




SUSTAINABLE PRACTICES IN THE TEXTILE INDUSTRY

Edited By
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Preface

In recent years, the textile industry has been the focus of rising interest in global markets due to varied and changing world market conditions. Increasing environmental and health concerns owing to the use of large quantities of water and hazardous chemicals in conventional textile finishing processes, has led to the design and development of new dyeing strategies and technologies. Effluents produced from the textile wet processing industry are very diverse in chemical composition, ranging from inorganic finishing agents, surfactants, chlorine compounds, salts and total phosphate to polymers and organic products. This has forced Western countries to exploit their high technical skills for the advancement of textile materials with high quality technical performances, and the development of cleaner production technologies for cost-effective and value-added textile materials. *Sustainable Practices in the Textile Industry* is a collection of the current sophisticated ways used to minimize the use of bioresource products to improve dye extraction and dyeing properties. Highlighted in this book are the innovative ways in which wet chemical processing methods are used to alleviate the environmental impacts arising from this sector. The major challenge in the textiles and fashion sector is that it requires massive sustainable innovation in terms of material and end-use products to mitigate the huge environmental impacts arising from chemical processing. Therefore, this book also contains innovations in eco-friendly methods for textile wet processes and applications of enzymes in textiles in addition to advancements in the use of nanotechnology for wastewater remediation.

The book is compiled of 13 chapters from various research areas dealing with the application of different sustainable technologies for enhancing the dyeing and comfort properties of textile materials with substantial reduction in wastewater problems. [Chapter 1](#) deals with the sustainable extraction of natural dyes from plant sources and their subsequent applications in the textile industry. [Chapter 2](#) deals with the advancements in non-aqueous dyeing systems. [Chapter 3](#) gives a brief account of structural coloration of different textiles achieved as a result of scientific observations of nature. [Chapter 4](#) deals with the use of enzymes for enhancing dyeing properties of different textiles. [Chapter 5](#) deals with the use of sustainable processes for textile coating. [Chapters 6](#) through [8](#) give a detailed account of the functional finishing properties achieved on different textiles using different dyeing methods with natural and synthetic functional finishing agents. [Chapter 9](#) provides up-to-date information regarding sustainable development for brands and manufacturers in the textile industry. Finally, the remaining [Chapters 10](#) through [13](#) deal with the advanced techniques used for wastewater remediation.

The authors who contributed to this book are specialists in fields involved in using different dyeing systems other than aqueous solvent, employing enzymes in dyeing procedures, surface modifications, sustainable developments for textile manufactures, functional finishing and different advanced techniques for wastewater remediation. Thus, the editors hope that students, researchers and academicians of various fields, such as textile dyeing, chemical engineering, environmental science, materials science among others, will find this book of great interest and useful in their curriculum. We expect it will definitely be helpful for engendering new ideas in textiles research, leading to interdisciplinary research collaborations.

Now the time has come to thank those who supported this book in any way. We acknowledge the great efforts of the eminent authors without whom this book would have been unimaginable. We also appreciate the interest shown and the support given by the publisher, which allowed us to compile this reference book.

Luqman Jameel Rather
Aminoddin Haji
Mohd Shabbir

Part 1

**SUSTAINABLE DYE
EXTRACTION AND DYEING
TECHNIQUES**

1

Extraction and Application of Natural Dyes

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Indore, India*

Abstract

Environmental pollution and population explosion are becoming the world's biggest issues. Eco friendly products and practices are popularizing day by day due to present national and international awareness on environmental situations. Textile industries are one of the reasons of environmental pollution and affect all forms of life adversely. Textile dyeing process generally uses chemical dyes and synthetic mordants. Chemicals in the dyeing process began with the discovery of "Mauve" by WH Perkin in 1856. These synthetic dyes are manufactured from coal tar, petrochemicals and many other chemicals, which cause allergies such as contact dermatitis, respiratory diseases, skin irritation and cancer etc. Naturally dyed textile materials are in demand globally because of harmful effects of chemical dyeing and continuous efforts of researchers in this field. Natural dyes can be obtained from natural resources like plants, minerals, insects and fungi but most of the dyes are taken from plant parts i.e. leaves, barks, flowers, fruits and roots. Natural dyes have some special properties like soothing color, biodegradable, non-hazardous, non-carcinogenic and antimicrobial resistance etc. Natural dye extraction process requires plant parts and sometimes their by-products as a raw material. Natural dyeing practices enhance the cultivation of flowering crops,

which provides an extra source of income to farmers. Thus, large scale production of naturally dyed fabric in future will solve the problem of human as well as environmental health.

Keywords: Natural dyes, source, fiber, mordant, dyeing, fastness, antibacterial, UV-protection

1.1 Introduction

In the present scenario people are more inclined to be nature-friendly, health conscious and become aware about the environment. The meticulous environmental standards are being imposed by many countries in response to the toxic and allergic reactions associated with synthetic dyes. It has created a revolution in research and development in eco-friendly and non-toxic colorant. Environmental considerations are now becoming vital factors during the selection of consumer goods including textile as well as in cosmetic, pharmaceutical and food industry all over the world. Coloring agent or dyes play an important role in all these industries during manufacturing and other production process. Both qualitative and quantitative research investigations have been undertaken all over the world on safe coloring substance. Natural dyes are widely used in following application ([Figure 1.1](#)):

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