

Industrial and Commercial Applications of Used Defense Technical Textiles Polymer Product Recycling

Dinesh Desai,^{*1} Kintu Jain,² Nirav Solanki²

Summary: The global market for technical textiles is rising as never before. Although US and EU continue to be major manufacturers and consumers of technical textiles, the Asian countries like China and India have recently emerged as chief production centers of technical textiles. In the year 2000, the world market for technical textiles was estimated to have value of US \$ 93 billion, which has already crossed US\$126 billion in 2010. Also in last five years, the textiles disposed of in landfill sites have raised from 7% to 30% in US alone. Soon the technical textile will have similar story all over the world because this being very strong, durable and versatile material and hence, will not degrade or destroy easily in the nature. With increase of its demand and consumption, the problem for its disposal will also increase many fold. The technical textiles are grouped in 12 main categories. Out of it, Protech (personal and property protection) textile, broadly refers to “Defense Textile” has been given special reference in this paper. Experiments have shown that the major properties of these textiles do not deteriorate much even after its main use for years. Finally ways and means for innovative, added-value applications for recycled defense textiles and making desirable products out of recycled post-consumer materials are explained in this paper.

Keywords: application; commercial; defense; protech; reuse; technical textile

Introduction

Technical Textiles are the high performance fabrics specially manufactured for various industrial specialized individual applications. These products are primarily preferred for their functional attributes. They are manufactured for 12 broad categories. They are i. Agriculture and Horticulture (Agro-tech) ii. Architecture (Build-tech) iii. Building and Construction Clothing Technology (Cloth-tech) iv. Geotextiles (Geo-tech). v. Functional home Textiles (Home-tech). vi. Industrial Textiles (Indu-tech). vii. Medical and Hygiene

(Med-tech). viii. Transportation (Mobil-tech). ix. Environmental friendly (Oeko-tech). x. Packaging (Pack-tech). xi. Safety & Protection (Protech), and xii. Sports & Leisure (Sport-tech).

Technical Textiles Industry and its Growth

The global market for technical textiles is rising as never before. Although US and EU continue to be major manufacturers and consumers of technical textiles, the Asian countries like China and India have recently emerged as chief production centers of technical textiles. In the year 2000, the world market for technical textiles was estimated to have value of US \$ 93 billion, which has already crossed US\$126 billion in 2010. Also in last five years, the

¹ Plastics Technology, L D College of Engineering, Ahmedabad, India
E-mail: dineshdesai2002@gmail.com

² Plast. Tech, L D College of Engineering, Ahmedabad, India

textiles disposed of in landfill sites have raised from 7% to 30% in US alone.

Soon the technical textile will have similar story all over the world because this being very strong, durable and versatile material and hence, will not degrade or destroy easily in the nature. With increase of its demand and consumption, the problem for its disposal will also increase many fold. Among the most demanding customers of textile materials in world are the members of our fighting forces, and army personnel are among those with the critical requirements. The technical textiles have proved to be the major contributor to all these defense applications replacing the conventional heavier materials. Protech (personal and property protection) textile broadly refers to “Defense Textile” or Safety & Protection Textile (Protech) is discussed below.

Traditional versus Technical Textile Markets

The technical textiles give an opportunity to the companies in the industrialized countries to survive the competition and to achieve sustainable growth due to their specialized skills, materials, processes and equipments.

There are certain basic differences between technical textiles and traditional textiles industries:

- Technical textiles are preferred for their highly specific performance quality and as such they are more expensive than the traditional textiles.
- Technical textile manufacturers have to use accepted testing methods in order to gain customers' faith regarding standard specifications.
- Technical textiles are for a distinct segment of a market as opposed to mass market. This target market needs more flexible and smaller production spells. Thus the technical textile manufacturers too have to be flexible in their production schedules.

- Technical Textiles survive on innovations. Thus, technical textile manufacturers must be ready to invest in research and development and newer equipments too.

Safety and Protection (Protech) Textile

Safety & Protection (Protech) i.e. “Personal Protective Textiles” are produced with the aim of eliminating or minimizing the risk of injuries, accidents and infections, acting as shields against chemical, biological and nuclear hazards, high temperatures and fire, sharp objects, and ballistic projectiles.

These textiles are considered to be second only to steel in the essentialities in the armed forces as they are the most critical customers having a variety of requirements for the textile materials. The Personal Protective Equipments (PPE) for the military personal are needed during both war and peace time.

Personal protective equipment for military personnel is needed during non-combat, combat & emergency survival operation. Among the most demanding customers of textile materials in world are the members of our fighting forces, and army personnel are among those with the critical requirements. Military uniforms must meet specific protective performance requirements related to their use in battlefield, tanks, aircrafts, underwater etc. including the high hazards such as gravitational forces during high acceleration-deceleration, extreme temperatures ambient conditions, immersion hypothermia etc. Thus the technical textiles have proved to be the major contributor to the defense applications by replacing the conventional heavier materials.

Experimental Part

For experimental set up a Universal Testing Machine for fabrics was selected and

Table 1.

Tensile strength of fabric

| Sr no. | Fiber | Tensile Strength in Kgf |
|--------|---------------|-------------------------|
| 1 | Fiber bundle | 36 |
| 2 | Used fabric | 156 |
| 3 | Actual fabric | 180 |

strength of various types of fabrics was found out.

This shows clearly that the strength as a main property of textile do not reduce much and can be readily used for various other purposes.

Protech Textile Recycling

In future, the Protech Textile industry will be among the most essential consumer goods industry. This will be also one of

the most polluting industries. Because, not only production but consumption of textiles also produce waste. To counter this problem, the industry has to take many measures for reducing its negative contribution towards environment. One of such measures is its recycling- the reuse as well as reproduction of fibers from these textile waste.

Sources and Uses of Discarded Technical Textiles

For Protech Textile, the development of fibers, yarns and fabrics, functional aspects - such as anti-bacterial, anti-static, UV protective, thermal, or biodegradable functions - are playing an increasingly important role. Performance requirements and technical specifications determine the success of a product. Some fields of its applications are given below in Table 2.

Table 2.

The Sector, Examples and Market of Reused Technical Textiles.

| Sr. | SECTOR | EXAMPLES | MARKETS |
|-----|------------------------------|---|---|
| 1 | Earthworks | Linings, netting, insulation, artificial grass ("geo textiles") | Construction companies for roads, water engineering, soil stabilization, tunnels and other earthworks |
| 2 | Construction | Insulation and roofing materials ("building textiles") | Building firms, architects |
| 3 | Agriculture | Sun protection for greenhouses, fishing nets ("agro textiles") | Farming, horticulture and fishing |
| 4 | Transport | Car mats and lining, airbags, fire resistant seat covers and carpets, safety belts | Producers of cars, aero planes, boats |
| 5 | Medical and healthcare | Bandages, medical corsetry ("medical textiles") | Hospitals, nursing homes, households |
| 6 | Protection | Safety nets, ribbons and tapes, fire resistant clothing ("protecting textiles") | Industry, public procurement, households |
| 7 | Packaging | Twine and cordage, sacks and bags, tarpaulins ("packing textiles") | Industry, distribution, households |
| 8 | Military and public services | Fire service equipment, bullet-proof jackets, army tents, parachutes, extinguishing blankets, tubes | Military/security, forestry, offshore oil industry |
| 9 | Specialized clothing | Sports, skiing and leisure | Active sports, mountaineering, households |
| 10 | Communications | Optical fibres, image conductor cables | Communication sector |
| 11 | Industry | Filters, drive and conveyer belts, abrasive belts | Engineering, machinery, chemicals, plastics, mining, energy, etc. |
| 12 | Furnishing | Interlaid scrims, braiding, shower curtains, umbrellas, parasols, deck chairs, textile wall papers | Decoration firms, households |

Conclusion

New durable items and its developments outlined above can emerge as the next generation of technical textiles in many critical applications. These structures are strong and possess significantly higher surface area than existing fabrics.

The emerging reused technical textile materials, however, will not be just simply textile but will be different from technical textiles in use today. Hence the future promises to be interesting and potentially very rewarding.

[1] Book

Good, Irene, "Textiles as a Medium of Exchange in Third Millennium B.C.E. Western Asia." University of Hawai'i Press, Honolulu. Pages 191–214. ISBN 978-0824828844 - (2006)

Teresa Archuleta-Sagel "Rio Grande Textiles." – (2005)

[2] Article

EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2003.

[3] Online Document

Mobil-tech Garment recycling web. <http://www.patagonia.com> Patagonia Common Threads Garment Recycling

Geo-tech Garment Recycling web. <http://www.letsrecycle.com>