

**Textile Fibers, Dyes,  
Finishes, and Processes**

**A Concise Guide**

**Howard L. Needles**

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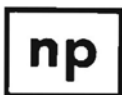
# TEXTILE FIBERS, DYES, FINISHES, AND PROCESSES

**A Concise Guide**

by

**Howard L. Needles**

University of California, Davis  
Davis, California



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## Preface

Fibers from natural sources have been used for thousands of years for producing textiles and related products. With the advent of the spinning jet in the mid-19th century, fibers could be formed by forcing dissolved polymeric materials through a small orifice (spinneret) into a coagulating bath. Regenerated natural and synthetic man-made fibers have been formed by this basic spinning technique or variations thereof since then. By the turn of the 20th century, rayon, a regenerated cellulosic and the first man-made fiber of commercial importance, was in full production. By the 1920s the cellulose derivatives acetate and triacetate were introduced as fibers of commerce, and inorganic glass fibers appeared during the mid-1930s. The first synthetic fiber (nylon) chemically synthesized from basic monomeric units and based on petroleum feedstocks appeared in the late 1930s. The advent of nylon marked a new era for fiber production, and several new types of synthetic fibers, including polyester, acrylic, modacrylic, polyolefin, and vinyl fibers, appeared in the 1940s, 1950s, and 1960s.

In less than 40 years we have gone from a period where fibers were available only from natural or regenerated sources to a time where a broad spectrum of fibers are available. The wide range of properties available in fibers today has greatly expanded the applications and areas in which fibers can be used. Even with such a range of properties available in fibers, each class of fiber has inherent deficiencies that require that chemical finishes or physical modifications be applied to the fiber. Also, addition of color to the fiber through dyeing or printing is necessary to meet the demand of the consumer for a wide spectrum of colors and patterns in textile products. Since 1945 a number of new textile processes have been introduced providing unique methods to form yarns and textile substrates of widely varying structure and properties. This book addresses itself to the structure and properties of textile fibers, dyes, and finishes and the processes used in fiber, yarn, and substrate formation and in dyeing and finishing of these substrates.

Owing to the growing number, types, and complexity of fibers now available for use in consumer textiles, students or professionals in textiles, textiles and clothing, and textile science need not only a listing of fibers and fiber properties but also a firm foundation in the relationship of fiber structure to the physical and chemical properties of fibers, as well as the consumer end-use properties that result in textiles made from these fibers. They also need to be acquainted with the processes used in formation of textile fibers, yarns, and fabric substrates and in dyeing and finishing these substrates. Textbooks in consumer textiles often stress the more aesthetic areas of textiles, whereas textbooks in textile chemistry and textile physics present a highly rigorous approach to the field. A book which lies between these two extremes would be of value to those with an intermediate understanding of the physical sciences. Thus this book discusses textile fibers, dyes, finishes, and processes using this intermediate approach, presenting in a concise manner the underlying principles of textile chemistry, physics, and technology. It should be an aid to students and professionals in textiles, textiles and clothing, and textile science, who desire a basic knowledge of textile fibers, finishes, and processes and their related consumer end-use. The book should also serve as a sourcebook of information within the textile and apparel industries.

I thank my colleagues and students who have contributed in numerous ways to this book. I especially thank Barbara Brandon for her expert preparation of the book for print.

University of California, Davis  
March, 1986

Howard L. Needles

## ABOUT THE AUTHOR

Howard L. Needles is presently Professor of Textiles and Materials Science at the University of California, Davis. After receiving his doctorate in organic chemistry from the University of Missouri in 1963, he began his career conducting research on wool and related model systems. His research was then extended to include synthetic fibers and the effect of chemical modification on the dyeing and color properties of these fibers. He has also continued his studies at North Carolina State University and at the University of Leeds, England, and is also Program Chairman of the Cellulose, Paper and Textile Division of the American Chemical Society.





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