

## **MEDICAL TEXTILES: SIGNIFICANCE AND FUTURE PROSPECT IN BANGLADESH**

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### **Abstract**

Now-a-days textiles are used in different sectors and various purposes beyond imagination. Medical sector is one of them. An important and emerging part of the textile industry is medical, hygiene and health sector. The development is taking place due to the simultaneous expansion and improvement of technology in both textile as well as medical sector. The number of applications is huge and diverse, ranging from a single thread suture to the complex composite structures for bone replacement and from the simple cleaning wipe to advanced barrier fabrics used in Operation Theater. The main object of this work is to study the types of medical textiles used in the medical sector, information on imported items and scope of manufacturing these items in Bangladesh. For this work we have visited Dhaka Medical College, Sir Salimullah Medical College, Uttara Adhunik Medical College and Hospital, BMA Bhaban Surgical Market. We have gathered very useful and vast knowledge about the term "Medical Textiles", as per our work and capability.

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**Keywords:** Extracorporeal devices, Implantable materials, Non-implantable materials, Chitin, Collagen

## Introduction:

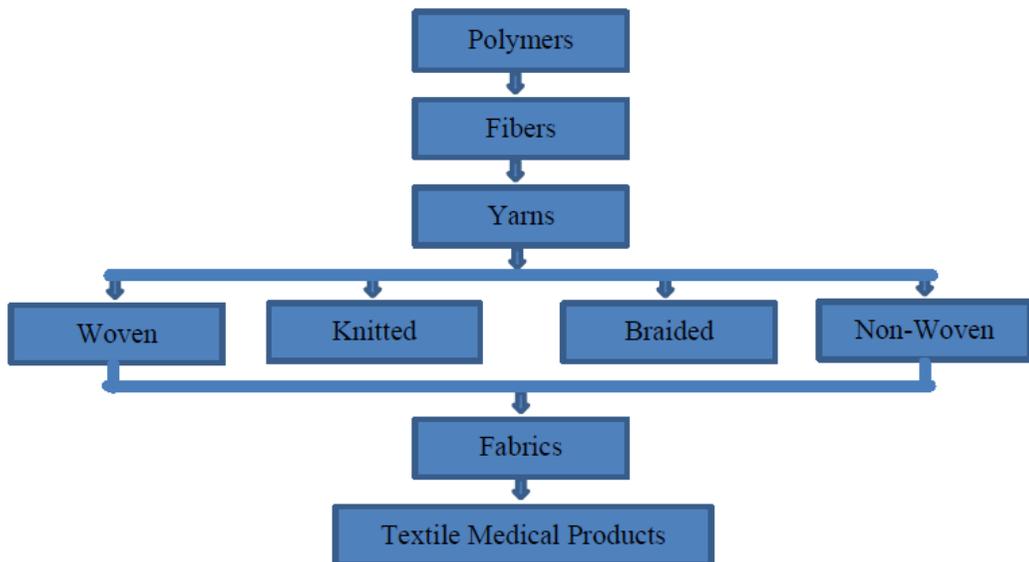
Medical textiles or Medtech is one of the most important, continuously expanding and growing field in technical textiles. Medical textiles represent structures designed and accomplished for a medical application. The number of applications is diverse, ranging from a single thread suture to the complex composite structures for bone replacement and from the simple cleaning wipe to advanced barrier fabrics used in operating rooms. Textile materials and products, that have been engineered to meet particular needs, are suitable for any medical and surgical application where a combination of strength, flexibility and sometimes moisture and air permeability are required. The medical textile industries have diversified with new materials and innovative designs. Recently, application of textiles has started going beyond the usual wound care, incontinence pads, plasters etc., Latest innovation i.e., 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 defined in various ways, such as:

David Rigby Associates.[1]

"The Medical Textile or Medtech application area "embraces all those technical textiles used in health and hygiene applications"

"Textile Terms & Definitions" defines Medical Textiles as - "A general term which describes a textile structure which has been designed and produced for use in any of a variety of medical applications, including implantable applications" [2].



Cotton	Polyester	Plastic film
Chitosan	Polypropylene	Viscose
Silk	Polyethylene	Super absorbent
Cotton linters	Polyamide	Collagen
Wood fluff	Lyocell	Poly hollow polyester
Alginate	Polyurethane foam	Hollow polypropylene
Chitin	Glass fiber	Hollow silicon membrane
Catgut	Carbon fiber	Silica fiber

### **Classification of Medical Textiles:**

Figure 1. shows the constituent element of medical textile products for medical applications include materials as fibres, yarns, woven, knitted, non-woven, PTFE felts and mesh etc.

Depending upon the usage, they are classified as-

1. Healthcare and Hygiene products
2. Extracorporeal devices
3. Implantable materials
4. Non-implantable materials

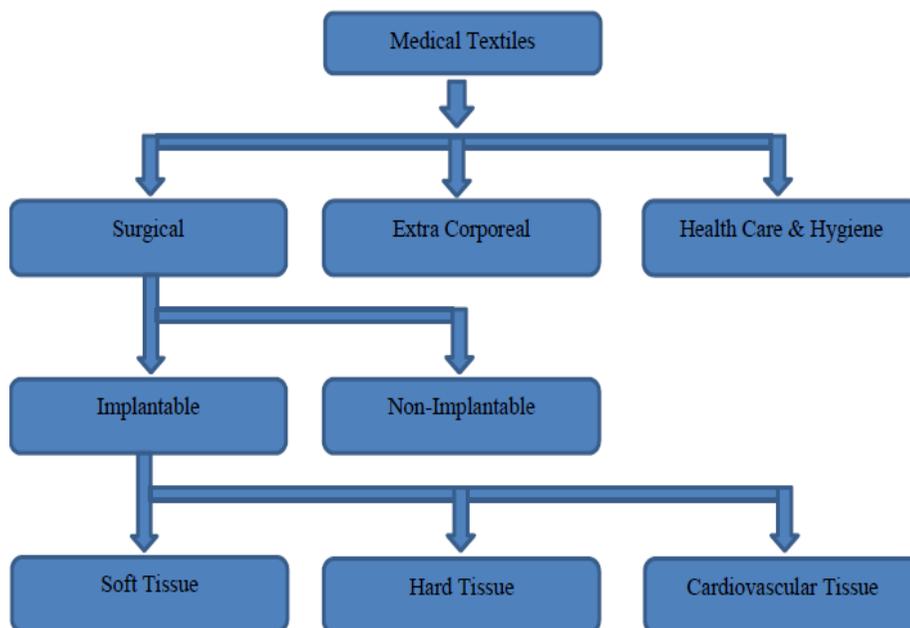
The classification of Medical Textile or Medtech can be represented in Figure 2.

### **Non-Implantable Materials**

These materials used for external applications on the body and may or may not make contact with skin. This includes wound care, bandages, plasters, pressure garments, orthopedic belts etc. They are shown in Table II.

### **Implantable Materials**

These materials are used in effecting repair to the body whether it is wound closure (sutures) or replacement surgery (vascular grafts, artificial ligaments etc.). They are shown in Table III.



<b>Fiber Type</b>	<b>Fabric Structure</b>	<b>Applications</b>
Cotton, Viscose, Lyocell	Non-woven	Absorbent Pad
Alginate fiber, Chitosan, Silk,	Non-woven	Absorbent Pad
Viscose, Lyocell, Cotton	Woven, Non-woven, Knitted	Wound-contact layer
Viscose, Lyocell, Plastics film	Woven, Non-woven	Base material
Cotton, Viscose, Lyocell, Polyamide fiber	Woven, Non-woven	Base material
<b>Fiber Type</b>	<b>Fabric Structure</b>	<b>Applications</b>
Elastomeric fiber yarns	Woven, Non-woven, Knitted	Simple non-elastic and elastic bandages
Cotton, Viscose, Lyocell	Woven, Non-woven, Knitted	Simple non-elastic and elastic bandages
Elastomeric fiber yarns	Woven, Non-woven, Knitted	High support bandages
Cotton, Viscose, Lyocell	Woven, Non-woven, Knitted	High support bandages
Elastomeric fiber yarns	Woven, Knitted	Compression bandages
Cotton, Viscose, Lyocell, Polyester fiber	Woven, Knitted	Compression bandages
Polyurethane foam	Woven, Non-woven	Orthopaedic bandages
Cotton, Viscose, Plastics film,	Woven, Non-woven	Orthopaedic bandages

Polyester fiber, Glass fiber,	Woven, Non-woven	Orthopaedic bandages
polypropylene fiber	Woven, Non-woven, Knitted	Plasters
Cotton, Viscose, Lyocell, Alginate fiber, Chitosan	Woven, Non-woven, Knitted	Plasters, Gauze dressing
Cotton	Woven	Lint
Viscose, Cotton linters, Wood pulp	Non-woven	Wadding
Poly lactide fiber, Poly glycolide fiber	Non-woven	Wadding
Carbon fiber	Spunlaid, Needle punched non-woven	Scaffold
Collagen, Catgut, Poly glycolide	Mono filament, Braided	Biodegradable sutures
fiber, Poly lactide fiber	Mono filament, Braided	Biodegradable sutures
Polyester fiber, Polyamide fiber,	Mono filament, Braided	Biodegradable sutures
PTFE fiber, Polypropylene	Mono filament, Braided	Biodegradable sutures
<b>Fiber Type</b>	<b>Fabric Structure</b>	<b>Applications</b>
Polyethylene fiber	Mono filament, Braided	Non-biodegradable sutures
PTFE fiber, Polyester fiber, Silk,	Mono filament, Braided	Non-biodegradable sutures
Collagen, Polyethylene fiber,	Mono filament, Braided	Non-biodegradable sutures
Polyamide fiber	Woven, Braided	Artificial tendon
Polyester fiber, Carbon fiber, Collagen	Braided	Artificial ligament
Low density Polyethylene fiber	Braided	Artificial cartilage
Chitin	Non-woven	Artificial skin
Poly methyl methacrylate fiber,	Non-woven	Artificial skin
Silicon fiber, Collagen	Non-woven	Eye contact lenses and Artificial cornea
Silicone, Poly acetyl fiber,	Non-woven	Eye contact lenses and

		Artificial cornea
Polyethylene fiber	Non-woven	Artificial joints/ bones

Figure 2. Classification of Medical Textiles

Table II. Non-Implantable Materials [3].

### Extra Corporeal Devices

These are extra corporeally mounted devices used to support the function of vital organs, such as kidney, liver, lung, heart pacer etc. The extracorporeal devices are mechanical organs that are used for blood purification and include the artificial kidney (dialyser), the artificial liver, and the mechanical lung. The function and performance of these devices benefit from fibre and textile technology. They are discribed in Table IV.

### Health Care & Hygiene Products

An important area of textile is the healthcare and hygiene sector among other medical applications. The range of prod-ucts available for healthcare and hygiene is vast, but they are typically used either in the operating theatre or in the hospi-tal wards for hygiene, care and safety of the staff and patients. They could be washable or disposable. These products are shown in Table V.

Table IV. Extra Corporeal Devices [3]

Fiber Type	Applications	Function
Hollow Polyester fiber, Hollow viscose	Artificial kidney	Remove waste products from patients' blood
Hollow viscose	Artificial liver	Separate and dispose of patients plasma and supply fresh plasma
Hollow polypropylene fiber, Hollow silicon membrane	Mechanical lungs	Remove carbon di-oxide from patients' blood and supply fresh Oxygen

Table V. Health care & Hygiene Products [3]

Fiber Type	Fabric Structure	Applications
Cotton, Polyester fiber, Polypropylene fiber	Woven, Non-woven	Surgical gowns
Viscose	Non-woven	Surgical caps
Viscose, Polyester fiber, Glass fiber	Non-woven	Surgical masks

Polyester fiber, Polyethylene fiber	Woven, Non-woven	Surgical drapes and cloths
Cotton, Polyester fiber, Polyamide fiber, Elastomeric fiber yarns	Knitted	Surgical hosiery
Cotton, Polyester fiber	Woven, Knitted	Blankets
Cotton	Woven	Sheets, Pillow cases
Cotton, Polyester fiber	Woven	Uniform
Polyester fiber, Polypropylene fiber	Non-woven	Protective Clothing, Incontinence, Diaper/ Sheet, Cover stock
Super absorbent fibers, Wood fluff	Non-woven	Absorbent layer



(a) Face Mask



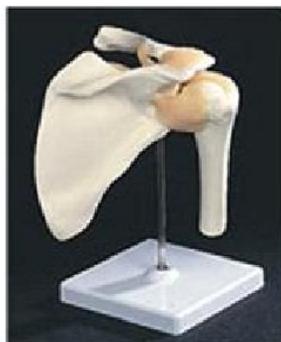
(b) Surgical sutures



(c) Vascular grafts



(d) Medical Mattresses



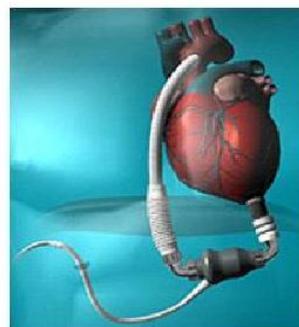
(e) Artificial Ligaments



(f) Artificial Joints



(g) Artificial Skin



(h) Artificial heart

Figure 3. Few examples of medical textiles [4-11]



Cervical Collar (Brand : AT-EX)



Thumb Spica Splint (Brand : Tynor)



Elastic Wrist Splint (Brand : Tynor)



Lumber Corset (Brand : AT-EX)



Pouch Arm Sling (Brand : Tynor)



Anklet (Brand : Tynor)



Surgical Suture (Brand : Johnson & Johnson)



Hernia Belt (Brand : MG Tech)

Figure 4. Medical textiles available in Bangladesh (collected from BMA market)

## Hospital Investigation of Medical Textiles in Bangladesh:

### 1. Dhaka Medical College And Hospital

Table VI. Consumption of Medical Textiles in Dhaka Medical College and Hospital

Medical Product Name	Consumption/Year (Approx.)
Bed sheet	3500 pcs
Pillow	400 pcs
Pillow cover	500 pcs
Mosquito net	500~ 600 pcs
Towel	1000 pcs
Quilt	400~ 500 pcs
Gauze	130000~ 140000 yds
Cotton	6000 ~ 7000 rolls
Surgical gown	4000~ 5000 pcs
Surgical mask	10000~ 12000 pcs
Surgical cap	7000~ 8000 pcs
O. T maxi	1000 pcs
Patience gown	1000~ 1200 pcs

### 2. Sir Salimullah Medical College And Hospital, Dhaka

Table VII: Consumption of Medical Textiles in Sir Salimullah Medical College and Hospital

Medical Product Name	Consumption/Year (Approx.)
Bed sheet	2800 ~ 3 000 pcs
Pillow	300 ~ 400pcs
Pillow cover	300~ 400 pcs
Mosquito net	500 pcs
Towel	600~ 700 pcs
Quilt	400 pcs
Gauze	100000 yds
Cotton	5000 rolls
Surgical gown	3500~ 4000 pcs
Surgical mask	10000 pcs

Medical Product Name	Consumption/Year (Approx.)
Surgical cap	5000~ 6000 pcs
O. T maxi	700~ 800 pcs
Patience gown	1000 pcs

### 3. Uttara Adhunik Medical College And Hospital

Table VIII. Consumption of Medical Textiles in Uttara Adhunik Medical College and Hospital

Medical Product Name	Consumption/Year
Gauze	3600 yds
Cotton	1800~3000 rolls
Surgical gown	1000~2000 pcs
Surgical cap	5000~6000 pcs
Bed Sheet	1500~2000 pcs.
Pillow	500 pcs
Pillow cover	1500~2000 pcs
Mosquito net	100~150 pcs
Towel	200~250 pcs
Quilt	250~300 pcs
Draw sheet	4000~5000 pcs
Eye sheet	100~120 pcs
O. T maxi	400 pcs
Patience gown	500 pcs
Blanket cover	5000 pcs
Mattress cover	500 pcs

#### Market Investigation of Medical Textiles in Bangladesh

In spite of the wide range of medical textiles, only limited items are used in most of the hospital in Bangladesh Data in Table IX. are collected from BMA Bhaban Surgical Market about the overall market investigation of medical textiles in Bangladesh.

From the investigation, we can say that -

- \* Only surgical gauze, roller bandage, plastic bandage and absorbent cotton are produced in Bangladesh.

- \* Maximum fabric structures of medical textiles are woven and nonwoven.
- \* Bangladesh imports medical textiles mainly from China and India.

### Market Potentials of Medical Textiles in Bangladesh

Bsngladesh is a populous country. About 150 million people live here. For this huge population, vast medical facilities are required as a basic need. Since Bangladesh is a develop ing country and always tries to improve its medical facilities for the people of the country. To fulfill such big demand,

Table IX. Overall Market investigation

Name of the Product	Fabric Structure	Brand	Origin	Price (BDT)	Purpose
Surgical Gauze	Woven	Al- Abi Marketing Company	Bangladesh	130 200/piece	Surgical
Surgical Gauze	Nonwoven	3M Health Care	Taiwan	58.30/roll	Surgical
Microporos surgical tape	Nonwoven	Nichiban Co. Ltd.	Japan	152.50/roll	Surgical purpose
Microspores' surgical tape	Nonwoven	Wenzhou Wuzhou	China	41.66/roll	Surgical purpose
Surgical Mask	Nonwoven	-	China	1/ piece	Surgical
Waterproof plastic bandage	Woven	Marketed by JMI Bangla company ltd.	Bangladesh	1/ piece	Wound care
Cotton strip	Woven	Neostrip	-	1/ piece	Wound care
Roller bandage	Woven	Al-Abi Marketing Company	Bangladesh	40/pack	Wound care
Elastic Bandage	Woven	Neo- bandage	China	55 / pack	Wound care
Pouch arm	Woven	Tynor	India	200/ piece	Orthopedic
Elastic wrist	Woven	Tynor	India	280/ piece	Orthopedic
Thumb spica	Woven	Tynor	India	250/ piece	Orthopedic
Anklet	Woven	Tynor	India	130	Orthopedic
Lumber	Woven	Tynor	India	180-300	Orthopedic

Many hospitals and clinics are set up here by government and public finance. So, a lot of medical textile products are required in these hospitals. There will be a huge need of medical textiles in the near future. There is no research work about the market size of medical textile in Bangladesh. For this we have not found sufficient data about the market size of Bangladesh. But, by investigating hospitals and market we have reached a decision that the market size of medical textile is increasing rapidly. the main causes are

the following -

- \* Population growth
- \* Consciousness development of people about health care
- \* Higher standard of living
- \* Establishment of international standard modern hospitals throughout the country
- \* Technology development

So, there is huge potential of medical textile marketing in Bangladesh. This potential is properly used by medical textile exporter country like China, India, Taiwan, Germany, South Korea, Pakistan etc. But we are lagging behind in this case. Our market share is very low in comparison with these countries. It may be 2-5%. If we are able to produce medical textile, we will be able to capture enough market share. Manufacturing Potential of Medical Textiles in Bangladesh is well known to the world as a traditional textile manufacturing country. But Bangladesh has also the potential to produce technical textile especially medical textile. It may be a great source of earning foreign currency. Our neighboring country India and Pakistan are already going ahead in this field. They consume their own product and also export to foreign countries. But we are lagging behind in this sector though we are ahead in the traditional textile sector. Nowadays, the consumption of medical textile is increasing rapidly in our country. Most of them are imported from foreign countries like China, India, Taiwan, Japan etc. It is a matter of sorrow that we are producing a very few medical textile products such as gauze, bandage and apron. The possibility of medical textile manufacturing in our country is analyzed below-

### ***Capital***

There are many local and foreign industrialists who can invest their capital in medical textile manufacturing if they get enough facilities from the government.

### ***Raw materials***

The raw materials of medical textile products are fibre or yarn and different types of chemicals for finishing. These raw materials can be imported from other countries or manufactured in our country if possible.

### ***Technology***

Mainly four manufacturing techniques are applied for medical textile products. These are woven, knitted, braided and nonwoven.

**Woven** - Simple elastic and non-elastic bandages, vascular grafts, gauze dressing, surgical gowns etc.

**Knitted** - Vascular graft, high support bandages etc.

**Braided** - Bio degradable and non-biodegradable sutures, artificial tendon, artificial ligament etc.

**Nonwoven** - Bandages, surgical tape, orthopaedics bandage, absorbent pad, surgical masks, caps etc.

Among these four techniques, nonwoven is now very popular because it can produce disposable and cost effective product. It replaces the woven and knitted products of medical textiles. But we are not as familiar with nonwoven technology as woven and knitted technology. There are a very few nonwoven factories in our country. If we are able to set up enough nonwoven factory in our country, we will be developed in the medical textile sector.

### ***Manpower***

There is a huge manpower in our country. They may be skilled or unskilled. Since it is a new project it may cause little problem for unskilled manpower. But proper training can solve the problem. To produce medical textile, it needs a combination of medical science and textile technology. So, medical specialist and a textile technologist should work together to develop the field. There are enough medical specialist and textile technologist in our country to develop this new field.

### ***Power***

Power is very important factor for any kind of industry. Bangladesh is going through an acute power crisis. There is lack of energy and power. So it should be overcome to develop medical textile sector.

### ***Environment***

Most of the medical textiles are undyed. So, medical textiles need not to be highly dyed or so many finishing techniques like traditional cloth. So, it is an environmental friendly sector which we need.

### ***Profit***

It is a profitable industry because the project cost is lower but the products selling price is higher. In US a simple bandage is sold at a price of 1-2 US dollar.

### **Result analysis and Recommendation:**

#### Challenges of Medical Textile Manufacturing in Bangladesh

The main challenges are-

1. Power crisis
2. Need to build up skilled manpower
3. Competition with China, India and other countries.
4. Need to increase of braided and nonwoven factory.
5. Need to increase of forward and backward linkage industry

### ***Result analysis***

This is a survey about the present status, significance and prospect of Medical Textiles in Bangladesh. Our main task was to visit the hospital and collect data of medical textiles which are used in the hospitals to assess the prospect of medical textiles in Bangladesh. From the hospital and market investigation we found that many medical textile products are used in Bangladesh. Such as-

1. Gauze
2. Different types of bandages
3. Different types of orthopedic items and bandages.
4. Different types of surgical items
5. Different types of healthcare and hygiene products.

But most of them are imported from foreign countries like China, Japan, Taiwan, India etc. Very few products are produced in Bangladesh such as gauze, bandages and diapers.

But these are not enough for our demand. The consumption of medical textile is increasing day by day. So, we should try to set up our own medical textile manufacturing project to fulfill the increasing demand. It will also help us to save our money from going to foreign countries. Finally we can say that it is possible to produce medical textiles to a large extent in Bangladesh. It will be very much profitable for the manufacturers who will interest to run this sort of mills in Bangladesh.

### ***To develop this sector, we recommend the followings -***

1. The government should take step to solve power crisis.
2. The textile technologists of our country should come forward to encourage the industrialist to set up medical textile manufacturing factory.
3. Collaborate with medical textile manufacturing companies of China, India etc.
4. Try to develop educated, skill manpower.
5. Try to ensure proper safety and sound condition of the factories.

### **Conclusion:**

The importance of medical textile for the healthier life and betterment of human being is great. The development of new technologies and new item will help the patients to overcome their suffering in previous days. To get correct, hygienic products we should put our concentration to develop new technologies as well as we should put concentration on the price of the products.

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