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RESEARCH ARTICLE OPEN ACCESS

Role of Textile Fibers in Medical Industry

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ABSTRACT
Currently, the use of natural offers several advantages, such as a decline in materials derived from non-renewable resources and a reduction in the effects on the environment. These substances have been effectively utilized in the fields of tissue engineering, wound care, drug delivery, and nanotechnology as hydrogels, scaffolding, matrices, and implantation. In terms of implants and other medical technology, biomaterials significantly contribute to the revolutionizing of human existence. Fundamentally, these materials must be extremely biocompatible and unaffected by physiological conditions in humans. Nevertheless, biodegradability is also a drawback of natural materials, as they cannot be as long-lasting as conventional artificial substances and are more prone to wear and tear because of their close contact with human tissue. Because the efficacy of a medical device depends on its suitability and capacity to perform the desired operation, selecting the appropriate material is crucial to developing a medical device.
Keywords: Natural Fibers, Medical Textiles Wound Care, Technical textiles & Nano technology.

I. INTRODUCTION:

Medical Textiles are used in the protection for healthcare professional from containment fluids, the major requirements for medical textiles are that it should be biocompatible and should be comfortable. Medical textile materials are used by doctors, textile chemists and technologists. These products are generally 70% disposable and 30% reusable. Specialty fibers and commodity fibers are used in the manufacturing of medical textiles. One of the most extensively studied issues in recent years is the consumption of natural fibers instead of manufactured fibers. This is because of their natural assets, which include being more biodegradable, renewable, and widely available than synthetic fibers, as well as their pleasant processing (lower tool wear and less skin discomfort) and effective acoustic and thermal insulation qualities. Natural fibers also have superior specific strength and stiffness compared to glass fibers because of their low specific weights. However, drawbacks such as inconsistent quality, moisture absorption, poor durability, weak impact resistance, and restricted production temperatures prevent the use of more natural fibers. Natural fibers are used directly in one-dimensional items such as lines and cables. Additionally, natural fibers have been used in ancient times for stringing ships, suspending bridges over water, and other purposes

II. CLASSIFICATION OF MEDICAL TEXTILES:

Medical textiles are classified under four main categories, namely:

- Health care/ Hygiene products: Used for bedding cloth, surgical gowns, wipes, cloths etc.
- Implantable materials: This includes sutures, artificial joints, artificial ligaments and vascular grafts.
- Non-implantable materials: Wound dressing, plasters, bandages etc.
- Extracorporeal devices: Artificial lungs, liver and kidney.

III. IMPORTANT CHARACTERISTICS OF MEDICAL MATERIALS:

MECHANICAL PROPERTIES	These properties include durability, strength and elasticity of the fibers used in the materials.
NON-TOXICITY	This is the most important property considered during the production of medical textiles. It is ensured that the material used should not cause rise in the body temperature, allergic reaction, any kind of inflammation and should be non- toxic in nature.
ABILITY TO BE STERILIZED	This property deals with the clean ability of the material as it may be contaminated with bacteria.
BIOCOMPATIBILITY AND OPTICAL PROPERTIES	The materials used should be bio-inert and bioactive. Also it should possess optical properties for contact lens purpose specifically.
DIFFUSION PROPERTIES	• It is an essential property for controlled drug delivery systems and membranes like in the artificial kidneys.

IV. FIBERS USED IN MEDICAL TEXTILES:

In medical textiles, different types of fibers are used as per there area of applications, like specialty fibers, commodity fibers, biodegradable fibers and non-biodegradable fibers.

1. Specialty fibers: This type of fibers include Chitosan, Chitin, Collagen and calcium Alginate fibers.

2. Commodity fibers: Commodity fibers are further classified into two categories, natural fibers and synthetic fibers. Natural fibers include silk, cotton, viscose which is used as non- implantable materials and for hygiene products.

3. Biodegradable fibers: These fibers can be absorbed by the body within 2-3 months after implanting them. Includes the polyamide, collagen and alginate.

4. Non- Biodegradable: Include polyester, PTFE carbon as the name suggests the fibers do not degrade and are used for external use only.

V. SPECIALTY FIBERS USED IN MEDICAL TEXTILES:

Chitin	It is a polysaccharide obtained from insects, lobster shells and crab. It is used as artificial skin dressings. Has good healing properties and are absorbed by the body, less painful and contributes in new cell formation.
Chitosan	It is obtained by alkali treatment of chitin and can be sun into filaments. It's generally used for slow drug release membranes.
Calcium Alginate	It is obtained by luminaire seaweed; it is no- toxic, natural and biodegradable. It is effective in wound healing.
Collagen	Collagen is obtained from bovine skin; it is basically protein that is either fiber or hydro gel. It is as strong as silk and can be used as sutures.

VI. MAJOR PRODUCTS / MATERIALS OF MEDICAL TEXTILES:

Wound dressing:

1. **Wadding:** It is a high absorbency material which is covered with no-woven fabric to prevent wound adhesion or fiber loss.
2. **Lint:** Lint is basically a plain weave cotton fabric used as a protective dressing for mild burns.
3. **Gauze:** Gauze is an open weave absorbent fabric which is coated with paraffin wax, used for the treatment for burns.

Bandages:

- Bandages are used for various applications; it helps to keep the dressing over the wound.
- Bandages can be woven, knitted or non-woven, warp and weft knitting is used to produce tubular structure. Can be elastic or non-elastic in nature.
- The elastic yarn provides comfort and support in the bandage structure.

Sutures:

It falls in the category of implantable materials. Sutures are multi or mono filament threads used to close wound, tie bleeding vessels or join tissue. Sutures can be further classified as absorbable and non- absorbable.

- An absorbable suture is made by using collagen, acid copolymer, polyglycolic acid etc. and is used for internal wound closing.

- Non- absorbable sutures include polypropylene, polyester and silk used for closing external wound and are removed by healing.
- Important properties required for sutures: Knot pull tensile strength, knot diameter, knot security, surface roughness and knot run down.

Health care/ Hygiene products:

- It includes operating textiles, barrier products, surgeon, nurses' caps and gowns, breathable membranes, foot wear and cloths etc.
- The main function of these products is to protect health care professionals from contamination by blood and other fluids which can be infectious.

Dental Biomaterials:

- The regeneration of tooth tissue is no possible hence the biopolymers are used in dental treatments to substitute for defects in tissues.
- The requirements of dental polymer is that it should be transparent, stability, offer good resilience, insoluble in oral fluids and should have softening point.
- The most widely used polymer is polymethylmethacrylate.

Artificial kidney:

- The blood is circulated through a membrane which is a flat sheet of hollow regenerated cellulose fibers in form of cellophane to filter waste material.
- Here, multilayer Filters are used which is composed of needle punched fabric with different densities.
- Other Medtech materials / products include, protective garments, mechanical lungs, artificial liver, Vascular implants, tendons, ligaments, biomaterials in ophthalmology.

VII. ADVANTAGES OF TEXTILES IN MEDICAL FIELD

- Flexible, comfortable and soft
- Breathable
- Reduced cross infection
- Cost-effective
- Protection from static electricity generated in operation theatres
- Biocompatible
- Safety of medical staff and patients
- Allow easy movement of body parts

VIII. CONCLUSION:

Medical devices are commonly made in whole or part from fibers. A medical device is defined as any device intended for medical purposes. It could be a machine, a reagent for use in the lab, software, an appliance, an instrument, or an implant. Demographic changes, increase in the population of elderly people, and need for increase in life expectancy have led to advancement in the field of medical textiles. Medical textiles serve as a bridge between biological sciences and engineering. Sustainable textile fibers have great influence on Medical textile Industry. Considering all these importance of natural sustainable fibers the first choice to the medical fields.

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