States. Appendix C lists selected trade names for fibers, yarns, fabrics, finishes, and cleaning procedures. Appendix D is a map of the world that students can use to understand the global nature of the textile complex. Appendix E provides definitions from the Federal Trade Commission for care label terms. A shorter list of such terms is now in Chapter 20. Appendix F provides stain removal guidelines.

## Features of This Book

Instructors and students have always liked this book's summary and reference tables and charts, the presentation of information in a clear and consistent fashion, the emphasis on serviceability, and the numerous illustrations, graphics, and photographs. I tried to strengthen these things in this revision. The flowcharts from previous editions have been maintained, with some revisions. I revised, reorganized, or updated tables where necessary or where students or colleagues suggested improvements.

Although the basic content and flavor of *Textiles* remain intact, the changes help students recognize and focus on the most important material. Objectives and key terms for each chapter were updated so that students will be able to identify and understand the major concepts. After reading and studying each chapter, students should be able to define each term in the key terms list and describe how terms relate to each other and to the chapter content. Additional review questions provide students with an opportunity to test their level of understanding, focus on key concepts or applications, and integrate the information. I updated the list of readings for students who would like to investigate topics beyond the scope of the book. Many of these readings are technical in nature. There are a few articles on textiles in the popular press, but these often include little substantive information. Hence, the most valuable articles and books tend to be those written from a technical perspective.

## Major Changes and Additions

The emphasis in this revision has been on updating and adding material where new processes or concerns have developed in the professional workplace, in the global textile complex, or among consumers. I added explanations, expanded discussions, and clarified concepts in areas where students had indicated the need or where colleagues expressed or suggested improvements. Terminology incorporates an industry perspective so that professionals can understand and communicate with other professionals. The pronunciation guide included with some words in the glossary will help professionals pronounce and use terms correctly. I kept the expanded index to facilitate the book's use as a resource by professionals who need to locate information quickly regarding a specific term,

process, or product. Color photographs and diagrams make the text more interesting and concepts easier to understand.

The book continues to focus on the three major end-uses of textiles: apparel, interiors, and technical products. However, many changes have been made in the text. Technological advances and new industry and societal concerns that have arisen or have increased in importance since the last edition are included. Several topics have been reorganized to more closely represent industry practices or to enhance learning. New fibers have been added to the fiber section.

The discussion of dyeing and printing has separated the resist dyeing methods from printing methods. The discussion of finishing is organized so as to make it understandable to students. In some cases, this approach combines mechanical and chemical finishes—an anathema to the textile purist, but an approach that works well with students. Nanotechnology and changes in chemicals and processes reflect the ever-increasing interest in sustainability.

The chapter on career opportunities has been extensively revised. This discussion is intended to help students understand careers and how they will apply their knowledge of textiles and textile products in their professional work. It should help students gain a better understanding of careers and how professionals interact with each other. Although this chapter may not be assigned in a beginning textile course, students might read the chapter on their own to explore career possibilities and use the information when considering career options other than those that are most obvious to the consumer.

Learning Activities and a case study are included with every chapter. The Learning Activities were developed to make use of the Basic Swatch Kit available to be purchased at a discount with this book. Other Learning Activities have been developed to allow students to discuss topics in small groups or use the textiles they are wearing as learning tools. I tried to keep these activities independent of additional resources. Key concepts for each chapter have been emphasized. Review questions have been included at the end of each main section of the book to encourage students to connect textile components to product characteristics and performance.

## Supplements

### Instructor Resources

- **Instructor's Manual** that includes an updated outline of the material for each chapter, a revised list of suggested activities, and sample test questions in a variety of formats.
- **PowerPoint Presentation** for use in lectures or as a supplement to class activities.
- **Online Instructor's Resource Center** to access supplementary materials online. Instructors need to request an instructor access code. Go to [www.pearsonhighered.com/irc](http://www.pearsonhighered.com/irc), where you can register for an instructor access code. Within 48 hours after registering, you will receive a confirming e-mail, including an instructor access code. Once you have received your code, go to the site and log on for full instructions on downloading the materials you wish to use.



## Student Resources

- **Swatch Kit** that is packaged in a 3-ring binder and includes 126 fabric swatches, master list of the fabric swatches (with fabric name, description, and fiber content), heavyweight mounting sheets, linen tester/stitch counter, and Textile Companion CD with more than 1300 fabric images.
- **MyTextilesLab** is an exciting new online digital resource that will contain cutting edge videos, animations, comprehensive digital fabric glossary, audio pronunciation guide, career interviews, learning activities, and assessment materials.

## Acknowledgments

I used the comments and contributions of many students and colleagues in preparing this revision. I find students' comments help the most in evaluating the approach, wording, and style of presentation, and therefore I appreciate hearing from any student or faculty member about the book. Thanks to retired faculty Nancy Owens and Barbara Harger, who were generous in sharing their perspectives and suggestions for improvements. Both positive and negative comments are incredibly helpful and invaluable in revising the book. I would especially like to thank Sara Marcketti and Carmen Keist of Iowa State University for their suggestions and perspectives. Thanks to reviewers for their comments and suggestions: Heather Akou, Indiana University; Deborah Carlson, Cleveland Institute of Art; Melinda Cowen, Florida State University; Yehia Elmogahzy, Auburn University; Kay Grise, Florida State University; Robert Gruber, Drexel University; George Hodge, North Carolina State University; Janice Lessman-Moss, Kent State University; Sara Marcketti, Iowa State University; Ajoy Sarkar, Colorado State University; and Patricia Walton, Georgia Southern University. Great thanks to my sister, Lora Camacho, who kept me fed and the house clean while I worked on this edition. And finally, thanks to Clementine, Silkie, Imp, and Sampson, who reminded me that 5 p.m. is feeding time—every day!

Revising this book is always an exciting challenge. I enjoy the opportunity to explore the textiles literature in more depth than university responsibilities usually allow. I enjoy sharing the exciting area of textiles with so many others. I hope that this book hooks you on textiles as the third edition of this book did for me when I was a college sophomore just beginning to learn about textiles.

Sara J. Kadolph

## About the Author

Sara J. Kadolph is a full professor of Textiles and Clothing at Iowa State University in Ames, Iowa, where she has taught for 30 years. She teaches several courses related to textiles: chemistry, dyeing, quality assurance, and conservation. Dr. Kadolph is the recipient of numerous teaching, advising, and professional awards including teaching excellence awards from the International Textiles and Apparel Association, Iowa State University, and the Iowa Association of Family and Consumer Sciences. She holds the Donna R. Danielson Professorship in Textiles and Clothing. She is a Fellow of the International Textiles and Apparel Association and a Wakonse Fellow.

Dr. Kadolph has consulted with companies in the textile complex to solve quality problems, educate product development/design teams, select materials, assess textile performance, write specifications, and develop quality assurance programs. Her teaching and research scholarship has been published in the *Clothing and Textiles Research Journal*, the *Journal of the Society of International Natural Dyeing*, the *Journal of the Korean Society for Clothing Industry*, the *Journal of Consumer Education*, the *Journal of Family and Consumer Sciences*, the *International Journal of Clothing and Science Technology*, and others. Her *Textiles* book with Pearson Education is used in colleges and universities throughout the world. She is currently working on two other books related to textiles for Pearson Education.

# brief contents

## **SECTION I: Introduction to Textiles**

- 1 Introduction | 5
- 2 Product Development from a Textile Perspective | 17

## **SECTION II: Fibers**

- 3 Textile Fibers and Their Properties | 31
- 4 Natural Cellulosic Fibers | 57
- 5 Natural Protein Fibers | 83
- 6 The Fiber-Manufacturing Process | 111
- 7 Manufactured Regenerated Fibers | 131
- 8 Synthetic Fibers | 151
- 9 Special-Use Fibers | 189

## **SECTION III: Yarns**

- 10 Yarn Processing | 213
- 11 Yarn Classification | 235

## **SECTION IV: Fabrication**

- 12 Weaving, Basic Weaves, and Fabrics | 255
- 13 Fancy Weaves and Fabrics | 291
- 14 Knitting and Knit Fabrics | 311
- 15 Other Fabrication Methods | 339

## **SECTION V: Finishing**

- 16 Finishing: An Overview | 375
- 17 Aesthetic Finishes | 395
- 18 Special-Purpose Finishes | 415
- 19 Dyeing and Printing | 441

## **SECTION VI: Other Issues Related to Textiles**

- 20 Care of Textile Products | 477
- 21 Legal, Sustainability, and Environmental Issues | 505
- 22 Career Exploration | 531

# contents

## SECTION I: Introduction to Textiles



### Introduction | 5

Chapter Objectives	5
Textiles and Textile Products	6
The Global Textile Complex	10
Key Terms	13
Review Questions	13
Case Study: Women's Wear	14
Suggested Readings	14



### Product Development from a Textile Perspective | 17

Chapter Objectives	17
Serviceability and the Consumer	20
Performance	22
Information Sources	24
Key Terms	25
Review Questions	25
Section Review Questions	25
Case Study: Product Development	26
Suggested Readings	26

## SECTION II: Fibers



### Textile Fibers and Their Properties | 31

Chapter Objectives	31									
Fiber Properties	33									
Physical Structure	34 • Chemical Composition and Molecular Arrangement	38								
Serviceability	39									
Aesthetic Properties	42 • Durability Properties	42 • Comfort and Safety Properties	45 • Appearance-Retention Properties	47 • Resistance to Chemicals	48 • Resistance to Light	48 • Environmental Concerns and Sustainability	49 • Care Properties	50 • Cost	50 • Fiber Property Charts	50

### Fiber Identification 50

Visual Inspection	50	• Burn Test	51	• Microscopy	51
• Solubility Tests	53				

### Key Terms 54

### Review Questions 54

### Case Study: Diapers and Incontinence Products 55

### Suggested Readings 55



### Natural Cellulosic Fibers | 57

### Chapter Objectives 57

### Seed Fibers 60

### Cotton 60

### Other Seed Fibers 69

### Coir 69 • Kapok 70 • Milkweed 70

### Bast Fibers 70

### Flax 71

### Other Bast Fibers 74

### Ramie 74 • Hemp 74 • Jute 76 • Kenaf 76 • Hibiscus 76 • Nettle 76 • Bamboo 77

### Leaf Fibers 77

### Piña 77 • Abaca 77 • Sisal and Henequen 77

### Other Cellulosic Materials 78

### Key Terms 79

### Review Questions 79

### Case Study: Colored Cotton 80

### Suggested Readings 80



### Natural Protein Fibers | 83

### Chapter Objectives 83

### Wool 85

### Production of Wool 86 • Types and Kinds of Wool 86 • Physical Structure of Wool 87 • Properties of Wool 91 • Environmental Concerns and Sustainability of Wool 94 • Uses of Wool 95



## Specialty Wools 96

Mohair 96 • Qiviut 97 • Angora 97 • Camel Hair 97 • Cashmere 97  
• Llama and Alpaca 98 • Vicuña and Guanaco 98 • Yak 99

## Silk 99

Production of Silk 99 • Physical Structure of Silk 101 • Chemical  
Composition and Molecular Structure of Silk 101 • Properties of Silk  
101 • Environmental Concerns and Sustainability of Silk 103 • Uses of  
Silk 104

## Spider Silk 105

## Identification of Natural Protein Fibers 105

## Key Terms 107

## Review Questions 107

## Case Study: Merino Wool 108

## Suggested Readings 108



## The Fiber-Manufacturing Process | 111

### Chapter Objectives 111

### Fiber Spinning 114

Spinning Methods 115

### Fiber Modifications 116

Spinneret Modifications 116 • Molecular Structure and Crystallinity  
Modifications 118 • Additives to the Polymer or Spinning  
Solution 119 • Modifications in Fiber Spinning 121 • Complex  
Modifications 122

### Environmental Concerns and Sustainability of Manufactured Fibers 124

### Manufactured-Fiber Consumption 125

### Manufactured Versus Natural Fibers 125

### Key Terms 126

### Review Questions 127

### Case Study: Brand Logos and Counterfeiting 127

### Suggested Readings 128



## Manufactured Regenerated Fibers | 131

### Chapter Objectives 131

### Cellulosic Regenerated Fibers 132

Rayon 132 • Lyocell 137 • Acetate 140 • Other Regenerated  
Cellulosic Fibers 144

### Other Regenerated Fibers 145

### Identification of Regenerated Fibers 146

### Key Terms 146

### Review Questions 147

### Case Study: Eco-Fashion 147

### Suggested Readings 148



## Synthetic Fibers | 151

### Chapter Objectives 151

### Synthetic Fibers: An Overview 152

Common Properties of Synthetic Fibers 153 • Common Manufacturing  
Processes 154 • Identification of Synthetic Fibers 156 • Common Fiber  
Modifications 157

### Synthetic Fibers 158

Nylon 158 • Polyester 166 • Olefin 174 • Acrylic 179

### Key Terms 185

### Review Questions 186

### Case Study: Green Apparel 186

### Suggested Readings 187



## Special-Use Fibers | 189

### Chapter Objectives 189

### Elastomeric Fibers 190

Rubber 190 • Spandex 191 • Elastoeester 194 • Elastereil-p 194 •  
Lastol 194

### Fibers with Chemical, Heat, or Fire Resistance 195

Aramid 195 • Glass 196 • Metal and Metallic Fibers 198 • Modacrylic  
Fibers 199 • Novoloid 200 • PBI 201 • Sulfar 201 • Saran 201 •  
Vinyon 202 • Vinal 202 • Fluoropolymer 203 • Carbon 203 •  
Melamine 204

### Other Special-Use Fibers 205

### Key Terms 206

### Review Questions 206

### Section Review Questions 207

### Case Study: PBI and Its Expanding Markets 208

### Suggested Readings 208

## SECTION III: Yarns



## Yarn Processing | 213

### Chapter Objectives 213

### Filament Yarns 214

Smooth-Filament Yarn 215 • Monofilament Yarns 215 • Tape and  
Network Yarns 215 • Bulk Yarns 216

### Spun Yarns 218

Processing Staple Fibers 220 • Inserting Yarn Twist 222 • Alternate  
Spun-Yarn Processes 224 • Spinning Filament Tow into Spun  
Yarns 226 • High-Bulk Yarns 227

Fiber Blends 227

Blend Levels 228 • Blending Methods 229 • Blended-Filament Yarns 229

Environmental Concerns and Sustainability of Yarn Processing 230

Key Terms 231

Review Questions 231

Case Study: Energy Use in Yarn Spinning 232

Suggested Readings 232



## 11 Yarn Classification | 235

Chapter Objectives 235

Fiber Length 236

Yarn Twist 237

Direction of Twist 237 • Amount of Twist 237

Yarn Size 239

Yarn Number 239 • Denier System 240 • Tex System 240

Yarn Regularity 241

Simple Yarns-241 • Sewing and Embroidery Thread 242

• Fancy Yarns 243 • Composite Yarns 245

Yarn Performance and Yarn Quality 247

Key Terms 249

Review Questions 249

Section Review Questions 250

Case Study: Tweed Yarn 250

Suggested Readings 251

## SECTION IV: Fabrication



## Weaving, Basic Weaves, and Fabrics | 255

Chapter Objectives 255

Fabric Quality 256

Woven Fabrics 257

The Loom 258

Preparing for Weaving 260 • Loom Advancements 260

Characteristics of Woven Fabrics 263

Warp and Filling 264 • Grain 264 • Fabric Count 264 • Balance 265

• Selvages 265 • Fabric Width 266 • Fabric Weight 266

Properties of Woven Fabrics 267

Naming and Diagramming Woven Fabrics 269

Plain Weave 271 • Twill Weave 280 • Satin Weave 283

Key Terms 286

Review Questions 287

Case Study: Denim 288

Suggested Readings 289



## Fancy Weaves and Fabrics | 291

Chapter Objectives 291

Dobby Weaves 294

Extra-Yarn Weaves 294

Piqué Weaves 295

Jacquard Weaves 296

Momie Weaves 297

Leno Weaves 298

Double Cloth 299

Double Weaves 299 • Double-Faced Fabrics 300

Pile Weaves 301

Filling-Pile Fabrics 301 • Warp-Pile Fabrics 302

Slack-Tension Weaves 305

Tapestry Weave 305

Narrow Fabrics 306

Key Terms 306

Review Questions 307

Case Study: Damask for the Hospitality Industry 307

Suggested Readings 308



## Knitting and Knit Fabrics | 311

Chapter Objectives 311

Knitting 313

Needles 315 • Stitches 315 • Fabric Characteristics 315 •

Environmental Concerns and Sustainability of Knitting 316

Filling (or Weft) Knitting 317

Machines Used in Filling Knitting 318 • Filling-Knit

Structures—Stitches 319 • Filling-Knit Fabrics 320

Warp Knitting 328

Machines Used in Warp Knitting 330 • Warp-Knit Fabrics 330

• Minor Warp Knits 333

Narrow Knitted Fabrics 334

Warp Knits Versus Filling Knits 334

Key Terms 335

Review Questions 335

Case Study: Developing the Competitive Edge in the Knit Industry 336

Suggested Readings 336



## Other Fabrication Methods | 339

Chapter Objectives 339

Fabrics From Solutions 340

Films 340 • Foams 342

## Fabrics From Fibers 342

Nonwoven or Fiberweb Structures 342 • Felt 347 • Netlike Structures 347

## Fabrics From Yarns 348

Braids 348 • Lace 348 • Embroidery 350

## Composite Fabrics 351

Coated Fabrics 351 • Poromeric Fabrics 353 • Suedelike Fabrics 353  
• Flocked Fabrics 354 • Tufted-Pile Fabrics 357 • Laminates 359  
• Stitch-Bonded Fabrics 361 • Supported-Scrim Structures 363  
• Fiber-Reinforced Materials 364

## Animal Products 365

Leather 365 • Suede 367 • Fur 367

## Key Terms 368

## Review Questions 369

## Section Review Questions 369

## Case Study: Leather 370

## Suggested Readings 370

# SECTION V: Finishing



## Finishing: An Overview | 375

### Chapter Objectives 375

### Routine Steps in Producing a Fabric 379

Fiber Processing 379 • Yarn Processing 379 • Yarn Preparation 380  
• Fabrication 380 • Fabric Preparation 381 • Whitening 384  
• Alternate Preparation Steps 385 • Coloration 386 • Finishing 386  
• Drying 386 • Reworking 388

### Routine Finishing Steps for Wool Fabrics 388

Crabbing 388 • Decating 389 • Carbonizing 389 • Pressing 389

### Environmental Concerns and Sustainability of Finishing 390

### Key Terms 391

### Review Questions 391

### Case Study: Finishing Linen Fabric 392

### Suggested Readings 392



## Aesthetic Finishes | 395

### Chapter Objectives 395

### Luster 398

Glazed 398 • Ciré 399 • Plasticize 399 • Moiré 399 • Schreiner 399  
• Embossed 400

### Drape 400

Transparent and Crisp 400 • Burned-Out 401 • Sizing 401  
• Weighting 401

### Texture and Hand 402

Embossed 402 • Pleated 402 • Puckered Surface 402 • Plissé 403

• Flocked 403 • Embroidered 404 • Expanded Foam 405 • Sheared 405 • Brushed 405 • Napped 405 • Crepeing 407 • Fulled 407  
• Beetled 407 • Coronized 408 • Emerizing, Sueding, or Sanding 408  
• Abrasive, Chemical, or Enzyme Washes 408 • Silk Boil-Off 410  
• Caustic Treatment 410 • Hand Builders 411

## Key Terms 412

## Review Questions 412

## Case Study: Embroidery Exhibit 413

## Suggested Readings 413



## 18 Special-Purpose Finishes | 415

### Chapter Objectives 415

### Stabilization: Shrinkage Control 416

Relaxation Shrinkage and Finishes 417 • Progressive Shrinkage and Finishes 418

### Shape-Retention Finishes 420

Theory of Wrinkle Recovery 420 • Durable Press 420 • Quality Performance Standards and Care 422

### Appearance-Retention Finishes 423

Soil- and Stain-Release Finishes 423 • Abrasion-Resistant Finishes 424 • Antislip Finishes 425 • Fume-Fading-Resistant Finishes 425  
• Surface or Back Coatings 425 • Light-Stabilizing Finishes 426  
• Pilling-Resistant Finishes 426 • Anti-Yellowing Finishes 426

### Comfort-Related Finishes 427

Water-Repellent Finishes 427 • Moisture Management Finishes 428  
• Porosity-Control Finishes 429 • Water-Absorbent Finishes 429  
• Ultraviolet-Absorbent Finishes 429 • Antistatic Finishes 430  
• Fabric Softeners 430 • Phase-Change and Temperature Regulation Finishes 431

### Biological-Control Finishes 431

Insect- and Moth-Control Finishes 431 • Mold- and Mildew-Control Finishes 432 • Rot-Proof Finishes 433 • Antimicrobial Finishes 433  
• Microencapsulated Finishes 434

### Safety-Related Finishes 434

Flame-Retardant Finishes 434 • Liquid-Barrier Finishes 436  
• Light-Reflecting Finishes 436

## Key Terms 437

## Review Questions 438

## Case Study: Fragrance and Textiles 438

## Suggested Readings 439



## Dyeing and Printing | 441

### Chapter Objectives 441

### Color Theory and Practice 443

### Colorants 445

Pigments 446 • Dyes 447



## Stages of Dyeing 450

Fiber Stage 451 • Yarn Stage 452 • Piece or Fabric Stage 453  
• Product Stage 453

## Methods of Dyeing 454

Batch Dyeing 454 • Package Dyeing 455 • Combination Dyeing 455

## Resist Dyeing 456

## Printing 457

Direct Printing 458 • Discharge Printing 461 • Screen Printing 461 • Other Printing Methods 463

## Recent Developments in Dyeing and Printing 464

## Color Problems 466

## Environmental Concerns and Sustainability of Dyeing and Printing 468

## Key Terms 470

## Review Questions 471

## Section Review Questions 472

## Case Study: Understanding Color Matching 472

## Suggested Readings 473

# SECTION VI: Other Issues Related to Textiles



## Care of Textile Products | 477

### Chapter Objectives 477

### Factors Related to Cleaning 479

Soil and Soil Removal 479 • Detergency 480 • Solvents 481

### Laundering 482

Synthetic Detergents and Soaps 483 • Other Additives 485  
• Sorting 488 • Washing Machines 488

### Drying 490

### Commercial Laundering 491

### Dry Cleaning 492

### Dry Cleaning of Leather and Fur 493

### Home Solvent Cleaning 493

### Professional Wet Cleaning 494

### Storage 495

### Other Cleaning Methods 495

Vacuuming 496 • Wet Cleaning 496 • Dry-Foam Cleaning 497  
• Hot-Water Extraction 497 • Absorbent Powder Cleaning 498  
• Ultrasonic Cleaning 498

### Conservation Practices 498

### Environmental Concerns and Sustainability of Cleaning 499

### Key Terms 500

### Review Questions 501

### Case Study: Dryer Sheets 501

### Suggested Readings 502



## Legal, Sustainability, and Environmental Issues | 505

### Chapter Objectives 505

### Labeling Laws and Care Regulations 506

Silk Regulation, 1932 506 • Wool Products Labeling Act, 1939 (Amended) 506 • Fur Products Labeling Act, 1952 (Amended) 507  
• Textile Fiber Products Identification Act, 1960 (Amended) 507  
• Permanent Care Labeling Regulation, 1972 (Amended) 509

### Laws and Regulations Related to Safety 510

Flammable Fabrics Act, 1953, and Its Amendment 511 • Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) 513 • Consumer Product Safety Improvement Act (CPSIA) 514

### Other Label Information 514

Mandatory and Voluntary Labeling Programs 514

### Codes 515

### Tort 516

### Consumer Recourse 517

### Sustainability Issues 518

### Environmental Issues 520

Environmental Laws and Regulations 522 • Efforts within the Global Textile Complex 523 • Environmental Health and Safety 524

### Disposal and Recycling 525

### Key Terms 527

### Review Questions 527

### Case Study: Floor Coverings 528

### Suggested Readings 528



## Career Exploration | 531

### Chapter Objectives 531

### Sourcing 533

### Product Development 534

### Production 535

### Design 536

### Merchandising 538

### Marketing 540

### Entrepreneurs 540

### Government 541

### Other Career Areas 541

### Summary 542

### Key Terms 543

### Review Questions 543

### Section Review Questions 543

### Case Study: The Resume 544

### Suggested Readings 544

## Appendixes

- A** Fiber Names in Other Languages | 545
- B** Fibers No Longer Produced  
in the United States | 546
- C** Selected Trade Names | 547
- D** A Map of the World | 551

**E** Standard Care Terminology | 552

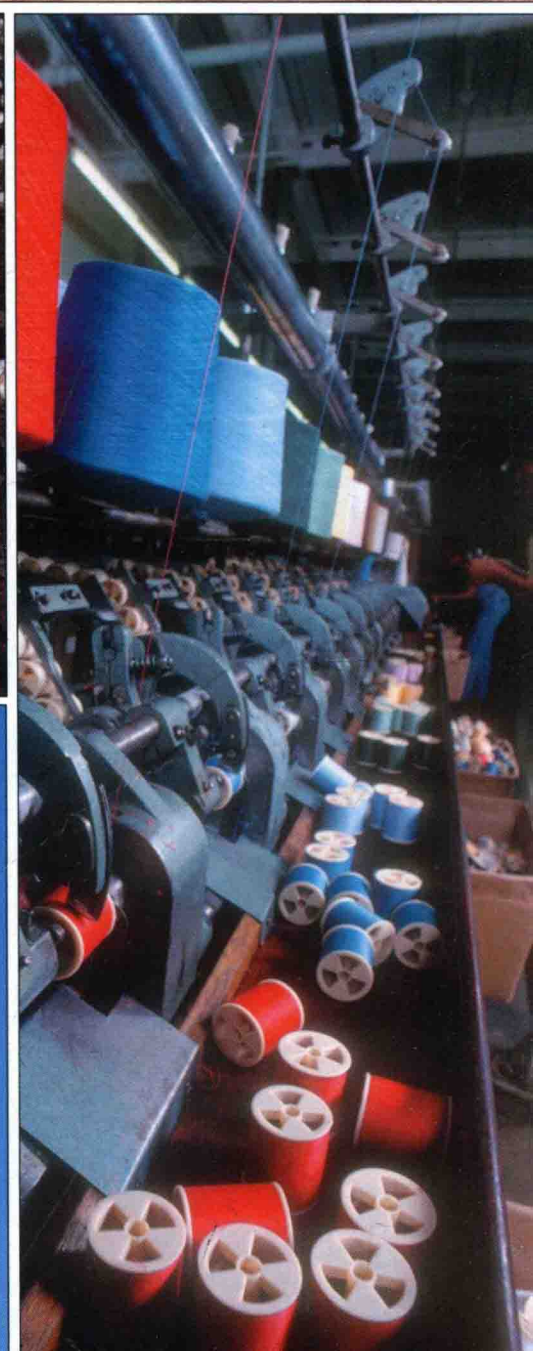
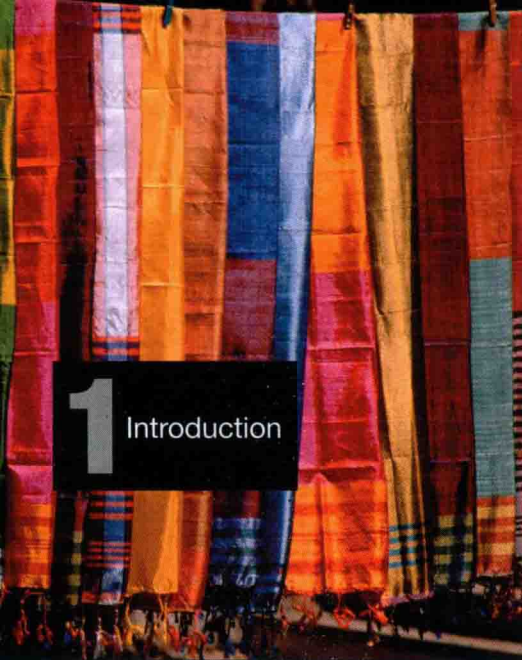
**F** A Guide to Stain Removal | 554

**GLOSSARY** | 558

**INDEX** | 572

**Textiles**





# Introduction to **TEXTILES**



**SECTION I**



