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MEDICAL TEXTILES

***Dr. Kanikicherla Rani**

Associate Professor, Dept. of Home Science, Ch.S.D. St. Theresa's College for Women (Autonomous), Eluru -534003, Andhra Pradesh.

***Corresponding Author: Dr. Kanikicherla Rani**

Associate Professor, Dept. of Home Science, Ch.S.D. St. Theresa's College for Women (Autonomous), Eluru -534003, Andhra Pradesh.

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ABSTRACT

Medical textiles definition is, "The textile material and products that have been engineered to meet particular needs suitable for the medical and surgical application, where the combination of following properties are required."

- Strength.
- Flexibility.
- Moisture absorbing capacity.
- Air permeability.

These materials are used in contact with tissues, blood, cells, proteins and any other living substances, so that these materials may be ceramic, polymers, natural fibers, metal and composite.

A medical textile product should have following properties.

- It should be non-toxic.
- It should be non-carcinogenesis.
- It should be non-allergic.
- It should possess the ability to be sterilized (radiation, dry heat, boiling).
- It should be chemically inert.
- It should be biocompatible.

Implantable medical textile materials are those which can be implanted in the human body. Those may be bio-absorbable or not bio-absorbable.

KEYWORDS: Medical, Surgical, Textiles, Implantable, living substances, chemically inert.

INTRODUCTION

Combination of textile technology and 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, natural or manmade textiles, normally aimed at how they enhance the comfort to the user. Development of medical textiles can be considered as one such development, which is really meant for converting the painful days of patients into comfortable days.

Textile materials that are used in **medical** applications include fibres, yarns, fabrics and composites. The **textile** materials should have some specific properties to be useful as **medical textile**. **Medical textiles** are also known as **Healthcare Textiles**. Medical

Textiles is one of the most rapidly expanding sectors in the **technical textile** market. It is one of the major growth areas within technical textiles and the use of textile materials for medical and healthcare products ranges from simple gauze or bandage materials to scaffolds for tissue culturing and a large variety of prostheses for permanent body implants. Textile products are omnipresent in the field of human hygiene and medical practice. Their use is based on a number of typical basic textile properties like softness and lightness, flexibility, absorption, filtering etc.

Advanced medical textiles are significantly developing area because of their major expansion in such fields like wound healing and controlled release, bandaging and pressure garments, implantable devices as well as medical devices, and development of new intelligent textile products. Present day society is undergoing

changes like large population size, need of increasing life span of every individual, various situations and hazards of human activity and civilization including transport accidents, chemical materials, fire, cold, diseases, and sports. Such factors increase the demand of medical textiles. So there are several research works going on all over the world in medical textile materials and polymers.

Nano-fibre based products as well as nano-coated materials are present innovations in the field of medical. Nano fibres are porous and the distribution of pore size could be of wide range, so they have application in wound dressings, bone regeneration and nano fibres to be the carrier of various drugs to the specific sites, etc.



Fig: Different medical textiles

The use of textile materials for medical and healthcare products can be classified into following main areas

- Barrier material (for infection control)
- Bandaging & pressure garment
- Antiseptic Wound care material
- Hygiene material
- Protective and healthcare textiles
- Implantable material (sutures, artificial Joints etc)
- Extra Corporal devices (like artificial Kidney etc)

Requirements of textile material for medical applications

- Biocompatible
- Good resistance to alkalis, acids and micro-organisms
- Good dimensional stability
- Elasticity Free from contamination or impurities
- Absorption / Repellency
- Air permeability

Examples for Medical Textile Products

Hollow polyester fiber, hollow viscose

Application: Artificial kidney

Function: Remove waste products from patient's blood

Hollow viscose

Application: Artificial liver

Function: Separate and dispose of patients' plasma and supply fresh plasma

Hollow polypropylene fiber, hollow silicone membrane

Application: Mechanical lung

Function: Remove carbon dioxide from patients' blood and supply fresh oxygen

Traditional applications

Include wound care products, diapers, braces, prostheses and orthoses, wipes, breathing masks, bedding and covers, ropes and belts etc. Innovative textile products can both add significantly to effectiveness of medical treatments as well as patient comfort. At the same time, new medical textiles, may contribute to cost containment.

Uses of Medical Textiles

Medical Textiles are the products and constructions used for medical and biological applications and are used primarily for first aid, clinical and -hygienic purposes. It consists of all those textile materials used in health and hygienic applications in both consumer and medical markets. As such it comprises a group of products with considerable variations in terms of product performance and unit value. Because of the nature of their application many medical products are disposable items.

Innovative products: Provide new treatment options (textile based implants instead of scarce donor organs; artificial tissues, joints and ligaments), Speed up recovery after medical treatment (innovative wound dressings; light, Breathable orthoses/ prostheses). Enhances quality of life of Chronically ill people (functional clothing). Surgeons wear, wound dressings, bandages, artificial ligaments, sutures, artificial liver/kidney/lungs, nappies, sanitary towels, vascular grafts/heart valves, artificial joints/bones, eye contact lenses and artificial cornea and the like are some of the

examples of medical textiles. Medical textiles are textile products and constructions for medical applications. They are used for first aid, clinical or hygienic purposes and rehabilitation.

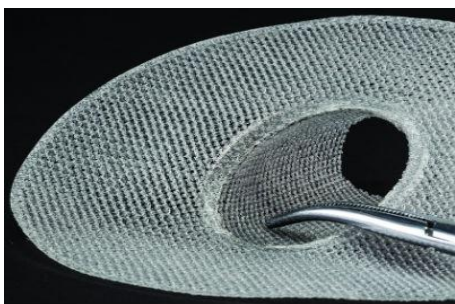
The applications in which implantable textiles play a part is extensive, and their presence is growing in conjunction with the infusion of new polymers, constructions, and the potential for more “active” device forms like drug/device combination products. Such products are typical in the sports medicine, trauma, orthopedics, wound management, tissue replacement, plastic surgery, neural, and endoscopy market segments.

A product list would include

- Hernia repair products
- Nerve conduits
- Cardiovascular plugs
- Heart valve sewing cuffs
- Collapsible orthopedic anchors
- Diabetic wound care tissue scaffolds
- Osteoconductive bone grafts
- Scoliosis correction devices
- Suture loops
- Sternal closure devices
- Partially to fully resorbable soft tissue repair products
- Drug and device combination products

Manufacturing Implantable Textile Devices

Implantable textile devices can be created using resorbable or non-resorbable polymers, or a combination of different materials, and custom shaped to meet specific anatomical and biological requirements, as well as facilitate shape transformation in vivo.



A combination of forming, cutting, and assembly capabilities for biomedical textiles supported by extensive materials handling expertise is needed to create 2D or 3D shapes with woven, knitted, braided, or non-woven textiles, films, and more. There are also multiple factors that need to be considered in the manufacturing process to ensure optimized implants that will provide maximum benefit to the end-user patient.

Vascular implants belong to a specialized class of medical textiles. The basic purpose of a vascular implant (graft and stent) is to act as an artificial conduit or substitute for a diseased artery. However, the long-term

healing function depends on its ability to mimic the mechanical and biological behaviour of the artery. This requires a thorough understanding of the structure and function of an artery, which can then be translated into a synthetic structure based on the capabilities of the manufacturing method utilized. Common textile manufacturing techniques, such as weaving, knitting, braiding, and electro-spinning, are frequently used to design vascular implants for research and commercial purposes for the past decades. However, the ability to match attributes of a vascular substitute to those of a native artery still remains a challenge. The synthetic implants have been found to cause disturbance in biological, biomechanical, and hemodynamic parameters at the implant site, which has been widely attributed to their structural design. In this work, the design aspect of textile vascular implants was reviewed by scientists and compared them to the structure of a natural artery as a basis for assessing the level of success as an implant. The outcome of this work is expected to encourage future design strategies for developing improved long lasting vascular implants.

SUMMARY

Textiles are developing into interdisciplinary high tech products with interesting chances on the market. Owing to the greater co-ordination among textile technologists and medical researchers, textile products for surgical procedures are being developed indigenously. Textile structures in implantation are identified by structure, material composition, behavior of fibre surface and degradation. Improved absorbable fibers will be of great interest. Advances in textile technology will clearly bring a new and improved group of medical textiles.

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