Environmental Footprints and Eco-design of Products and Processes

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Sustainable Fibres for Fashion Industry

Volume 1

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Introduction

The concept of sustainability is widely used in every industrial sector including textiles and clothing. According to Muthu (2014, p. v) *a sustainable textile product is the one that is created, produced, transported, used and disposed of with due consideration of environmental impacts, social aspects and economic implications.*

The social and environmental impacts from textile production are varied and evidence a mosaic of interconnected flows of the resources affected. According to Kate Fletcher and Lynda Grose (2012), fibers visibly connect us to many of the major issues of our time: Somehow we can relate climate change, waste production, and water shortage to material use, treatment, and demand. More specifically, Gardetti and Torres (2013, p. 7) state that the impacts of fiber extraction are *the use of pesticides during this process leads to workers' health issues, causes soil degradation and biodiversity loss. Water is vital in the processing of cotton, in particular, that this crop has been called the "thirsty crop." While the use of agrochemicals tends to be reduced, the use of genetically modified organisms for such purposes could lead to another type of impacts. Abuses on working conditions are also commonly presented in other stages of these industries; many times, human rights are violated in the so-called sweatshops which are characterized by low wages and long working hours. The risks are even greater if safety and health care systems are not appropriate. In turn, many of the synthetic fibers are derived from a non-renewable resource such as oil. In general, environmental abuse combines with ethical issues when water is overused, and when land for food production is usurped.*

Fibers (materials) are an essential element in fashion: They turn symbolic into real production while providing us with the physical means to build our identity and act as social beings as individuals. (Fletcher 2008 and 2014).

Fletcher (2008) explained very clearly that one of the first tasks is to acknowledge this complexity and to build expertise with a portfolio of more sustainable fibers because of their appropriateness to both product and user. Indeed, perhaps one of the greatest challenges of sustainability is to become skilled at this task. We should be able to translate the *system* "big-picture" issues (e.g., diversity, ethics, or consumption) and the *product* "small-picture" detail (e.g., fiber life-cycle

analysis profile) and transfer such knowledge to our daily work so as to be able to make decisions that are simple and practical.

The fashion and textile industry's future success will depend on us reducing its environmental and social burden across the *entire* life cycle. And, for such purpose, we should develop a more pluralist, decentralized, and diverse approach. That is the hallmark of this first volume of Sustainable Fibers for Fashion Industry.

This book begins with a chapter written by Ammayappan Lakshmanan, Seiko Jose, and Sujay Chakraborty, titled "Luxury Hair Fibers for Fashion Industry". Their work analyzes animal hair fibers with limited production and unique characteristics that are used in the fashion industry to enhance the aesthetic and prestige look of garments. To sustain the luxury hair fiber industry, the authors look into existing luxury hair fibers in the fashion market and their potential applications.

Along this line, the chapter titled "Mainstreaming of Sustainable Cotton in the German Clothing Industry", by Erik G. Hansen, analyzes the sustainability-oriented transformation of clothing industries. While sustainability pioneers introduce new products in niche markets, incumbents advance them into the mass market. Together this can lead to the transformation of industries, markets, and consumer habits. This chapter reviews the German clothing retail industry with a focus on organic cotton and related sustainable fibers. The analysis also covers 4 of the 10 largest German textile retailers.

Moreover, in the third chapter titled "Possum Fiber—A Wonderful Creation of Nature", Mohammad Mahbubul Hassan analyzes possum fiber, which is harvested from a rodent called the "possum." The fiber is very soft and smooth unlike merino wool fiber. In addition, it is quite different from other animal fibers because of its unique shape and morphology. Over the past 15 years, the possum fur industry has grown in New Zealand, and when the fiber is blended with merino wool it produces various luxury apparels including coats, jackets, scarves, and cloaks. However, it poses some challenges due to its color (reddish brown). Therefore, in this chapter, the following are both analyzed and discussed: the brushtail possum and their habitat and food; the harvesting of possum fur; the physical and mechanical properties of possum fiber; and the mechanical and chemical processing methods, including bleaching and dyeing, of possum fur. Sanjoy Debnath explains, in the work "Natural Fibres for Sustainable Development in Fashion Industry", the large number of natural fibers available in nature from plants, animals, insects, and minerals. Accordingly, these fibres—alone or mixed with other fibres—are used in the design and development of specific fashion products. Different fashion industries have been developed all over the world to produce different fiber-based fashion products. These fashion industries have a huge potential for value addition with the intervention of newer product design. Recent trends also show the use of these natural fibers for sustainable growth in the fashion industry. This chapter also deals with future aspects of the use of uncommon natural fiber for sustainable fashion industry.

The next chapter, "Sustainable Bio Polymer Fibers—Production, Properties and Applications", by Karthik Thangavelu and Krishna Bala Subramani, deals with the less investigated and emerging biopolymer fibers, which will have huge impact on

the sustainable luxury fashion going forward. The bio-fibers from animal protein (spider silk, hag fish slime), regenerated cellulose (seaweed), regenerated protein (milk fiber), and biopolymers synthesized from bio-derived monomers (PLA, PTT) are discussed in depth. The raw materials for the production and extraction of fibers, the properties and application of fibers, and the ecological impact of fibers are analyzed as well.

The last chapter of this first volume, developed by Y.A. Lee, is a case study titled "Case Study of Renewable Bacteria Cellulose Fiber and Biopolymer Composites in Sustainable Design Practices". This case study challenges researchers and practitioners to rethink what constitutes sustainable consumer products in a world of increasingly stressed natural resources by exploring innovative ways to develop renewable biocomposite materials, such as leather-like nonwoven fabrics, which can be used for apparel and footwear products.

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