Medical textile

Medical textiles, also known as biomedical textiles, are textile products and constructions for medical and biological uses, e. g. , first aid, clinical, or hygienic purposes. (SASMIRA, 2007) The term medical textile literally means textile used for medical purposes. Textile apart from being a vital part human life is long since been used in medical field, though the term has been coined very recently. Textile materials have wide range properties such as flexibility, elasticity, strength etc.

Textiles used for medical purposes should be non-allergic, non-carcinogenic, non-toxic, and antistatic in nature, optimum fatigue endurance, biocompatibility, flame proof, dyes must be non-irritant. An important and growing part of the textile industry is the medical and related health care and hygiene sectors. The extent of the growth is due to the constant improvements and innovations in both textile technology and medical procedures. (Yogita Agrawal (Associate Prof), 2008) 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 fibres and manufacturing technologies for yarns and fabrics. Development in the field of textiles, either natural or manmade textiles, normally aimed at how they enhance the comfort to the users. Development of medical textiles can be considered as one such development, which is really meant for converting the painful days of patients into the comfortable days. Chet Ram Meena) Medical textiles are one of the most rapidly expanding sectors in the technical textile market, according to reports, and hosiery products with medical industry applications

are among a long list of textile products being consumed in that market. An important field of application of textile in medicine has been developed such as wound care and preventing chronic wounds. Bandages and wound dressings are most commonly used because they are affordable and reusable. Textile products are used in medical and healthcare sector in various forms.

The complexity of applications has increased with research and developments in the area of medical textiles. Recent advances in medical textiles to be used as extracorporeal devices are also significant. Nonwovens are a major player in the medical textiles field. Nonwovens are beginning to take the place of woven and knits as they offer disposability at a time when fear of disease contraction is at its height. Medical textiles are proving to be just as important as the medicines that are used today.

These textile products act in the same capacity as they treat and prevent medical problems with patients. Businesses and scientists are combining efforts to develop new medical textiles that optimize biocompatibility, sterility, leak resistance, and wear of medical products. The various applications of different fibre in medical field are shown as follows: Current Issues Sr No. | Fibre | Application in medical field | 1 | Cotton | Surgical clothing gowns, Beddings, Sheets, Pillow cover, Uniforms, Surgical hosiery | 2 | Viscose | Caps, Masks, Wipes | | Polyester | Gowns, Masks, Surgical cover drapes, Blankets, Cover stock | 4 | Polyamide | Surgical hosiery | 5 | Polypropylene | Protective clothing | 6 | Polyethylene | Surgical covers, Drapes | 7 | Glass | Caps mask | 8 | Elastomeric | Surgical hosiery | Medical Textiles Classification Medical textiles may be divided into two categories:

disposable products made of nonwoven materials; and reusable products made of woven or knitted fabrics. No matter what these products are made of, they have to perform 100 per cent of the time. The design of a biomedical textile is driven by its end use.

The main factors in designing a biomedical include: • Function: the textile needs to fulfil the purpose for which it was designed • Biocompatibility: the compatibility of textile with blood and an implantable material. • Cost: this depends on the raw materials and manufacturing process • Product approval: each country has its own regulations and standards for the approval of biomedical textiles Depending upon the usage, they are classified as (TECHNICAL TEXTILES) a. Healthcare and Hygiene products b. Extracorporeal devices c. Implantable materials d. Non-implantable materials Healthcare and Hygiene products (AMIR, 2006)

An important area of textile is the healthcare and hygiene sector among other medical applications. The range of products available for healthcare and hygiene is vast, but they are typically used either in the operating theatre or in the hospital wards for hygienic, care and safety of the staff and patients. They could be washable or disposable. Operating theatre This includes surgeon’s gown, caps and mask, patient drapes and cover cloth of various sizes. Surgical gown: - It is essential that environment of operating theatre is clean and strict control of infection is maintained.

A possible source of infection to the patient is the pollutant particle shed by the nursing staffs, which carries bacteria. Surgical gowns should act as barrier to prevent release of pollutant particles into air. Traditional surgical

gowns are woven cotton goods that not only allow the release of particles from the surgeons but also a source of contamination generating high levels of dust (lint). Disposable non-woven surgical gowns have adopted to prevent these sources of contamination to patients and are often composite materials of nonwoven and polyethylene films.

Surgical masks: They should have higher filter capacity, high level of air permeability, lightweight and non-allergic. Surgical caps: These are made from nonwoven materials based on cellulose. Surgical drapes and cover cloths: These are used to cover patients or to cover working areas around patients. It should be completely impermeable to bacterial and also absorbent to body perspiration and secretion from wound. Hospital ward This includes beddings, clothing, mattresses covers, incontinence products, clothes and wipes. E. g.

In hospital cross infection should be prevented and hence traditional woollen blankets replaced by cotton leno woven blankets. Incontinence products for patients are available in both diaper and flat sheet forms with later used for bedding. Cloths and wipes are made from tissue paper or nonwoven bonded fabrics, which may be soaked with an antiseptic finish. Super absorbent fibres for healthcare and hygiene products They absorbs upto 50 times their mass of water, whereas the conventional wood pulp and cotton linter absorbents absorb approximately 6 times their mass of water.

The superabsorbent fibres offer advantage as compared to superabsorbent powders due to their physical form, or dimensions, rather than their chemical structure. Whilst they do absorb fluids to a similar level as powder, they do,

however, do it faster. This is due to the small diameter of the fibres (? 30?), which gives a very high surface area for contact with the fluid. Typically fibre will absorb 95% of its ultimate capacity in 15 seconds. Product application| Fibre type| Fabric type|

Surgical clothing gowns| Cotton, Polyester, Viscose rayon, Polypropylene| Nonwoven, Woven| Caps masks| Viscose rayon, Polyester, Viscose, Glass| NonwovenNonwoven| Surgical coversDrapes cloth| Polyester, PolyethylenePolyester, Polyethylene| Nonwoven or WovenNonwoven or Woven| Beddings, Blankets, SheetsPillow covers| Cotton, PolyesterCottonCotton| Woven, KnittedWovenWoven| Clothing uniformsProtective clothing| Cotton, PolyesterPolyester, Polypropylene| WovenNonwoven| Incontinence Diaper sheetCover stockAbsorbent layerOuter layer| Polyester, PolypropyleneWood fluffSuper absorbentsPolyethylene fibre| NonwovenNonwovenNonwoven| Cloths/ Wipes| Viscose rayon| Nonwoven| Surgical hosiery| Polyamide, Polyester, Cotton, Elastomeric yarns| NonwovenKnitted| Extracorporeal devices These are extracorporeally 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. Artificial kidney * Tiny instrument, about the size of a two-cell flashlight. * Made with hollow hair sized cellulose fibres or hollow polyester fibres slightly larger than capillary vessels. * Fabric, which is used to remove waste products from patients’ blood. Artificial liver *

Made of hollow viscose to separate and dispose patients’ plasmas and supply fresh plasma. Artificial heart An 8-ource plastic pump lined with decom velour to reduce damage to blood and is a chambered apparatus about the size of human heart * Silastic backing makes the fabric impervious to emerging gas that is not desirable in the blood. Mechanical lung * Made with a hollow polypropylene fibre or a hollow silicone membrane. * Used to remove carbon dioxide from patients’ blood and supply fresh oxygen. Implantable materials Textile fibres, yarns, fabrics, composites and 3-D shaped fabrics from woven, knitted, nonwoven, braided and embroidery play a vital role in the manufacture of various implants, including the replacement of diseased or non-functioning blood vessels and segments of aorta or other big arteries.

It is even feasible to produce vascular prosthesis as fine as 2-3mm in diameter. These materials are used in effecting repair to the body whether it is wound closure (sutures) or replacement surgery (vascular grafts, artificial ligaments etc.) Biocompatibility is of prime importance if textile materials are to be accepted by the body and four key factors will determine how the body reacts to the implants * The most important factor is porosity, which determines the rate at which human tissue will grow and encapsulate the implant. * Small circular fibres are better encapsulated with human tissue than larger fibres with irregular cross sections. The fibre polymer must not release toxic substances, and fibre should be free from surface contaminants such as lubricants and sizing agents. * Biodegradable Artificial Tendon (Mesh) The composite meshes made up of polyester, polypropylene and polyester / carbon fibre are used for repairing hernia. The utilization of mesh

grafts in humans for hernia operations is based on the fact that during the absorption period a neomembrane is formed at the site where the mesh has been implanted. The mesh graft prevents recurrence of hernia and hence has an advantage over the tissue repair technique practiced for a long time in India. Artificial Joints The artificial joints are made of stainless steel, chromium cobalt, titanium or some other inert material.

The textile material present in the joints is Ultra High Molecular Weight HDPE (UHMWHDPE). Artificial Arteries Artificial arteries made of knitted polyester textile tubes are used for many patients whose natural arteries leading to their legs are blocked. Patients with diabetes have a tendency to suffer from cholesterol blockage of arteries leading to their feet. If not corrected, poor circulation can lead to gangrene and loss of limbs. Artificial arteries that look like pencil diameter corrugated vacuum cleaner hoses are surgically inserted to bypass the blockages, thus restoring circulation and saving limb functions. These implants require crucial textile technology to prevent clotting and rejection. Vascular Grafts

Vascular grafts are used to treat hindrances to blood flow caused by vascular and other diseases. A vascular graft replaces the damaged artery or creates a new artery in order to increase blood flow. The vascular grafts are sterile and single patient use only. They are of following types: Polyester grafts - used to repair thoracic and abdominal occluded arteries, Dacron grafts - for aortic surgeries and Polytetrafluoroethylene (PTFE) grafts - to repair occluded arteries and veins in the hands and feet and for dialysis treatment of chronic renal failure patients. product| | | | SuturesBio-degradableNon-bio degradable| | | | | | | Non-implantable materials

These materials used for external applications on the body and may or may not make contact with skin. They are made from co-polymer of two ? amino acids. This includes wound care, bandages, plasters, pressure garments, orthopaedic belts etc. (Aswini) Surgical dressing These are employed as coverings, adsorbent, protective and supports for injured or diseased part. They are different types: * Primary wound dressing * Absorbent * Bandages * Protective * Adhesive tapes Primary wound dressing * Placed next to the wound surface * Nonwovens with a binder content of 60% and made of cellulose fabrics are being used. Absorbent Similar to wound pads used in surgery. Manufactured from well bleached, carded and cleaned cotton fabrics.

Absorbent lint is cotton of plain weave, warp nap raised on one side, by a process known as linting EPI 36, PPI 32, used as an external absorbent and protective dressing and for the applications of oilments and lotions, as antiseptic adsorbent and protective dressing in first aid treatment. Surgical and other gauze provide absorbent materials of sufficient tensile strength for surgical dressing. They are made of cotton gauze loosely woven.