Impact of Textiles in Medical Field

Dr.Chinta S.K.
D.K.T.E's Textile & Egg. Institute, Ichalkaranji

Veena K.V
D.K.T.E's Textile & Egg. Institute, Ichalkaranji

Abstract - Combination of textile and its application in medical sciences has resulted into a new field called medical textiles. New areas of application for medical textiles have been identified with the development of new fibers and manufacturing technologies for yarns and fabrics. Development in the field of textiles, either natural or man-made textiles, normally aimed at how they enhance the comfort to the users. Development of medical textiles is really meant for converting the painful days of patients and surgeons into the comfortable days. The major requirements for biomedical polymers are-Non toxic, Nonallergenic response, Mechanical properties, Strength , Elasticity, Durability and Biocompatibility. The ability to be sterilized as biomedical materials may be contaminated with bacteria, sterilization is very important for biomedical polymers. The sterilization technique can be physical or chemical.

I. INTRODUCTION

Healthcare is a serious business which is not only influenced by practicing medical professionals but also by the manufacturers of diverse medical products. In today's healthcare environment, textile products are finding innovative applications which were not imaginable just a few years ago.The importance of textile materials in the medical field is credited to their excellent physical properties, such as strength, extensibility, flexibility, suppleness, air and moisture permeability and wicking. The various applications of textile materials in medical and healthcare industries may be broadly categorized as follows:

Hygiene: these are primary healthcare products meant for protection, general health care and hygiene, including bedding and clothing, mattress covers, surgical gowns, face masks, head and shoe covers, apparel, sterilization wraps, incontinence care pads, nappies, tampons etc.

Extracorporeal: these are extracorporeally mounted devices used to support the function of vital organs, such as kidney, liver, lung, heart-pacer etc.

Therapeutic: the products used for the treatment and cure of diseases due to ill health, such as heating pads.

Nonimplantable: these are materials used for wipes, swabs, wound dressings, bandages, gauzes, plasters, pressure garments, orthopedic belts, etc.

Implantable: these are materials implanted on or in the human body to either support or replace the functions of internal organs. Besides classical implantable textile materials, such as sutures, recent developments in the medical treatments have found new applications , such as heart valves, vascular grafts, artificial veins, artificial tendons and ligaments, artificial joints and bones, artificial skin, artificial cartilage etc.

While many textile materials used in traditional applications in healthcare are still found, recent development in the advanced healthcare has led to the development of new materials through crosscutting research approaches in the field of textiles, polymer, biomedical, pharmaceutical and medical sciences. This paper deals with an overview of such modern developments in various healthcare applications discussed above.

Textile has always been a part of a healthcare combination of Textile Technology and Medical Sciences has resulted into MEDICAL TEXTILES. Medical Textiles are one of the fastest growing sectors of the global Technical Textile industry.

The medical textile industries have diversified with new materials and innovative designs. Recently only, application of textiles has started going beyond the usual wound care, incontinence pads, plasters etc.,Latest innovation ie., wide variety of woven, non woven, knitted forms of textile increasingly finding their way into a variety of surgical procedures. As the healthcare industry is growing enormously in India, the demand for the Medical Textile is also on the rise.

Medical Textiles are the type of technical textiles which offer a variety of technical & functional properties having application in the field of medical and clinical care are manufactured primarily for their technical performance & functional properties rather than their aesthetic or decorative characteristics

The vey main objective is to improve quality of health care delivery through disposable products and enhance the standard in health care delivery by minimizing the risk of infections.

Market size of technical textiles in India in value terms							
		Market Size & Potential			Market Size & Potential		
		Rs. in Crore)			Rs.in Crore)		
S.No	**Technical Textile Sector**	**2003-04 (Actual)**	**2007-08 (Predicted)**	**Rank**	**2005-06 (Actual)**	**Assumed growth rate per annum (%)**	**2014-15 (Predicted)**
1	Clothtech	6833	8415	1	7583	15	26677
2	Packtech	4602	7359	2	5152	12	14288
3	Indutech	2212	2993	5	1148	12	3182
4	Sporttech	1534	2049	7	1773	15	6238
5	Meditech	1525	2339	6	1152	20	5945
6	Mobiltech	1323	2046	8	1532	10	3613
7	Hometech	1029	1897	9	1398	15	4918
8	Agrotech	303	464	12	376	20	1938
9	Protech	284	638	10	819	10	1931
10	Buildtech	281	478	11	1333	20	6877
11	Oekotech	200	6732	3	42	10	98
12	Geotextiles	-	6591	4	999	10	2357
TOTAL		**20128**	**42006**		**23307**	**14.37**	**78060**

1.1 Basic Requirements of Textile in Medical Field

1. Conformance to technical specs.
2. Sterile
3. Anti Allergenic
4. Anti Bacterial
5. Environment friendly
6. Economical

1.2 Advantages of Textiles in Medical Field

1. Cross infection is reduced
2. Protection of care providers
3. Cost effective
4. WHO recommends disposable PPEs
5. The comfort level is higher e.g. gowns
6. Breath-ability of non-woven is better
7. Engineered to have high barriers to blood and other body fluids.
8. Are compatible with various types of sterilization techniques
9. In OT's they protect the user from static electricity
10. Are flexible, soft and comfortable.

1.3 Application of Textiles in Medical Field

Medical Textile is classified into following categories based on their application

1. Health Care Textiles (Surgical Dressings)
2. Sutures and ligatures
3. Implants & Devices
4. Extra Corporal Devises

Table 1: Non-Implantable Materials

Fibre Type	Fabric Structure	Applications
Cotton, viscose, Lyocell	Non-woven	Absorbent pad
Alginate fibre, chitosan, silk,viscose, lyocell, cotton	Woven, non-woven, knitted	Wound-contact layer
Viscose, Lyocell, plastic film Woven,	nonwoven	Base material
Cotton, viscose, Lyocell, polyamidefibre, elastomeric-fiber yarns	Woven, non-woven	Simple non-elastic and elastic bandages
Cotton, viscose, Lyocell, elastomeric-fiber yarns	Woven, non-woven, knitted	High-support bandages
Cotton, viscose, Lyocell, elastomeric-fiber yarns	Woven, non-woven, knitted	Compression bandages
Cotton, viscose, Lyocell, polyester, polypropylene, polyurethane foam	Woven, knitted	Orthopaedic bandages
Cotton, viscose, plastics film, polyester fibre, glass fibre, polypropylene fibre	Woven, non-woven, knitted	Plasters
Cotton, viscose, lyocell, Alginate fibre, Chitosan	Woven, nonwoven, knitted	Gauze dressing
Cotton	Woven	Lint
Viscose, cotton linters, wood pulp	Non-woven	Wadding
Polylactide fibre, polyglycolide fibre, carbon	Spunlaid, needlepunched nonwoven	Scaffold

Table 2: Implantable Materials

Fibre Type	Fabric Structure	Applications
Collagen, catgut, poly glycolide and polylactide fibre	Monofilament, braided Biodegradable	Sutures
Polyester fibre , polyamide fibre, PTFE fibre, polypropylene fibre, polyethylene fibre	Monofilament, braided	Non-Biodegradable sutures
PTFE fibre, polyester fibre, silk, collagen, polyethylene fibre, polyamide fibre	Woven, braided	Artificial tendon
Polyester, carbon fibre, collagen	Braided	Artificial ligament
Low density polyethylene fibre Artificial cartilage Chitin	Nonwoven	Artificial skin
Poly (methyl methacrylate) fibre, silicon fibre, collagen		Eye-contact lenses and Artificial cornea
Silicone, polyacetyl fibre, polyethylene fibre		Artificial joints/ bones
PTFE fibre, polyester fibre	Woven, knitted	Vascular grafts
Polyester fibre	Woven, knitted	Heart valves

Table3: Extracorporeal devices

Fibre Type	Fabric Structure	Applications
Remove waste products from the patient's blood	Hollow polyester fibre, hollow viscose	Artificial kidney
Separate and dispose of patients' plasma and supply of fresh plasma	Hollow viscose	Artificial liver
Remove carbon dioxide from patients' blood and supply fresh oxygen	Hollow polypropylene fibre, hollow silicone membrane	Mechanical lung

Table 4 Healthcare / hygiene Products

Fibre Type	Fabric Structure	Applications
Cotton, polyester fibre, polypropylene fibre	Woven, nonwoven	Surgical gowns
Viscose	Nonwoven	Surgical caps
Viscose, polyester fibre, glass fibre	Nonwoven	Surgical masks
Polyester and polyethylene	Woven, nonwoven	Surgical drapes,cloths
Cotton, polyester fibre, polyamide and elastomericfibre yarns	Knitted	Surgical hosiery
Cotton, polyester fibre	Woven, Knitted	Blankets
Cotton	Woven	Sheets, pillow cases
Cotton, polyester fibre	Woven	Uniforms
Polyester fibre, polypropylene fibre	Nonwoven	Protective clothing,incontinence diaper /sheet, coverstock
Superabsorbent fibres,	wood Nonwoven	Absorbent layer
polyethylene fibre	Nonwoven	Outer layer
Viscose, Lyocell	Nonwoven	Cloths/wipes

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