

Preface

The concept of sustainability is widely used in every industrial sector, including textiles and clothing industry and is one of the important agendas of today's textiles and clothing sector. The textile and clothing sector consists of a fairly long supply chain, starting with fiber formation and ending at the apparel production and consisting of many intermittent stages. When it comes to the lifecycle of textile products, this entire lengthy supply chain occupies nearly half and the rest is left to the consumers in terms of use and disposal stages. Measuring and practicing the sustainability of textile products through this lengthy supply chain and across all the lifecycle phases of a textile product is not an easy task, but doable though.

Since its first definition, sustainability has been used and defined in different sectors in various forms and it has many faces and facets. Referring to the very first definition of sustainable development, stemming from the Brundtland Report, a sustainable textile product is the one that is created, produced, transported, used, and disposed of with the due consideration to environmental impacts, social aspects, and economic implications, thereby satisfying all three pillars of sustainability. In the entire life span and across all the lifecycle phases, a sustainable textile product is expected to create the minimum possible or very least environmental and social impacts.

Any product demands deployment of various resources throughout its entire lifecycle and textile products are no exception to this. In a typical lifecycle model, textile products need various material, energy, and process inputs and create various outputs in their stages from cradle to grave. In the case of sustainable textile products, all these inputs and outputs are expected to ensure environmental and social friendliness and safety to human health throughout the entire lifecycle phases, apart from utilizing renewable and/or recycled input streams. A sustainable textile product should begin and end its lifecycle as smoothly as possible without harming the environment and human beings.

The textiles and clothing supply chain employs a wide array of raw materials, auxiliaries, and a long list of processing methods/sequences. Lifecycle assessment study of textile materials consists of a fairly long inventory list, even for a very simple textile product without many accessories (say, even a simple cotton t-shirt). Embracing the concept of sustainable development for a clothing product is quite ambitious and a cumbersome process too, because this has to be implemented in the lengthy supply chain and across the various lifecycle phases. This is the main

motivation of this roadmap series on sustainable textiles and clothing. In different volumes, this series covers detailed and minute aspects of sustainability in the textiles and clothing sector.

Volume one is the first step in this roadmap series and discusses sustainable (eco-friendly) raw materials, technologies, and processing methods in the textile and clothing sector. Information on sustainable raw materials and processing methods for the development of suitable textiles and clothing products is disseminated in this volume in 10 informative chapters dealing with various pertinent issues.

“[Natural Plant Fibers: Production, Processing, Properties and Their Sustainability Parameters](#)” deals with the topic of natural plant fibers. Among various natural plant fibers, very important fibers namely cotton, flax, jute, and hemp are chosen for discussion. This chapter includes various topics pertaining to these chosen fibers such as the present scenario, market trends, production, processing, and applications. And very importantly, this chapter highlights the details of various factors influencing the sustainability of these natural plant fibers by concentrating on various Lifecycle Assessment studies (LCA) on these fibers.

“[Natural Dyes: Sources, Chemistry, Application and Sustainability Issues](#)” and “[Sustainable Dyeing with Synthetic Dyes](#)” are dedicated to natural and synthetic dyes for textile application. “[Natural Dyes: Sources, Chemistry, Application and Sustainability Issues](#)” takes the readers through a complete journey on natural dyes covering the different sources, chemistry, and extraction of natural dyes, application methods, and various sustainability parameters and issues associated with the current natural dyes. With the similar frame, “[Sustainable Dyeing with Synthetic Dyes](#)” presents detailed discussions pertaining to the sustainability aspects of synthetic dyes. “[Sustainable Dyeing with Synthetic Dyes](#)” includes detailed discussions on the history of textile dyeing with synthetic dyes, an overview of synthetic dyes, and their applications on various textile materials by highlighting their sustainability aspects.

“[Biosynthetic Fibers: Production, Processing, Properties and Their Sustainability Parameters](#)” deals with the production, processing, applications, and sustainability implications of biosynthetic fibers. Potential fibers of this type, namely PLA (Poly Lactic Acid), soybean protein, casein, alginate, chitin, and chitosan are chosen for discussion in this chapter. LCA studies conducted on PLA fibers are also discussed to a great extent.

Another important topic under the captioned title of this volume of roadmap is recycling and applications of recycled fibers. “[Textiles and Apparel Development Using Recycled and Reclaimed Fibers](#)” is dedicated to the discussion of this important subject and it details the development of textiles and clothing products from recycled materials. Various aspects such as the classification of textile waste, recycling methods, various potential applications of recycled materials in the development of textile products, challenges, and the future prospects of the textile recycling industry are discussed.

“[Environment Friendly Textile Processing Using Plasma and UV Treatment](#)” deals with the processing of textiles using plasma and UV treatments. This chapter

includes the details pertaining to the different surface modification methods of textile materials, different types of plasma and UV treatments, and their generation methods. Detailed discussions pertaining to the applications of these treatments in textile chemical processing and finishing stages of textiles and the clothing sector are presented. A comparative look at conventional processing, plasma, and UV treatments is also discussed along with highlighting the sustainability advantages of plasma and UV treatments.

“[Sustainable Textile Wet Processing-Applications of Enzymes](#)” is dedicated to the subject of enzymes and their applications in textile chemical processing. Enzymes, one of the important elements used in the textile sector today are a sustainable alternative to toxic textile chemicals used in the clothing sector. An overview of classification, advantages and disadvantages, and the mechanism of enzymes are presented here. Applications of enzymes in various textile processing steps are discussed in detail.

“[Regenerated Cellulosic Fibers and Their Implications on Sustainability](#)” deals with the sustainability aspects of regenerated cellulosic fibers. This chapter includes the present scenario, production technologies, properties, applications, and market trends of these fibers. Different sustainability issues pertaining to the production of regenerated cellulosic fibers are also presented.

“[Application of Bio-Technology in the Processing of Textile Fabrics](#)” talks about the applications of biotechnology in the textile sector. This wide subject has been dealt in detail in this chapter through various topics such as the overview of industrial biotechnology and its role in achieving a low carbon economy, green polymers, different enzymes used for bioprocessing, employment of biotextiles in various industrial textile applications, and the applications of biotechnology for the development of sustainable textiles.

“[Jute-Based Sustainable Agrotextiles, Their Properties and Case Studies](#)” deals with the details pertaining to jute-based agro textiles and its implications on sustainability. Jute is one of the important natural fibers being discussed widely under the fold of sustainable textiles. This chapter presents the properties of jute-based agro textiles and its associated case studies.

I would like to take this wonderful opportunity to thank all the contributors of different chapters included in this first roadmap volume of sustainable textiles and clothing for their incredible efforts in bringing out this book successfully with the enriched technical content in their chapters. I have no doubt that readers will certainly benefit from this book which brings out the important details associated with sustainable raw materials, processing methods, and techniques of the textile and clothing sector. This first roadmap volume on sustainable textiles and clothing will certainly become an important reference for the researchers and students, industrialists, and sustainability professionals working in this field.

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