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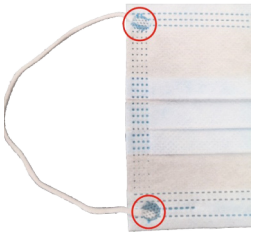

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Content

Editorial

"The only constant in life is change"-Heraclitus

In the wake of pandemic when the whole world has been paralyzed with disruptions from its regular progress, economic downfall and knowledge sharing; Tantu have stepped forward to emancipate the industry from these unprecedented constraints that bleaked the prosperity of industry direly- if not permanently but immediately for sure. Having respected the social distancing measures, we were compelled away from our usual activities like the last years to arrange seminar, star studded panel discussions where industry stalwarts and academicians had addressed the issues prevailing in the supply chain, unearthed the opportunities lurking behind the foreseeable hindrances in various product segments, connected the art of Fashion manufacturing to the technological advancement. But crisis ate the same time unleashes opportunities too. And we availed us of the opportunity of digital revolution in this period overcoming the decadence of technology by arranging thought provoking webinars and workshops for industry in association with internationally accomplished quartermasters and trailblazing organizations. You can know more about these on our official website.

We have always held ourselves responsible for betterment of the society beyond contributing to bigger umbrella of industry. And this year it was no difference. Right when the industry stumbled over the uncertainties, Tantu came up with coverall manufacturing resource guide publicly on their website and its members served industry with their expertise, consultancies all throughout the value chain of supply process. Being responsible about the community around us, Tantu have also donated money to Ramkrishna Math and Mission for their pandemic relief fund.

During India's remarkable journey from being a PPE importer through a self-sufficient manufacturer to exporter, we have realized how the medical & healthcare textiles can turn into the breadwinner for Indian industry in imminent future. Keeping the necessity in perspective and seeing Tantu's members' involvement nationally and internationally in different projects to combat the severity of pandemic to bring a light of hope in facilitating endemic free world, we decided to go forward to publish our annual journal on the theme of Textiles in Healthcare to share our proud journey, to share our members' experience & findings in different realms to address issues and way out to the solutions.

And the day has come when we are delighted to announce the successful publication of our annual journal, undaunted against all odds. We would like to extend our gratitude to all those personalities who have been behind the brainchild of webinar activities, valuable ideas, guidance and suggestions in torching our path forward and all other active members- without whose continuous support this accomplishment could never have been possible. We would also like to thank our official sponsors and industry partners who have been supportive of us financially and professionally in this success story.

This way, we vow to embrace the challenge to withstand the test of change and set an example in the industry in successfully paving the path of improvement forward together as an organization.

Prasanta Sarkar, Editor
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APPLICATIONS OF TEXTILES IN HEALTHCARE

Dr Amal Chowdhury | Assistant Professor, The Technological Institute of Textile & Sciences (TIT&S), Bhiwani

INTRODUCTION

Textiles used in healthcare (often referred to as medical textiles) can be viewed as one of the most rapidly expanding sectors in the technical textile market. Products defined in this category range from wound dressings and bandaging materials to scaffolds for tissue engineering, implantable prostheses and barrier fabrics. Enhanced developments of medical textiles and its applications can be attributed to a worldwide population growth, an ageing population and the modern lifestyle choices of individuals. Innovations in fibrous materials are creating new capabilities to have cost effective and quality healthcare along with mitigating risks of infection to both patients and health workers. Today, textile materials can be engineered with a range of properties from softness . and lightness and flexibility to absorption, filtration and the promotion of cell renewal. Apart from the above, innovation has also led to the developments of artificial livers, lungs, kidneys and dialysis filters using textiles [1]. Healthcare textiles can be categorized into the following areas, namely - External Devices, Hygiene products, Protection in the healthcare setting and Implantable materials. This paper reviews the healthcare and hygiene products based on textiles with a special emphasis on protection in the healthcare setting in the backdrop of present crisis.

EXTERNAL DEVICES

These consist of materials that work on the outside of the body either directly against damaged skin or to support and control body functions such as movement and blood flow. Examples of such type of product are wound-care-dressings, wadding and plasters, bandages, compression hosiery and pressure garments. When it comes to wound care management, a variety of innovative bandages have been developed. These are electrical Bandage [2], smart bandage, color changing bandage, gecko bandage [3] etc.

HYGIENE PRODUCTS

These materials are used primarily as an absorbent medium and placed in direct contact on the outside of the body. Nappies/diapers, feminine hygiene products come in the category of hygiene products.

PROTECTION IN THE HEALTHCARE SETTING

These materials are used in the healthcare environment and serve the function of providing comfort, modesty, barrier properties (between patient and healthcare worker), cleanliness and sterility. Surgical clothing, wipes, facemasks, surgical covers for the operating table, waterproof and water repellent textiles and clothing, staff uniforms, hospital bedding and curtains are the examples to quote a few.

A vast majority of textiles used within the healthcare industry are required to possess barrier properties providing varying degrees of water repellence. Commonly used materials for water repellency include vinyl fabrics comprising polyurethane, PVC, or a blend of PVC with either cotton or polyester. The vinyl

fabrics often possess a coating to resist bacteria and fungi on a long-term basis, alongside stain repellence. The combination of a vinyl-based fabric with a waterproof finish prevents the passage of water or oil based solutions through the fabric [4].

Staff Uniform

When it comes to staff uniform, porosity is an important factor which depends on appropriate choice of fibre, fineness of fibre, weave type and fabric density. Alongside, of particular importance is how the selected uniforms should act as a barrier with protection against fluids and airborne pathogens. The barrier function is normally provided by the use of a fabric finish or applying a laminate to the material. The uniform must be designed in a way so that it must provide protection against fluid penetration and at the same time it should provide breathability for wearer comfort. This may be possible by achieving a microporous structure as it contains numerous very fine pores to allow water vapour through but not liquid to penetrate. This combined with an appropriate finish can contribute to the creation of well-performing hospital clothing.

There are various techniques to apply effective antimicrobial protection to textiles. One of them is adding bio-functional additives at the fibre production (polymer formation) stage. Cupron [5] have produced a copper containing antimicrobial fibre. In the melt spinning process nanoparticles of copper oxide are mixed and dispersed in the fibre. Another method is coating the fibres or fabric post fibre production. Modern nanotechnologies like nanotechnology and plasma treatment have allowed nanoparticles and nanolayers of silver and copper to be applied to the surface of textiles.

Both Silver and copper have proved to provide effective protection against bacteria. However, silver, requires a moist environment to be most effective indicating it underperforms in some circumstances. On the other hand, copper is effective across a broad spectrum of temperatures and humidity conditions meaning greater reliability in the hospital setting. Furthermore, copper component not only suppresses the growth of bacteria, viruses, and fungi but can also stimulate collagen formation in tissue promoting skin regeneration [6].

Other properties alongside comfort and barrier include static control, which is an additional requirement for clothing worn in sensitive operating theatres. In a bid to have static control, a conductive carbon-impregnated polyester yarn is often inserted into the weave periodically to take care of static electricity. Antistatic properties are often added to textiles used within the operating theatre to reduce the risk of injuries due to static shock and interference with sensitive equipment during surgery.

Hospital bedding

Hospital bedding presents secondary risk area. Bed linen, though has comfort, durability, and longevity, its use in infection control is not significant. Barrier materials commonly accompany bed linen in hospital and are used beneath the standard sheeting to protect the mattress. These may either be non-breathable vinyl or washable cotton/polyester nearest the skin with a polyurethane film base to provide the waterproof barrier.

Incontinence products

Many medical textile applications require that the material absorbs and retains fluids rather than acting as a barrier to repel. Incontinence products, wound dressings, swabs and many maternity and operating theatre disposables are required to

draw in and retain fluids and bodily products. There are two main types of products used within the management of incontinence, namely - body-worn pads and bed pads. Body-worn pads, which are used in a similar way to babies' diapers, are complex and needs to be contoured around the body. While body-worn pads may be used as the primary method of liquid absorption, bed pads are often used as a back-up system on a patient's bed to absorb bulk liquid. The facing fabric on bed pads is usually cotton, polyester or a combination of the two. The absorbent cores are usually produced of viscose/polyester, which is either needle-punched felt or knitted, with a backing consisting of a polyurethane fabric. The fabrics are often quilted together to eliminate fabric shear, and waterproof backings can be integrated or separated. Separate backings are less easily handled but can easily be replaced if damaged. Bed pads, disposable in nature, are often nonwoven bonded materials treated with an antiseptic finish and accompanied with a backing of polyurethane. The non-woven pad may contain fluff pulp as the absorbent medium. Nowadays, to improve the absorbency, composite fluff products – which uses hydrogel superabsorbent polymers [7] or thermoplastic fibres, either individually or together - are often used.

Curtain

Studies have revealed that curtains are a potential source of cross contamination [4]. The majority of curtains comprise a tightly woven polyester structure to provide strength and durability and have a fire retardant finish to comply with safety regulations. Materials are commonly impregnated with an antibacterial finish or may have, for example, silver threads woven into the structure to provide a barrier against germs. To restrict the accumulation of dust particles and soiling on the surface of the curtain the fabric may be also be composed of a stain-resistant or antistatic finish. Some modern finishes which are designed to combine antimicrobial protection, fire retardancy, and stain resistance find their uses in curtain. It is pertinent to mention here that any finish applied to a fully washable fabric should withstand repeated harsh temperature laundering to comply with hospital sterilization procedures.

Gowns/Coveralls/ Personal protective equipment (PPE)

Gowns can be either reusable or disposable. Many tend to be single use and therefore do not require disinfection after use. Disposable gowns are usually a spunbonded, meltblown non-woven structure of a single layer, double-reinforced layers or multi-layers, depending on the level of protection required from liquid penetration [4]. Materials used are commonly polyester, polypropylene or blends. Spunbonding and melt-blowing processes have enabled to manufacture SMS (Spunbond, Meltblown, Spunbond) - which is a tri laminate non woven fabric and critical for coverall fabrics. SMS structure has its thin melt blown layer sandwiched between two spun bond layers [8]. Although SMS is more expensive than other materials such as non-layered materials, its unique features and specific design make it widely applicable for use. It is made up of a top layer of spunbond material, a middle layer of meltblown material and a bottom layer of spun-bond material [9]. The layering order of spunbond and meltblown material is shown in figure 1.

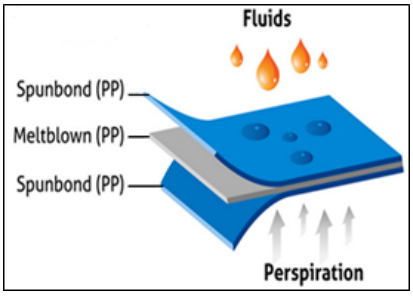

Figure 1- SMS material

The spun-bonded filaments do not have the fineness of the melt-blown method. Combination of spunbond and meltblown materials means that the features of each can make up for the weaknesses of the other [10]. For example, meltblowns have limited strength, so it should be combined with a spunbond to become a strong material. On the other hand, meltblown has relatively weak tensile properties but due to the smaller diameter and associated larger surface area, it has excellent wicking and barrier properties. Thus, the spun bond layer provides strength to the structure while the melt-blown layer provides barrier properties with good breathability. SMS structure has softness, comfort, wearability and lightweight. Finally, it is also fine enough to serve as a disposable fabric. Medical SMS fabric is therefore suitable for medical and hygiene products such as diapers, protective wear, face masks, hospital gowns, wound care, caps, filtration fabrics, and much more.

StaySafe™ Medical Clothing's range includes hospital gowns, medical caps, medical masks, and shoe covers which are manufactured using spunbond and meltblown techniques [10]. Studies as regards scope of using **SMMS** (spunbond, meltblown, meltblown and spunbond), **SSMMS** (spunbond, spunbond, meltblown, meltblown and spunbond) and even **SMMMS** (incorporating 3 layers of meltblown) are also underway for further improvement of performance of these structures.

One of the important components of PPE is N95 mask. The N95 mask requires a fine mesh of synthetic polymer fibers, specifically a nonwoven polypropylene fabric. It is produced by melt blowing and forms the inner filtration layer that filters out hazardous particles.

There is a significant difference between the design of traditional coveralls and isolation/surgical gowns. Coveralls typically provide 360-degree protection because they are designed to cover the whole body, including back and lower legs and sometimes head and feet as well, the design of surgical/isolation gowns do not provide continuous whole-body protection. Gowns, on the other hand, are relatively easier to put on and, in particular, to take off. The level of heat stress generated due to the added layer of clothing is also expected to be less for gowns than coveralls due to several reasons, which include the openings in the design of gowns and total area covered by the fabric. For gowns, it is important to have sufficient overlap of the fabric so that it wraps around the body to cover the back (ensuring that if the wearer squats or sits down, the gown still protects the back area of the body). As of today, in view of pandemic caused by Covid-19, design of coverall/PPE has got special attention as the kind of design protects healthcare workers working in close proximity of suspect/confirmed covid-19 cases.

According to guidelines set by Ministry of Health and Family welfare, the fabrication of body coveralls must be done only by sewing/adhesion/thermal/RF welding/ultrasonic welding or combination of techniques followed by application of sealing tape in stitched area. This kind of design of coveralls makes it possible to create a barrier to eliminate contact and droplet exposure (virus). Given the tiny size of novel coronavirus, it is appreciated that the stitched/sealed joints area of gown must be taken care of by sealing so that virus cannot penetrate through these vulnerable areas.

The commonly used method in the sewn product industry is that the traditionally stitched seam is sealed by overlaying tape. This is called

'seam sealing' and it requires special machinery called 'hot air seam sealing machine'. The application of seam sealing machine is to seal the seam of personal protective equipment (Coverall/Suite) to restrict the entry of corona viruses through the pores to protect the wearer from infection. The hot air seam sealing machine uses tape which has multilayered adhesive films whose nature depends on the type of fabric used. The machine produces hot air with precisely controlled temperature to directly heat up the adhesive of seam tape – which causes melting of adhesive and thereby sealing of seam. To maintain good quality of sealed seam, the key parameters which are to be monitored are temperature during sealing, pressure of roll in sealing machine and feeding rate to the machine. The efficacy of sealed seam is tested by hydrostatic tester. Table 1 shows the test standards for coveralls – which mentions the standard test method to ascertain the efficacy of the product.

Test parameter	International/Indian standard
Physical parameterst	Physical parameterst
Coverall for COVID-19 specification	IS 17423
	ISO 16603
Synthetic blood penetration resistance test	IS 16546
	ASTM F1670
Mass per unit area	ISO 9073 – I
	Biological parameters
Biological parameters	
Viral penetration resistance test	
	ISO 16604
	IS 16545
	ASTM F 1671
Resistance to dry microbial penetration	ISO 22612

IMPLANTABLE MATERIALS

Surgical sutures, cardiovascular implants such as vascular grafts (for redirection of blood flow), Artificial ligaments, tendons, skin, lumen, joints, bones, scaffolds for tissue engineering may be cited as implantable materials. Some of them are inserted into the body either on a temporary or permanent basis. Accordingly, materials used within the body can either be biodegradable or non-biodegradable depending on the longevity of the device. Where appropriate, there has been a shift away from the use of permanent materials to those required for a matter of months to serve as a scaffold supporting new growth before being reabsorbed by the body.

Long-term implants such as some artificial bones, joints, and ligaments may be required to stay in the body for a period of years. Non-biodegradable materials required for longer-term use in patients include polyester, polypropylene, PTFE, carbon, nylon, and polyethylene along with metals and ceramics for permanent insertion.

Regardless of the material being biodegradable (temporary)/non-biodegradable (permanent), biocompatibility is of paramount importance if materials are to be accepted by the body. If the implant is

not completely biocompatible, at the site of implantation infection can occur and the body starts to reject the implant. To increase the chances of acceptance by the body, cells from the host body are combined with the textile scaffold. One modification used on non-degradables is the use of a titanium coating to provide enhanced biocompatibility reducing the side effects caused by inflammation [4].

Apart from biocompatibility, materials that are required to stay within the body for several years and become accepted require bio-stability. An artificial ligament, for example, is required to be permanent and able to react with blood cells and surrounding tissue. Artificial bones and joints are often made of textile structural composites and found to be compatible within human body.

BIOCOMPATIBLE POLYMERS

In terms of biocompatibility a balance between hydrophilic and hydrophobic surfaces are required, depending on the requirements and nature of the implant or scaffold. A hydrophilic surface, and thus lower surface tension, is thought to be more biocompatible. However, hydrophobic surfaces when generating a contact angle with water of more than 65 degrees tend to adsorb proteins present in blood plasma. Rapid protein adsorption at the implant site plays a pivotal role in how the body responds to an implanted biomaterial and the associated initial inflammatory response.

Considerable research has been undertaken in the area of biocompatible textiles in recent years with advances in regenerative medicine. Cellulose is the most commonly used natural polymer and forms the basis of many healthcare textiles. Regenerated cellulose has been seen as a replacement for traditional materials with examples including viscose and Lyocell, both of which are hydrophilic. Other polymers that deserve attention are keratin and fibroin which are commonly used due to their biodegradability and biocompatibility.

Apart from these, alginate, polyglycolic acid (PGA) and polylactic acid (PLA) also have shown potential for healthcare applications. Alginate is non-toxic, non-carcinogenic, non-allergic, haemostatic biocompatible, able to be sterilized and easily processed. PGA polymerized directly from glycolic acid is strong, has a high melting temperature and low solubility in organic solvents. PGA is biocompatible and biodegradable thus is widely used in scaffolding. PLA made most commonly from corn is polymerized directly from lactic acid. It shows good biocompatibility, bio degradability, is hydrophobic, strong, and durable. It is commonly used as a carrier material for cells to grow during bone tissue engineering. A variation of PLA and PGA is poly(lactic-co-glycolic) acid (PLGA), which has a shorter absorption time by the body as it undergoes hydrolysis in the body to produce original monomers, lactic acid, and glycolic acid. This makes PLGA ideal for implants [12].

Another interesting polymer is chitin, found naturally and widely available from shells of crabs and crustaceans, has excellent bioactive properties. Chitosan (a form of chitin), partially deacetylated, is biocompatible, biodegradable, and dissolvable in many aqueous acidic solutions. It is ideal for use in drug delivery and tissue engineering. In a major breakthrough, researchers found another important polymer collagen - which is a commonly found animal protein. It has a controlled biodegradation rate, is biocompatible, and used in scaffolds, tissue culture, and wound healing. Hybrid scaffolds, comprising collagen and chitin, have been used in tissue engineering with gelatin, which is often used as an adhesive in scaffold manufacture [13].

RECENT DEVELOPMENTS

To make the fabric water repellant, continuous research is being carried out since long back and with advances in technology there has been a drive towards the use of biomimetics. Using fluorochemicals and nanotechnology, finishes have been created to achieve water- and stain-resistance that mimics the lotus leaf. To achieve a super-hydrophobic surface with a greater contact angle (over 150 degrees) using inspiration from the lotus leaf, the surface roughness of the fabric should be increased mechanically, creating a substrate with a multiplicity of microscale to nanoscale projections or cavities [14]. It should be noted that these advances in technology are still in relative infancy and surface roughness in relation to durability of use in healthcare textiles requires further exploration.

In related development, Grasim Industries has launched anti-microbial viscose fibre and many brands in India started using Anti-microbial Liva fabrics to make their garments in various categories [15].

One of the most important aspects of operating-theatre clothing is the barrier properties and so the comfort to the wearer is often seen as less important in such cases. However, during long procedures the lack of comfort to the surgeon may have a detrimental impact on performance. Thus this aspect should not be overlooked. The same applies to PPE coveralls used by doctors nowadays to fight against novel coronavirus as these clothes are not permeable. Inside the PPE coverall, temperature increases in the range of 36 to 390C resulting in a great discomfort to the wearer. Keeping this in mind and in a significant development, researchers have come with cool jacket – which uses a thermostat fixed inside the garment and the temperature is monitored externally. With proposed cooling system, temperature inside the PPE coverall can be maintained in the range of 25 to 280C. However, the product is yet to receive a nod for commercial practice.

Recently, in a major development in the area of antiviral fabric, Arvind Ltd., a leading textile-to-retail conglomerate in India has recently collaborated with Swiss Textile Innovator HeiQ to introduce HeiQ Viroblock technology in the country. Arvind will now be able to offer shirting, fabrics, apparels and masks using this Viroblock technology under its brand 'Intellifabrix' [16]. Tests on a virus similar to COVID-19 called 229E proved the treated material can destroy virus in a few minutes after contact of garments with HeiQ Viroblock.

Conclusion

To protect ourselves against bacteria and viruses is a major challenge as of today. In view of this kind of situation, the increased textile performance and standardization of healthcare textiles can play an increasingly prominent/critical role. Advances in fibre and fabric development and associated surface finishes allow for the possibilities of fabrics with improved surface properties to meet the ever-changing requirements of the medical industry. Further, with the development of technology, it will be possible to strive towards the creation of more environmentally friendly, safe, and durable textiles in healthcare. Last but not the least, developments of textiles in healthcare is the need of the hour and poses to be an emerging field in near future.

References

(1). https://www.technicaltextile.net/articles/medical-textiles-2587

(2). https://www.medgadget.com/2019/03/scientists-explain-why-electric-bandages- ork.html (accessed August 28, 2020)

(3). www.popularmechanics.com/science/health/a5089/4328266/ (accessed August 25, 2020)

(4). Davies, A., 2017. Healthcare textiles, Williams, J. (Ed.), In: Waterproof and Water Repellent Textiles and Clothing, Woodhead Cambridge

(5). Qin, Y., 2016. Medical Textile Materials. Woodhead Publishing, Cambridge. pp. 13–22

(6). Codita, I., Caplan, D.M., Dragulescu, E.C., Lixandru, B.E., Coldea, I.L., Dragomirescu, C.C., Surdu-Bob, C., Badulescu, M., 2010. Antimicrobial activity of copper and silver nanofilms on nosocomial bacterial species. 69 (4), 204–212

(7) Davies, A.M., 2011. Use of knitted spacer fabrics for hygiene applications. In: McCarthy, B.J. (Ed.), Textiles for Hygiene and Infection Control. Woodhead, Cambridge

(8). https://www.fibre2fashion.com/industry-article/1575/spunbonded-nonwovens-an-overview

(9). https://www.textileinnovations.co.uk/latest-news/what-is-sms-or-spunbond-meltblown-spunbond/

(10). https://www.staysafemedicalclothing.com/news/an-introduction-into-sms-material/

(11). Thevenot, P., Hu, W., Tang, L., 2008. Surface chemistry influence implant biocompatibility. Curr. Top. Med. Chem. 8 (4), 270–280

(12). Ivanova, E.P., Bazaka, K., Crawford, R.J., 2014. New Functional Biomaterials for Medicine and Healthcare. Woodhead Publishing, Cambridge

(13). Lee, S.B., Kim, Y.H., Chong, M.S., Lee, Y.M., 2004. Preparation and characteristics of hybrid scaffolds composed of B-chitin and collagen. Biomaterials 25, 2309–2317

(14). Gulrajani, M.L., 2013. The use of nanotechnology in the finishing of technical textiles. In: Gulrajani, M.L. (Ed.), In: Advances in the Dyeing and Finishing of Technical Textiles, Woodhead, Cambridge

(15). https://www.birlacellulose.com/download_files/Antimicrobial_pdf_1592503892.pdf

(16). https://www.thehindu.com/business/Industry/arvind-ties-up-with-heiq-to-introduce-anti-viral-fabrics-garments-under-intellifabrix-brand/article31795222.ece

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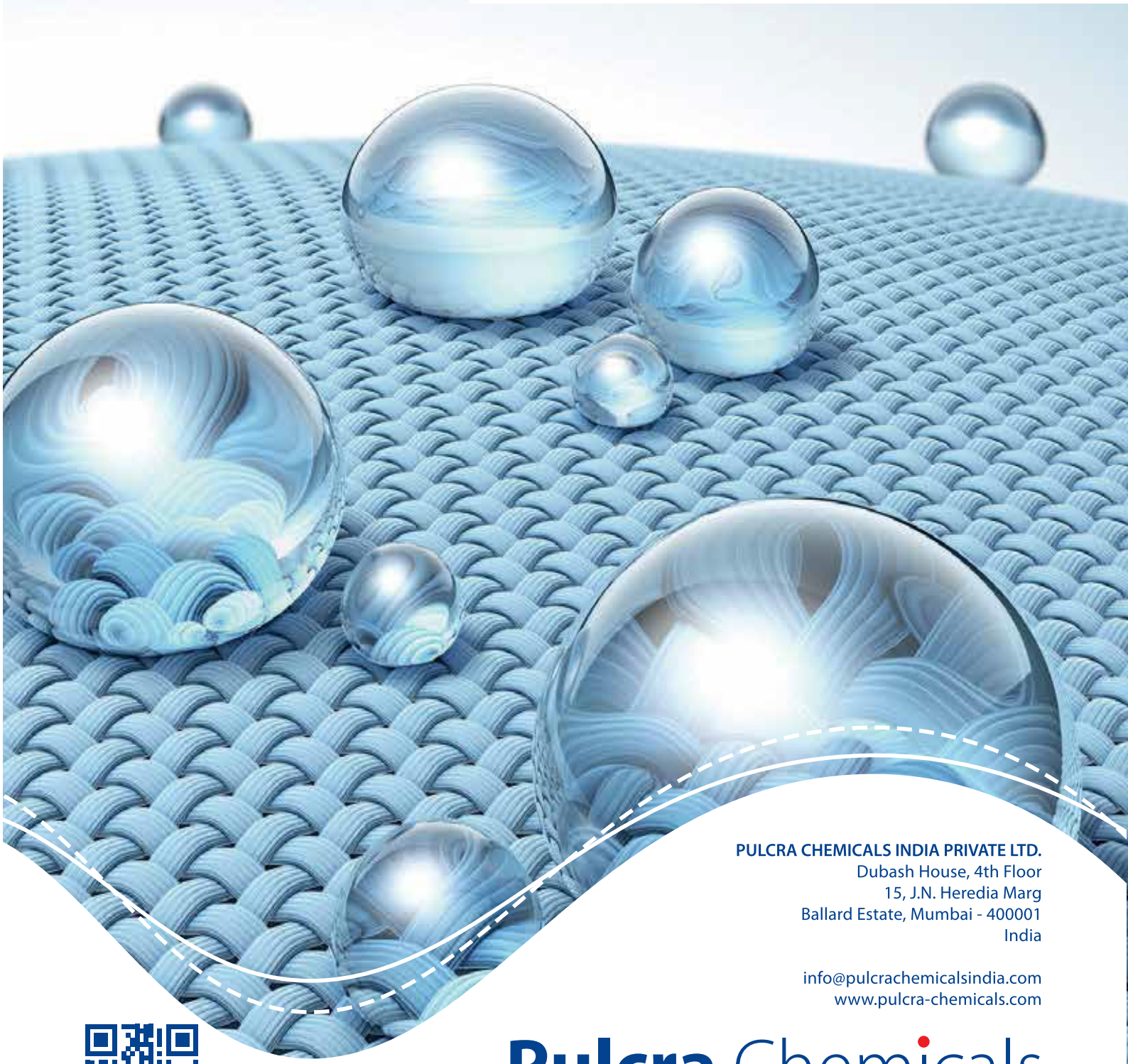

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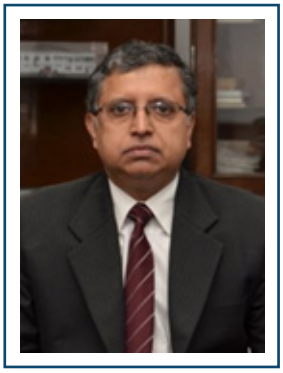
PERSONAL PROTECTIVE EQUIPMENTS (PPE) FOR MEDICAL PROFESSIONALS AND HEALTH CARE WORKERS FOR PROTECTION FROM COVID-19 VIRUS INFECTIONS

Arindam Basu | Director General, Northern India Textile Research Association, Ghaziabad 201002



Personal Protective Equipments (PPE) are commonly used by the professionals who prevent them from injuring themselves during working. Depending on the risks involved in a particular profession PPE are developed so that it can save the wearer from being affected by the accidents caused in his/her profession. For example, PPE used by the personnel working in a metal factory will be different from the PPE used by the fire fighters. For protection of health workers, medical professionals and patients the perceived risk is infection from other patients.

Surgical gowns have been adopted to prevent the release of pollutant particles in the air which is a probable source of contamination to the patients. Also the doctors and health workers are protected from coming in touch of blood, other body fluids and bacteria/virus. The general requirements for surgical drapes and gowns include liquid repellency and bacterial barrier properties, aesthetics (including comfortability, tactile softness, and comfort), strength, lint propensity, abrasion resistance, flame resistance, static safety and toxicity [1]. The characteristics of ideal gown have been well defined in the literature and summarised by Rutala and Weber [2]. Some of the characteristics of ideal gown listed are: barrier effectiveness, functionality or mobility, comfort, cost, strength, fit, time to don and doff biocompatibility, flammability, and odour and quality maintenance. The interfaces are as crucial for the protection HCWs as the fabrics used for the gowns. The construction of a garment, particularly in critical locations such as glove gown interface, can render it ineffective. The areas most vulnerable to strike through (extent of liquid penetration through the fabric) were found to be cuff, forearm, thigh, chest and abdomen [3].

Generally the PPE can be of two types; Disposable and reusable. Disposable surgical textiles are mostly made from hydraulically entangled nonwovens with cellulose pulps and FC finish or from a spunbonded-meltblown-spunbonded (SMS) construction made from PP fibres. Disposable surgical textiles for high performance class mostly consist of a spunbonded-meltblown-non woven construction with more weight per unit area or of film laminates made from hydraulically entangled nonwovens with PE or PP film. Reusable surgical textiles for the standard performance class are mostly made from PES filament woven fabric with FC finish, whereas those for high performance are made of multi-layered laminates consisting of PTFE; PES or PU membranes. An exposure and risks in areas close to wound differ from those in more remote areas, the demands vary, too.

Therefore many OR gowns consist of different fabrics in different areas [4]. In country like India where maintenance in Government hospitals and health centres are not of high standard disposable PPE are preferred over reusable. Nonwoven fabrics are the most commonly used textiles for surgical gowns, patient drapes, laboratory coats, coveralls, and other kinds of protective clothing. In a study of 2181 clean and clean-contaminated general surgical operations, Moylan et al [5] found that there was a significant reduction in the post-operative infection rate in both categories of operations when a disposable gown and drape system was used compared with a conventional reusable cotton system.

Some attempts were made by researchers to inhibit antimicrobial nature to the PPE used by the doctors. Synthetic fibers such as polypropylene and polyester are commonly used in the construction of surgical drapes and gowns as well as viscose. Montazer et al [6] prepared antimicrobial nonwoven fabrics by directly incorporating of a quaternary ammonium salt namely, cethyl trimethyl ammonium bromide, on polyester and polypropylene and viscose nonwoven fabrics. An interesting observation is the clear zone of inhibition and excellent reduction of bacteria growth on polyester and polypropylene fabrics. It is apparent that the antimicrobial activity of CTAB is bactericidal in nature and not bacteriostatic. CTAB was effective as antibacterial agent on E.coli for three different fabrics. However CTAB did not act on S. aureus and P. seudomonas when applied on viscose fabrics which may suggest method of production influence on antibacterial activity of CTAB. The antimicrobial and fluorochemical finishes used in this study were compatible in a single bath and could be applied to nonwoven fabrics to impart the desirable finish.

Due to pandemic caused by COVID 19 the PPE for medical personnel has attracted lot of attention. As it is highly transmittable disease not only medical professionals anybody going near to the patients need to be protected by using suitable PPE. Seeing its large scale and risks involved it is very much important that the products supplied to the frontline warriors are fulfilling the minimum standards of the PPE. Government of India has made it mandatory to register the manufacturers of Covid 19 PPEs with Bureau of Indian Standard (BIS) and the products need to be tested according to IS 16546:2016 and the whole materials are brought under IS 17423: 2020 Medical Textiles – Coveralls for Covid 19 – Specification [7].

As per this specification the coverall for COVID-19 should be made from suitable textile material that is not prohibited for use for the purpose under any applicable law / regulation in force so that the product made out of this meets the requirements specified in this standard.

The fabric used for the manufacturing of coverall should be a single or multi-layered textile structure made of woven or non-woven (spunlace or spunbond or combination of spunbond and meltblown) or knitted structure with or without coating / lamination engineered to fulfill the functional requirements. The material used for manufacturing coveralls shall not cause irritation to the user.

The coverall for COVID-19 consists of an integrated hood with elastic around face opening. It shall be provided with suitable fastening arrangement which shall be covered with a storm flap with provision of self-adhesive sealing. In case of elastic waist, it should be adhered with glue to minimize the potential entry points. The coverall may also be provided with elastic wrists and ankles for

convenience and freedom for movement. It shall also be provided with thumb loop for better and secure fit during overhead work.

The coverall should be joined by sewing, adhesion, thermally/ultrasonically welding or any other suitable technique. The seams should be sealed with a tape of suitable material of medical grade of minimum 16 mm width or any other sealing arrangement that ensure that the seam shall pass the same tests as the body. The design of the coverall should be as per the agreement between the buyer and the seller.

Each coverall has to be provided with a pair of shoe covers with an elastic strip to tighten it with the coverall, so that there is no passage for air through it. The coverall shall be manufactured with light colours only, as it is easy to detect possible contamination on light colours. As we are discussing about textile component this is a very important component. Beside coverall gloves, mask, goggles and face shield are the other components of the PPE.

Gloves surgical to be used made of nitrile (preferable), latex, polyisoprene or polychloroplene. They should be sterile, powder free and for single use. Gloves should have long cuffs, reaching well above the wrist, ideally to mid forearm with minimum thickness of 010mm and sizes ranging from 5-0 – 9.0.

Goggles, glasses protective should have good seal with the skin of the face, flexible PVC frame to easily fit with all face contours and even pressure [8]. It should enclose eyes and surrounding areas, accommodate wearers with prescription glasses, should have clear plastic lens with fog and scratch resistant treatment. It should have adjustable band to secure the goggles firmly so as not to become loose during clinical activity and should have indirect venting arrangement to avoid fogging. It can be reusable or disposable.

Face shield should be made of clear plastic and providing good visibility to wearer and the patient. Adjustable band has to be provided to attach firmly around the head and fit smugly against the forehead and preferably fog resistant. It should cover the side and length of the face. This may be reusable (made of robust material which can be cleaned and disinfected) or disposable.

The masks used by the front line workers should be equal to or better than N95 masks. The dust mask and single layer face mask do not offer protection against COVID infections [9]. The surgical mask is made up of three layers. The inner most layer is made up of an absorbent material that absorbs moisture from the wearer's breathe, the middle layer is made up of a meltblown material that acts as filter and the outer layer is made up of material that repels liquid. Surgical masks need to fulfill the following quality standards: bacterial filtration efficiency >98%, particulate filtration efficiency <99% for 0.1 micron particle size, differential pressure that measure ease of breathing < 3mm and fluid resistance of 80mmHg. Surgical masks are intended to be used only once between 3 to 8 hours and then safely disposed. One study that evaluated the use of cloth masks in health care facility using cotton cloth masks were at increased risk of infection compared with those who wore medical masks reinforcing the medical masks among health care workers [10]. Few recent publications reported that F95 mask with ventilator does not protect the wearer from virus properly. Hence those may be avoided by the medical professionals and health workers.

The Coveralls and masks are tested in the authorized laboratories and based on the report the products are accepted or rejected. The major tests conducted are as follows:

- Determination of resistance of protective clothing materials to

- penetration by using synthetic blood (ISO 16603:2004, ASTMF1670/ F1670M-17: 2017 or IS 16546:2016)
- Virus Bacteriophage Simulation Test (ISO 16604 or equivalent ASTM)
- Weight per unit area (IS 1964)
- Moisture vapour transfer (ASTM E 96, E 96M-05)
- Resistance of Face mask to penetration by synthetic blood (ASTM F 1862/ F 1862M-17)
- Respiratory protective device breathing resistance (EN 13274-3)
- Particle filtration efficiency for face mask (EN 13274-7:2008, ASTM F2299/ F2299M-03, IS 9473:2000)
- Gloves, surgical sterile (EN455/ASTM D3577)
- Goggles, glasses protective (EN 166, ANSI/ISEA Z 87.1 or alternative equivalent standard)

Ideally the coveralls should fulfill all the requirements i.e. low weight, not restricting any movement, comfortable for the wearer, soft etc. besides providing maximum protection. But practically these cannot be achieved as in many cases the quality requirement for the protection and the comfort are opposite to each other. For example if the coverall has good air permeability value the : wearer will get good comfort but the virus may enter with the air itself. Hence some compromise is being made keeping the protection as the first priority. In general, the nonwoven fabrics are coated to protect from virus attack and this affects the air permeability and moisture vapour transfer. The coating with micro pores are performed to allow moisture vapour transfer somehow but air permeability has to be compromised for proper protection. The experience shows that major problem with presently available Indian products are failure to protect leakage of synthetic blood in seam areas, especially in cross seam and joint areas. The major reasons for the same are:

(1). The quality of the tapes covering the seams is very poor. This includes tapes of lower width than requirement, poor quality adhesives on the tapes resulting in improper coverage of the seams.

(2). The improper covering/sealing of the seams by the tapes due to poor quality of craftsmanship.

(3). The fabric coating/ lamination are not up to the mark though this case is much lower as compared to other two.

One of the most important points for disposable PPE is proper collection and disposal of used PPE. Ideally the proper disposal of PPE is being taken care of by the national authorities according to the guidelines provided by World Health Organisation (WHO). The used PPE are incinerated following proper protocol. Following proper method of collection of used PPEs, carrying them up to incineration places can create some work for people in India who has lost their jobs but precaution need to be ensured [11]. Jain S et al [12] reviewed this situation and presented a strategy to dispose the PPE kits by their conversion to alternative fuel. Some others have suggested producing brick using them.

It may be concluded that while selecting PPE the first criteria should be protection from the risk faced by the user, then comfort, price and environmental impact. Proper selection of PPEs, precautions during wearing and taking off and proper disposal protocol can save the front line warriors from infection by CORONA-19 virus.

References

(1). Huang W and Leonas K. K.(2000), Evaluating a one bath process for imparting anti-microbial activity & repellency to nonwoven surgical gown fabrics, Text Res J, 70(9), 774-782.

(2). Rutala W A, Weber D J (2001), A review of single use and reusable gowns and drapes in healthcare, Infection Control and Hospital Epidomologies, 22 (4), 248-257.

(3). Goldfrank, Lewis R, Livermann Catharyn T (200&), editors, Preparing for an Influenza Pandemic: Personal Protective Equipment for Healthcare Workers, Washington D.C.

(4). Leonas K K, Jinkins R S(1997), The relationship of selected fabric characteristics and the barrier effectiveness of surgical gown fabrics, American Jour of Infection Control, 25, 16-23.

(5). Moylan J A, Fitzpatrick K T, Davenport K E(1987), 'Reducing wound infections. Improved gown and drape barrier performance', Arch Surg, 122-152-157.

(6). Montzar M, Rangchi F and Siavoshi F (2007), Preparation of Protective Disposable hygiene fabrics for medical application, Proc. Of Medtex 2007, Centre of Material Research and Innovation, 16th – 18th July 2007, Bolton, U.K.

(7). IS 17423: 2020 Medical Textiles – Coverall for COVID19 Specification.

(8). www.who.int/medical_devices/priority/COVID_19_PPE/en

(9). Ramamurthi D, Nugelally R R M, Cheeranahully J N, Rangappa M and Sivakumar V (2020), Personal Protection Equipments – Prerequisite, Rationale and Challenges during COVID19 Pandemic, Indian Journal of Community Health, 32, No.2 (Special Issue) April.

(10). MacIntyre C R, Seale H, Dung T C, Hien N T et al (2015), A cluster randomized trial of cloth masks compared with medical masks in Healthcare workers, BMJ open 0215: e006577.

(11). Srivastava J (2020), An optimistic approach towards PPE incineration (COVID-19), Conf: Emerging trends, issues, challenges and opportunities Post Corona crisis; Mahatma Gandhi Central University, Bihar, June.

(12). Jain S, Lamba B Y, Kumar S and Singh D (2020), Strategy for repurposing of disposed PPE kits by production of biofuel: Pressing priority amidst COVID19 pandemic, Biofuel, and August 2020.

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FACE MASKS- GENERAL AWARENESS THAT MAY BE GUIDED BY TECHNOLOGICAL FINDINGS

Arnab Sen | Associate Professor, National Institute of Fashion Technology (NIFT), Bhopal, M.P.

While some changes creep in slowly into the world, a very few come as a result of knee-jerk reactions. The latest pandemic is an instance of the later one, which has changed us socially, economically, educationally, fashionably, communicatively, and in 'n' number of ways in a very short span of time. In most of these cases, there was no other option but to change, and we 'changed'.

One very interesting such 'change' for a textile professional must have been the use of face masks. Of course, 'PPE' perhaps should come before discussing the mask, since a PPE is not only expensive, it also is technologically challenging in many ways. What have been the challenges? Well, to make a garment that stops something as small as a virus, that too merely physically, without using any chemical or biological treatment on the fabric is definitely a huge challenge. Besides, the ergonomic hassle of wearing a PPE for long hours has definitely added to it. So, developing a PPE that is satisfactory in performance in such a short span was a difficult ask, especially since very little was so far done on the making of PPE at a research level.

But, PPE is not the topic of the article. We can see many manufacturers offering PPE kits with varying degree of comfort and protection. We are, however, to focus on a more 'common' product here, the face masks. We can see around that a number of brands are offering them online with different looks- some with an 'office' flavor and others aesthetically appealing with floral prints and motifs. But we can hardly notice some good technical know-how about these masks. Probably we need to worry more about the masks as they are about the common people, the masses. To contain the spread, the masks for the mass deserve special attention.

What are probably missing?

Almost all sorts of technical specifications needed for making a face mask that really 'protects', is missing! We know we have to wear a mask outdoors but we are not aware of how to measure the extent up to which a mask can protect us. What should be the ideal range of fabric weight (GSM), how much should be the dimensions of the gaps in between the threads to stop the droplets from coming out (or entering), can we chemically treat the fabrics to make masks so that viruses can be stopped on the outer layer- all these questions are important and unanswered.

What should we know?

A face mask is made to cover our nostrils and mouth so that droplets can be prevented from escaping or entering. Some studies have already proven that masks are only partially successful in achieving this. The N95 mask is a better option, but it's non-washable. A face mask that is washable, good to look at, comfortable and

yet protective is what the dream product should be. It's unfortunate that while a lot of effort was put to mass produce masks in the country, little energy was driven to get these information handy for the users as well as the suppliers. These information are as important as the technical specifications required for a PPE.

How fabric construction should matter?

So far, the fabrics for masks are all intended to stop the spread through droplets only physically. When a fabric tries to stop something penetrating it physically, it can be compared to a filter. Like in a filter, the gaps in between the threads matter a lot in preventing the physical penetration, for a fabric too, the same becomes important. We need to have a range of yarn fineness for the warp and the weft that suits the need for a mask the best. However, we cannot make the thread too coarse so that breathability becomes a problem. The right balance between comfort and protection has to be struck. Similarly, the ends and picks per inch (or centimeter) should be chalked out as a favorable range. The best combination of yarn fineness and thread count can provide us a fabric that gives maximum . protection with satisfactory comfort

Do these fabrics need to be chemically treated?

When we are trying to stop prevention of a biological entity, perhaps there will be no harm in thinking in this line as well. Chemical finishes have really taken off in the apparel sector, offering unbelievable kind of products over a decade. Why not invest some time in trying to figure out if a suitable chemical treatment can make the masks more protective? Let's review what the masks are doing once again. They are, as a matter of fact, not stopping the viruses directly. They are hindering the entry (and exit) of the cough droplets. How are they able to do so- by absorbing the droplets (or parts of them) on their surfaces. Obviously, a cotton mask is more effective since it has a high moisture regain %. Can we, therefore, not think of a chemical treatment that would probably increase the moisture absorption capacity of the fabrics manifold? If we can achieve this, probably the droplets can be absorbed in larger proportion, therefore increasing the protection of the masks greatly.

There can be another reason for investing time in a chemical treatment for the masks. When we wash the masks after one use, the chemical treatment would partially leach out, and may be after 4-5 washes, its effectiveness will decrease considerably. If we have a chemical that the masks can be treated with after washing so that it may help regain the superior moisture absorption capacity of the masks, the longevity as well as effective protection of the masks will increase. This can probably open up another business option of these chemical finishes reaching the end users, much like the synthetic starch finishes that we already have.

The stitches play an important role!

Most of us would undermine the importance of the stitches along the edges of a face mask, unless we notice them a bit more closely. There are certain masks with nose pins and hard stitches along the edges. While the nose pins deteriorate in performance after each wash, the harsh stitches ensure that the edges do not ensure the absence of gaps with the skin. A softer edge with a fabric that has a greater extent of drape can help the edges of the masks be in touch with the skin (or at least very close to it) along its length. Use of a softer sewing thread for the edges should therefore be recommended.

The high drape of the fabric can be an issue as the mask may lie closer to the nostrils and the mouth. To avoid that, the fabric may be stitched in minor folds along its width. The folds will help gain some artificial stiffness in order to keep the mask away from the mouth to an extent that should be satisfactory.

Summing it up!

There is/are little information available in public domain regarding the above parameters, which are important to ensure the face masks do really well what they intend to do. In order to equip us better for preventing a resurgence or a new pandemic, some research should be initiated relating to the above parameters, which may be only a few of the important ones related to manufacturing of a face mask. It will be very important to have the information on public domain, as they would be related to public health.

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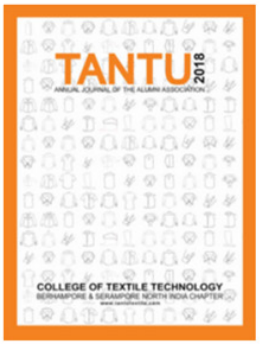

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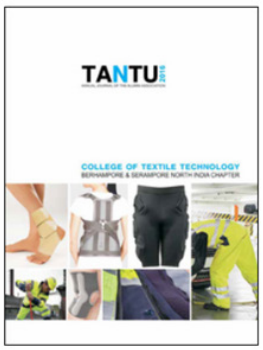

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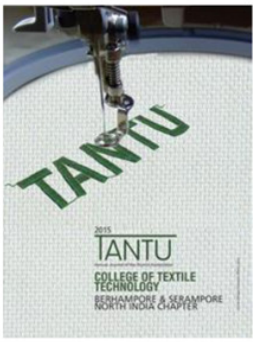

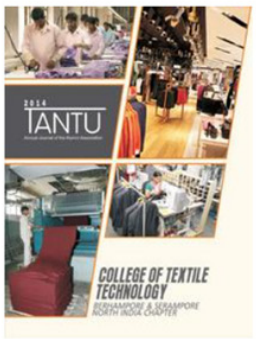

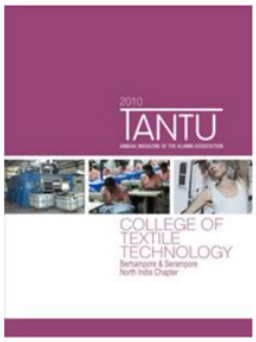

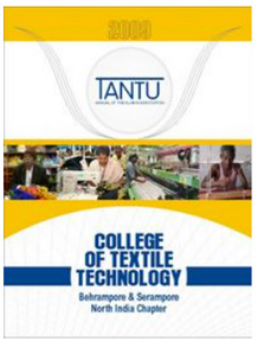

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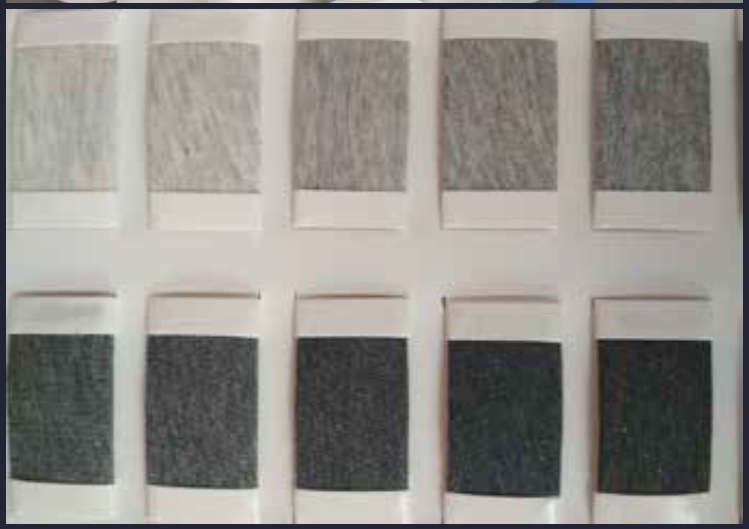


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MEDICAL TEXTILES- A BEGINNING OF NEW ERA, OPENS NEW VISTAS

Chandan Saha | Fellow of Institution of Engineers, India.

Medical Textile is identified as a Sun rising industry in the present context of improved health consciousness among people and professionals attached to healthcare sector. This sector is growing rapidly across the globe to meet the diverse requirements of people with the change of lifestyle & growing consciousness on hygienic issue and safe living.

The industry is still in nascent stage in India though there is a huge surge in consumption pattern in recent years. It is reported that Indian industry is mostly confined in manufacturing of consumable items like surgical cotton, and dressings including pads in medical textiles. There are few manufacturers in the area of health care products in southern states mainly in Tamil Nadu. India until now mostly depends on imported items.

Medical textiles are mainly classified into broad two categories namely - consumer products and hospital products. Consumer products mainly encompass the products that take care of health directly like sanitary napkins, baby diapers, wipes, and adult diapers etc. Hospital products encompass many items like surgical gowns, surgical drapes consumable items are like dressings, absorbent cotton, pad, suture and mask etc. Medical textiles are produced in diverse features, sourcing the materials from fiber to fabric. All variety of fabrics like; Woven, Knitted, braided and Nonwovens are used as medical textiles for diverse purposes. The medical textile manufacturers are widely scattered in various states, hence; statistics & data are not rightly available till now. But it's a fact that manufacturing activity of such products is quite scientific, and a lot of compliances are required to maintain hygienic norms & standards as set by the buyers and it also needs a regulatory compliance and license. One has to have professional acumens while planning to set up such industries.

It is reported that USA is the leading manufacturer of medical textiles followed by Germany, UK, South Korea and Japan. China has joined in the bracket of manufacturing leaders in recent times and captured a substantial share in global market. As per information available, global market of medical textiles is growing at around 5 percent and expected to grow little higher in the coming years as the pandemic is spread world wise that infused an improved consciousness of health among people & professionals attached to hospitals and other places and that will enhance the requirements of medical textiles hugely. The Global market was valued at US$16,686.6Mn in 2019 and expected to reach US$23.3Bn. in 2025. The estimated demand may spike further after the pandemic. India has failed to make its presence visible till now either as a manufacturer or as an exporter in the global market though our consumption pattern indicates a big surge in last decade with a growth rate of 5-20 percent in various categories and consumption got escalated substantially during the pandemic. Indian

manufacturers made a big attempt to manufacture Personal Protective Equipment (PPE) during the pandemic but failed to make a big breakthrough in absence of adequate knowledge & technical excellence.

Rajkot in Gujarat became a hub of manufacturing a wide range of Mask. Gujarat and Haryana are known for manufacturing surgical cotton and dressings for long. But such effort failed to yield a big outcome in absence of requisite framework. There is no standard formulated right from materials to finished product conforming to standards in international circuits. Govt. of India has laid emphasis on technical textiles since 11th plan and a scheme was specially designed to give a fillip to this sector. Concerned stake holders are also on the job to frame various norms to boost manufacturing activities to meet the domestic needs. Further growing global market also brings an opportunity to the industry stalwarts to make an inroad in the overseas market. At present India is exporting Surgical/Absorbent cotton, dressing materials and pads to many countries though it is still insignificant. However, with the concerted efforts of Technology Excellence Centers, manufacturers, BIS, and administrative authority, we can make it happen shortly to give a boost to the sector.

Industry at Glance – Global vis. a vis. India

Medical textile industry is countries excluding China, are yet to mark their presence visible though India has a sizeable contribution in the area of absorbent cotton, surgical dressings and bandages. As these items are low value-added, hence, its contribution remains insignificant in terms of revenue. It is reported that India is highly dependent on imported items in most of the products till now and 80% of medical devices are imported for uses in absence of requisite manufacturing facilities. Medical textiles encompass a wide range of product. The detail information is placed below: still dominated by few countries of developed world. At present global market is mostly shared by USA, Germany, UK, China and South Korea etc. Asian

Table-1: Classification of medical textiles

Hygiene and Healthcare Medical Textiles	Non-Implantable Medical Textiles	Implantable Medical Textiles	Extracorporeal Nedical Textiles
1. Surgical gown, drap es 2. Surgical facernasks 3. Bedding% blankets, sheets,. 4. pillow covers. Feminine hygiene 5. products 6. Wet wipes Adult incontinence 7. diapers Underpads	1. Compression stockings 2. Wound dressings 3. Waddings 4. Tubular bandages 5. Gauze 6. Pressure garments	1. Vascular grafts 2. Abdominal viall patches/meshes 3. Sutures 4. Heart patches valves 5. Stents: pet rncinofilament Tendowligarnent 6. reinforcements 7. Dura patches(Non-woven) 8. Artificial veins 9. Artificial joints and bones 10. Artificial skin and artificial cartilage	1. Hemodialysis 2. Artificial liver 3. Extracorporeal membrane oxygenation 4. Artificial heart 5. HME filter 6. Leukodepletion filter

As per information available, there are estimated few hundred units engaged in manufacturing of medical textiles but there is no specific statistics & data available now. The industries are mostly in MSME sector and widely scattered in nature. Maharashtra and Tamil Nadu are the important hubs of medical textiles. Medical textile units are also established in Gujarat, Haryana and Rajasthan. There are few units in operation in eastern states like West Bengal, Odisha and Chhattisgarh. West Bengal was once a leader in manufacturing Absorbent Cotton and surgical dressing till '90s but slowly got shifted to other states. At present only a few units are engaged in manufacturing and exports of such products. Rajkot in Gujarat became a new hub of manufacturing a wide range of Masks with different price tag during the pandemic. Maharashtra and Tamil Nadu are manufacturing a wide variety of health care products. With the passage of time a greater number of industries are expected to join to meet the growing requirements of wellness centers, Beauty Parlour, Gym& hotels etc. for a safe living.

Global Market scenario:

Global market of medical textiles got developed stably, with an average growth rate of 8% in last several years and the global production of medical textiles reached 3258 K MT in 2015.With the introduction of developed manufacturing technology and low labor cost, China became the leading player, with the production market share over 32%, Europe accounted for over 34% of market size in global market in 2015. The market had got developed in Europe due to the mature healthcare sector, growing consumer demand for improved healthcare facilities. North America is the second largest regional segment accounting for over 29% of the global market volume in 2015. Meanwhile, China and other Asia regions demand is projected to witness a high growth rate of over 10% due to increasing penetration of disposable baby diapers and feminine hygiene products.

Non-woven textile dominated the global medical textiles market, accounting for over 57% of global volume in 2015. This segment is projected to gain market share over the forecast period, due to high performance characteristics such as easy disposability, cost-effectiveness and reduced danger of cross-contamination. Healthcare and hygiene products and non-implantable goods application segments together accounted for a share of nearly 60% in 2015. Healthcare and hygiene products are rapidly gaining popularity in the developing regions including Asia Pacific, Latin America, and the Middle East due to rising healthcare infrastructure.

It is reported that the Global medical textile market was valued at US$16,686.6Mn in 2019, estimated to reach US$ 20.23Bn in 2022 and it is projected to reach US$ 23.3bn at a CAGR of around 5% by 2025. USA may witness a growth rate of 5.3% in next couple of years. The medical textile market of Germany was valued US$1,852.1Mn in 2019 and is projected to grow significantly in next couple of years. China's market is anticipated to reach US$1,547.4Mn. by 2025.

The market size of India's Medical textile was $600Mn in 2014 of which surgical dressings and surgical sutures alone accounted for about more than 50% at a value of US$380Mn that was estimated at a value of US$780Mn. In 2017 and is expected to reach US$ 1000Mn in 2020. India has a share of medical textile among technical textile is around 6% though our consumption pattern indicates a rising trend over the years and the gap is bridged by import. India's market share in Global market is around 2-3%. India

is exporting and importing various products to other countries. At present India is importing medical textiles from various countries like USA, China, Germany, South Korea Japan and Norway etc. India is also exporting various products to US and a few EU countries including Asian countries. The information is given in tables below:

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Table-2: Import of Medical Textiles in India 2017-18

Rank	Country	Value (in US$Mn)	% of share
01.	The US	8.5	13.9
02.	Indonesia	6.8	11.1
03.	Germany	5	8.3
04.	South Korea	5	8.3
05.	Puerto Rico	4.2	6.8
06.	Norway	3.6	5.9
07.	Lithunia	3.6	5.9
08.	China	3.5	5.7
09.	Japan	3	4.9
10.	Thailand	2.7	4.5

Source: - DGCIS & EXIM Bank Research working paper published in Dec 2018

Table-3: Export of Medical Textiles from India 2017-18

Rank	Country	Value (in US$Mn)	% of share
01.	Spain	19.2	18
02.	Netherland	8.8	8.2
03.	The USA	8	7.5
04.	Germany	7.2	6.8
05.	Poland	7	6.5
06.	The UK	6.6	6.2
07.	Italy	4.9	4.6
08.	Russia	4.3	4
09.	Nepal	3.5	3.3
10.	South Africa	2.9	2.8

Source: - DGCIS & EXIM Bank Research working paper published in Dec. 2018

The New Vistas:

It is expected that there will be huge surge in consumption of medical textiles in the coming years due to an attack of COVID Virus world wise. The pandemic has affected around 199 countries of the world and medical facility was on near collapsed in many countries and there was an acute shortage of

various medical consumables & protective clothing. Besides, there is a renewed thought to equip the medical facilities establishment and wellness centers with full protection to save the life of healthcare professionals and Doctors. Hotels, Restaurants, Beauty Parlour and Gym etc. made a new beginning of health care measures after the pandemic. With the rising population & more life expectancy and improved living style etc. are also fueling the demand of such specialized textile items.

It is reported that U.S. medical textiles industry revenue is projected to grow at a rate of 5.3% over the forecast period. The rising concern regarding chronic diseases and aging population has led to increased demand for non-implantable goods in the country, which is driving the market. Germany medical textiles market was valued for USD 1,852.1 million in 2018 and is projected to grow significantly over the forecast period. Germany is an important leader in foreign trade of medical textiles. China market is anticipated to reach USD 1,547.4 million by 2025. India is a traditional exporter of consumables like Absorbent Cotton, Dressings and bands etc. A few entrepreneurs in Southern states had initiated a big attempt to manufacture hygienic products to meet the rising demand in domestic market. It is estimated that there will be a rise in demand of 5-20% for various items in next couple of years.

Table-4: Growth Trajectory of Medical Textiles in India.

Medical Textiles	Market size	Annual growth rate (%)
Surgical Dressings	$154.43 million	5-10
Healthcare Textiles	$26.72 million	13-16
Sutures	$98 million	15-20
Sanitary napkin	-	8-10
Diapers	$17.4 million	5-10
Medical implants and devices	$154.43 million	10-15

Source: Textile value chain. In

Technology is indigenously available for many products. With the severe impact of this pandemic, now hospitals & laboratories will be upgraded to comply with norms & standards in the areas of safety & hygiene thus demand will surge. India has good base of nonwoven & knitted textiles and the fabrics are used in the myriad application of various consumable & disposable items that has a big share in medical textiles and creates ample opportunity to start manufacturing such items to bridge the demand supply gap both in domestic and overseas market. Recently Hon'ble Textile Minister also emphasized to tap the potential that arises at this juncture as market size may experience a big surge in next couple of years.

Conclusion

Medical textile is still in incipient stage in India despite there is a huge market potential. India's market appears in high growth trajectory as demand of hygienic products and consumables depicts a big rise in next couple of years. Govt. is also encouraging the professionals to set up industries. Technical knowledge and skill both are pre-requisites of manufacturing. Centers of Excellency at various academic institutions and Textile research centers are well equipped to provide technical support and knowledge on product development & innovation. That will pave the way for the both and new generation entrepreneurs to meet rapid rise in consumption of medical textiles both in domestic and overseas market, once the upcoming opportunities are fully tapped.

References:

(1). Indian Textile Journal Jan.2017, Sept.15

(2). Business Standard Jan'13

(3). 3. EXIM Bank Research Report & Working paperno.83 Dec,18

(4). 4. Market Research Report 19-25.

(5). Fiber & textiles in Eastern Europe report. Jan 2005.

(6). TNN Report Jan'19

(7) Medical Textile Market Research report'2020.

(8). The world Medical Textile Report June 2019.

(9). Opportunities for new entrepreneurs in medical textiles, SITRA Study report. Feb,19

(10). Advances in medical textile application. Nov'16.

(11). Medical textiles- A potential Segment to grow April 2020.

(12). Symposium on medical textiles, Applications & opportunities, July'15

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Face Masks and the Beyond

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Personal Protective Equipment (PPE) is an equipment worn to limit the exposure of wearers from variety of potential hazards such as thermal, chemical, radioactive radiation, airborne particles etc. PPE includes protective clothing or coverall, gloves, face masks, boots, helmets, etc. PPE is usually worn by workers (e.g., firefighters, military soldiers, oil and gas industry works, health care professionals) working in potentially dangerous occupational environments to provide them occupational health and safety [1]. In the events of pandemic such as 1918 Spanish Flu, Ebola, Evian Flu, or SARS (Severe Acute Respiratory Syndrome), face masks recommended for every individual have been proven to curb the spread of airborne infectious viral particles [2]. Therefore, since the outbreak of novel Corona Virus (SARS-CoV-2) in December 2019 that cause COVID-19, face masks have . been employed as a protective measure to control the spread of corona virus [3]

Health authorities agree that COVID-19 spreads through transmission of respiratory droplets. Respiratory droplets release into the air while speaking, breathing, sneezing or coughing. The size of respiratory droplets is relatively larger (>5 μm) while sneezing and coughing than the size of respiratory droplets while breathing and speaking. The larger droplets may tend to fall nearby due to gravity while the smaller size droplets (<5 μm) may go quite far i.e. 6-feet or more. Therefore, a protective physical barrier such as a face mask should be used to curb the spread of the virus.

There are many types of face masks available in the market, but all face masks are not alike, their construction, design and functional capabilities varies. Therefore, it is very important to understand the differences in commonly available face masks so as to make an informed decision before buying or making them, and to save ourselves from having a false sense of security.

Types of Face Masks

Face masks can broadly be divided into two categories- Medical Grade and Non-medical face masks. Medical Grade face masks includes surgical masks and respirators (N95 masks), while non-medical masks include the cloth face masks. An FDA (Food and Drug Administration) approved surgical mask is a loosely-fitted disposable mask made of a nonwoven material that can filter out large particles from air, while NIOSH (National Institute for Occupational Safety and Health) approved N95 mask can filter out both small and large air particles when wearer inhales. As the name of N95 suggests, it can filter out 95% of the small air particles [4]. N95 does come with an external valve or vent, that makes breathing easier but unfiltered air is released through it while exhaling. Wearer needs to be cautious that an N95 mask is

as effective as its tight seal against the face, if there is any leakage, its effectiveness would be compromised.

While a cloth mask is made of commonly available fabrics like cotton, silk, polyester etc. A clothed mask basically traps the respiratory droplets released from the nose and mouth of the wearer while breathing, speaking, coughing and sneezing, and this is how it helps in stopping the transmission of respiratory droplets in the air (i.e. ensuring source control) [5]. The filtration effectiveness of cloth masks is lower than the medical masks. Only medical grade masks are the PPE, cloth masks are not the PPE. Therefore, medical grade surgical masks and N95 masks are needed the most by health care providers and medical staff in hospitals, while general public could use non-medical cloth mask to control the spread of the infectious corona virus [5].

Few months back, supply chain was so severely affected that there was hardly any medical grade face mask available in the market. Therefore, World Health Organization (WHO) and other public health organization such as U.S. centers for Disease Control (CDC) recommended using the cloth face masks (textile-based face mask) for public in containing the spread of infectious corona virus [3].

So, many people came up with the home-made cloth face mask and suddenly every second person was making their own masks. But the question is, are all the clothed masks effective enough to protect ourselves from the Corona Virus. These days we also see a trend of fashionable, trendy designer masks to meet our aesthetic needs, but again the question arises whether such fashion masks are meeting their functional needs i.e. protect from the Corona Virus. Moreover, people are very confused what specifications to follow while buying a mask i.e. 3-ply surgical masks, masks with silver particles, masks with external valves etc. and how to care for reusable cloth face masks. Though, markets now have abundant cloth face masks, but they all lack the unbiased testing about the material, its efficacy protecting against the virus or whether it is made up of breathable material, etc.

In this regard, it is noticeable that all fabric materials are not equally effective in stopping the larger and smaller size respiratory droplets, number of factors influence the filtration effectiveness of cloth face masks such as type of textile material, thread count, weave design, water resistance and fit [2]. Therefore, fabric selection is very important while making or buying a textile-based face mask. A textile fabric should not only be effective in blocking the high- or low-velocity, small- or large-size respiratory droplets (i.e. it should be impermeable) but also be breathable at the same time. It is very likely that a highly impermeable fabric would have low breathability. If the air cannot pass through the fabric, then it may circle through the sides of the fabric and would fail the whole purpose of wearing the mask. Therefore, we need to seek the balance between protection and breathability in the face mask.

Following things should be considered while making an economical home-made face mask or while buying one:

- **Common textile fabrics used in the construction of face masks:** A fabric material which provides a balance between protection and breathability is best suited for the construction of textile-based face masks. Cotton is the most favorable textile material used in a face mask. Nylon does provide better protection but has less breathability. But studies have shown that 100% cotton fiber cloth face mask performs better than synthetic fiber-based

cloth masks (e.g., Nylon, Polyester, etc.). Other study has also suggested that the hybrid face masks constructed using one layer of tightly-woven cotton with either two or three layers of non-cotton fabric like natural silk or flannel or chiffon provided better filtering efficiency than face masks made with multi-layer cotton fabric only [6].

- **Layers and Weave:** Studies have shown that textile-based masks should be layered for better protection, at least two layers are recommended [8]. The outside layer acts as a barrier against the viruses so a tightly woven cotton fabric could be used, preferably having over 300 thread count. A quick 'light test' can be conducted to check whether a textile fabric has enough thread count to act as a barrier against infectious viruses. For conducting the light test, hold the fabric in hand towards a light source and ensure whether light can pass through the fabric or not, if light can easily pass through the fabric i.e. it has low thread count, which shows that fabric is likely too thin or has loose weave or is a knitted fabric, and could not effectively protect against the infectious virus. In this case, multiple layers of lower thread count fabrics could be used to make a good outside barrier. Furthermore, multiple layers add to the thickness and provide better filtering efficiency than masks made up of tightly woven fabric with lesser thickness (i.e. fewer number of layers). Sometimes, a filter might also be added along with multiple layers, and a filter made with a polypropylene material has been found very effective [6]. Furthermore, the filtration effectiveness of dry fabrics has been found better than wet fabrics, so water-resistant material are suited better for face masks such as polypropylene [2].

- **Design:** A well-designed face mask should tightly fit against the face of the wearers to provide the proper protection against the infectious viruses. The breath should pass through the mask layers, it should not leak through top, bottom or sides of the masks. Therefore, adults and children should use different size and style of the mask for the good fit and thus adequate protection.

  For easy breathing through masks, some masks come with one-way valves e.g. N95 masks with exhalation valves. Wearers need to be aware that N95 masks with one-way valve are not effective in protecting others around them because the valve closes when the wearer breathes in and opens when the wearer breathes out allowing the droplets to escape out. Therefore, wearer needs to wear a cloth mask or a surgical mask over a N95 masks with exhalation valves.

Whether we use a cloth mask or a trendy fashionable mask, as long as it meets the following requirements, it is good to go:

Features of an effective face mask:

i. It should be thick enough to act as a barrier against virus, therefore multiple layers of different textile material are preferred.
ii. It should snuggly fit over the bridge of the nose and under the chin.
iii. It should be breathable while wearing it.
iv. It should secure well on the ears through ties or straps.
v. If it is made up of a textile fabric, it should be washable.

Usage and Care of Clothed Face Mask:

Ideally a clothed face mask should be cleaned after each use. It could be hand-washed or machine-washed with soap and hot water.

Limitations of the face masks:

i. Moisture retention: Most common fabrics used in cloth masks like cotton are hydrophilic and they retain the moisture. While medical masks are hydrophobic i.e., they repel the water. When a mask gets wet with exhaled moisture, its filtration efficacy reduces, it becomes more resistant to air flow or less breathable [9].
ii. Poor filtration: If fabric selection (water-resistant material) as well as construction (i.e. multi-layer, high thread count, tightly woven, hybrid mask) of face mask is not done with proper consideration, it may lead to poor filtration efficiency.
iii. Limited visual communication: Masks hinder the visual communication; therefore, transparent masks are preferred. Transparent masks not only block the droplets, but also helps in visual communication, especially for people mostly relying on lip-reading.
iv. iv. Reuse: Surgical masks and N95 masks are disposable masks and are intended for only one-time use. While cloth masks are washable and could be good to reuse up to 15 washes. But, wearers need to ensure every time before using the mask that mask's structural integrity is intact. That is, if a mask has lost its shape, fit or shows any signs of degradation, so user should not use the mask.

Proper donning and doffing of the masks, cautious handling, and cleaning as well as the proper fit of the masks are considerably important factors as a selection of proper type of mask in ensuring the protection from the infectious Corona virus

Future Trends:

1. **Electroceutical fabrics:** Such fabrics are made from textiles such as polyester, geometrically patterned with metals such as Silver and Zinc particles. This fabric generates electricity when it comes in contact with a conductive medium such as any aqueous solution containing ions in it e.g. exhaling moisture, water droplets from coughing or any other bodily fluid. This small amount of electricity generated is sufficient enough to deactivate viruses from any further transmission. Though electroceutical fabrics have not yet been tested for SARS-CoV-2, but the tests conducted with other viruses show promising results [10].
2. **Smart Mask:** This mask is made up of white plastic and silicone. This has an embedded microphone and connects to the smartphone through Bluetooth and needs an app. This smart mask can amplify the wearer's voice and also can transcribe the text in 8 languages. Though this smart mask does not provide any protection, so it needs to be worn over a medical mask or a cloth face mask [11].

References:

(1). 1. Retrieved From https://www.osha.gov/Publications/osha3151.pdf

(2). Chughtai AA, Seale H, Macintyre CR. Effectiveness of cloth masks for protection against severe acute respiratory syndrome coronavirus 2. Emerging Infectious Diseases 2020 Oct. https://doi.org/10.3201/eid2610.200948

(3). U.S. Food and Drug Administration. N95 Respirators, Surgical Masks, and Face Masks. Retrieved From https://www.fda.gov/

(4). Mandal, S., Guowen, S. (February, 2016). Textile-based personal protective equipment for healthcare personnel. TechnicalTextile.Net. Retrieved From https://www.technicaltextile.net/

(5). Rodriguez-Palacios, Alex, Cominelli, Fabio, Basson, Abigail R, Pizarro, Theresa T, and Ilic, Sanja. "Textile Masks and Surface Covers—A Spray Simulation Method and a "Universal Droplet Reduction Model" Against Respiratory Pandemics." Frontiers in Medicine 7 (2020): Frontiers in Medicine, 2020-05-27, Vol.7. Web.

(6). Schive, K. (2020, August 6). How do I choose a cloth face mask? MIT Medical. Retrieved From https://medical.mit.edu/

(7). Chiu, A. (2020, August 11). Wearing a neck gaiter may be worse than no mask at all. The Washington Post. Retrieved From https://www.washingtonpost.com/

(8). Aerosol Filtration Efficiency of Common Fabrics Used in Respiratory Cloth Masks Abhiteja Konda, Abhinav Prakash, Gregory A. Moss, Michael Schmoldt, Gregory D. Grant, and Supratik Guha. ACS Nano 2020 14 (5), 6339-6347. DOI: 10.1021/acsnano.0c03252

(9). Dyer, J. (2020, May 7). When It Comes to Fighting Covid-19, Some Problems Can't Be Masked. Infection Control Today. Retrieved From https://www.infectioncontroltoday.com/

(10). Crowell, R. (2020, June 24). Electrified Fabric Could Zap the Coronavirus on Masks and Clothing. Scientific American. Retrieved From https://www.scientificamerican.com/

(11). Cairns, R. (2020, August 3). A Japanese robotics startup has invented a smart mask that translates into eight languages. CNN Business. Retrieved from https://www.cnn.com/

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EFFECTS OF AIR POLLUTION - WHY TO PONDER FOR A BETTER FUTURE AND POSSIBLE SOLUTIONS

Montu Basak | Associate Professor, National Institute of Fashion Technology (NIFT), Kolkata

Abstract:

Air pollution is a major contributor in the estimates of Global Burden of Disease which does not need a mention. The adverse effects of particulate matters (PM) of air pollution (PM2.5 and PM10) on human health are being observed at all levels of exposure, currently being experienced by most of the urban and rural inhabitants in both developed and developing countries alike. Even relatively low concentrations of air pollutants may lead to a range of detrimental effects on human health. It is, therefore, the high time when the world needs to pause for a moment, reflect back and to ponder over the wide-ranging impacts of air pollution on the Mother Earth and on the health of its residents. These deleterious effects of air pollution, especially on human health are currently a major issue for the global community. This article majorly focuses on discussing these 'slow but sure' effects of air pollution that may cause several disorders in human body, not even sparing its long term effects on child's brain development that may induce neurological issues in them at a very early stage of their life, thereby indirectly impacting a nation's growth at large.

Keywords: Air Pollution, Pollutants, Particulate Matter, Global Burden of Disease, Neurological Disorder, Brain Development, Lung Cancer, Cardiovascular Disease, Air Filters, etc.

Introduction:

Pollution refers to the contamination of the earth's environment with materials that interfere with human health, quality of life or the natural functioning of the ecosystems. The major forms of pollution include water pollution, air pollution, noise pollution and soil contamination. It would be difficult to identify any one particular form of pollution, responsible for maximum risk to health. However, air and water pollution appear to be responsible for a large proportion of pollution related health problems in this world (1).

Air pollution is a major environmental risk to health and is estimated to cause approximately 2 million premature deaths worldwide per year. More than half of the burden from air pollution on human health is borne by people in developing countries. The WHO Air Quality Guidelines (AQGs) mentions that, in order to prevent ill health, the level of PM10 should be lower than 20 µg/m3. By reducing the air pollution levels, the global burden of disease could be reduced considerably from respiratory infections, heart disease, and lung cancer, etc. Study shows that a reduction of PM10 pollution from 70 µg/m3 to 20 µg/m3,air quality-related deaths can be reduced by around 15%(2).

The Global Burden of Disease study has described the worldwide impact of air pollution with reports of 3.1 million all-cause and all-age deaths being attributable to ambient air pollution. Moreover, ambient air pollution ranked 9th among the modifiable disease risk factors and accounts for 3.1% of global disability

-adjusted life years, an index that measures the time spent in the states of reduced health (3). Thus, these facts stress upon the fact that the air pollution (both indoors and outdoors) is a major environmental health problem affecting everyone's health in developed and developing countries alike. The following sections discusses about the various effects that the air pollution bring in on human health.

'Slow but Sure' Effects of Air Pollution on Human Health:

Environmental and air pollution has been described as a greater threat to mankind than any other communicable diseases. Several research reports have been published all around the world about the serious impacts of air pollution and its significant contribution towards the damage of public health. It acts as an important stimulus for the development and exacerbation of respiratory disease such as asthma; chronic obstructive pulmonary disease and lung cancer (Figure 1). Alongside these affects, long-term exposure to air pollution, which has risen to alarming levels in the past years, likely to cause serious impacts on the cardiovascular activity in human body, brain and mental development in children and adolescents, kidney failure (according to American Society of Nephrology) too, have been reported in various published journals.

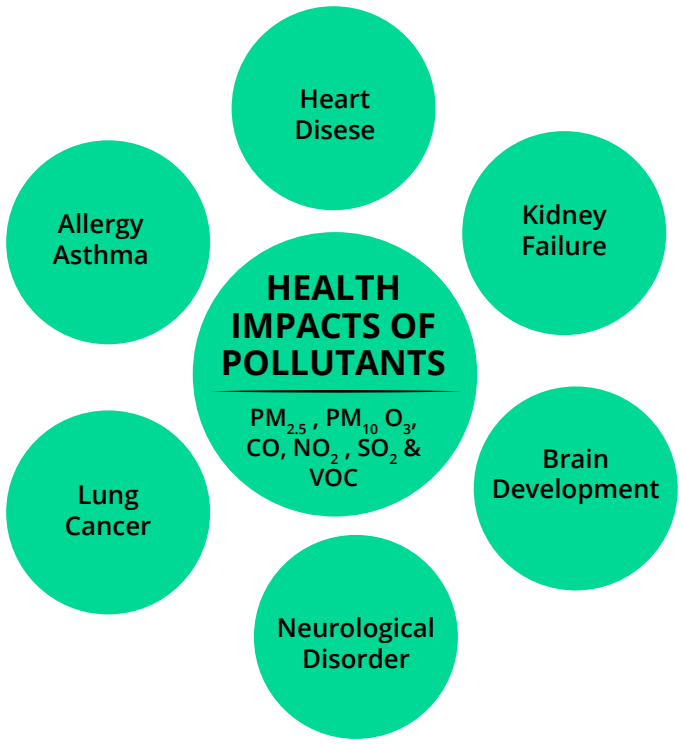

Figure 1: Established outcomes of short-term and long-term exposure to air pollutants (gaseous and particulate matter)

Air Pollution; Effect on Child's Brain and its Holistic Development

Presence of heavy metal, such as lead, in air pollution interferes with physiological processes of human body. During gestation period and in early childhood, the development of the brain is harmed when Pb2 induces the release of a neurotransmitter in elevated amounts and at the wrong time (e.g. during basal intervals, when a person is at rest). Thus, at high lead exposures, a person may have abnormally high amounts of brain activity (when it should be lower) and, conversely, when a neural response is expected, little or no increase in brain activity is observed. This may induce chronic effects when synaptic connections in the brain are truncated during early brain development. Lead also adversely affects the release of the transmitter, glutamate, which is involved in brain activities associated with learning.

It also complicates and exacerbates the other neurotransmitter effects and harms the cell's chemical messaging (i.e. second-messenger systems), synthesis of proteins, and genetic expression. Herbert Needleman, a paediatrician at the University of Pittsburgh Medical Centre, discovered that a correlation existed between the amount of lead in the teeth of infants and their intelligence as at age 16, as measured by their intelligence quotient (IQ) scores. His research has shown a dose–response between lead dose and IQ. That is, the higher the lead content, the lower the IQ in these teenagers. In a series of follow-up studies, Needleman determined that lead poisoning had long-term implications for a child's attentiveness, behaviour, and school success.

Another pollutant nitrates in air and water has been also been regarded as harmful to human body. It has been shown that ingesting high concentrations of nitrates can cause serious short-term illness and even death. The serious illness in infants happens due to the conversion of nitrate to nitrite by the body, which can interfere with the oxygen-carrying capacity of the blood, known as methemoglobinemia. Especially in small children, when nitrates compete successfully against molecular oxygen, the blood carries methemoglobin (as opposed to healthy hemoglobin), giving rise to clinical symptoms. At 15–20% methemoglobin, children can experience shortness of breath and blueness of the skin (i.e. clinical cyanosis). At 20–40% methemoglobin, hypoxia will result. These acute conditions can deteriorate a child's health rapidly over a period of days. Long-term, elevated exposures to nitrates and nitrites can cause an increase in the kidneys' production of urine (diuresis), increased starchy deposits and haemorrhaging of the spleen (4). Epidemiological studies have shown that symptoms of bronchitis in asthmatic children increase in association with long-term exposure to NO2 present in air (5). Studies in children have also found similar correlations between particulate matter in ambient air and attention deficit hyperactivity disorder between vehicular air pollution and increased blood levels of lead (a potential risk factor for abnormal mental development in children(6).

Air Pollution; Its Effect on Allergic Reaction to Pulmonary and Respiratory System

Amongst other air pollutants, sulphur dioxide (SO2), coming out mainly from vehicular emission, is an important precursor that has negative impact on human health. Several researches have shown that a proportion of people with asthma experience changes

in pulmonary function and respiratory symptoms after periods of exposure to SO2 as short as 10 minutes. It can affect the respiratory system and the functions of the lungs, and causes irritation of the eyes, too. Inflammation of the respiratory tract causes coughing, mucus secretion, aggravation of asthma, and chronic bronchitis, and makes people more prone to infections of the respiratory tract.

Another research, undertaken to study the respiratory and systemic toxicity associated with chronic exposures to biomass smoke, has shown remarkable increase in the prevalence of respiratory symptoms, lung function reduction, airway inflammation, and covert pulmonary haemorrhage. There was a significant reduction in superoxide dismutase (SOD) enzyme activity in blood plasma, suggesting a decline in the body's antioxidant defence. This was accompanied by a higher frequency of micronucleus formation in airway epithelial cells and comet formation in lymphocytes, suggesting a higher rate of chromosomal and DNA damage. Moreover, airway epithelial cells of biomass users had greater instances of metaplasia and dysplasia, implying a higher risk of cancer in the airways. In addition, biomass users had prolonged menstrual cycles, a higher risk of spontaneous abortions, still births (5). Elderly persons, children and people with chronic lung disease, influenza or asthma are especially sensitive to the effects of particulate matter (7). Another article also cites a growing trend of chest infections and allergies among children due to air pollution (8).

It is also being investigated and shown that the pattern of outdoor pollutants have diverse effect on allergy (9). Elevated levels of particulate pollution have been associated with increased incidence of respiratory symptoms and diseases including acute lower respiratory infections (ALRI) in children, carcinoma of the lungs and exacerbations of bronchial asthma and chronic obstructive pulmonary disease. In addition, epidemiological studies have also linked exposure to indoor air pollution to decreased pulmonary function, increased hospitalisation for respiratory diseases and increased mortality (10)

Air Pollution; Its Effect on Cardiovascular Disorder

World Health Organization reported that the annual mean concentration for PM was 20 µg/m3, beyond which the risk for cardiopulmonary health effects are seen to increase (11). Numerous manifestations of cardiovascular disease have been associated with air pollution, involving both the arterial and venous circulations. Air pollution not only exacerbates existing heart conditions but also appears to have a role in the development of the disease (Figure 2), with particularly strong evidence for an adverse effect of PM compared with gaseous pollutants.

An English national cohort study also found that long-term exposure to PM and NO2was associated with increased incidence of heart failure. A systematic review and meta-analysis of the current evidence of the association between air pollution and heart failure showed a positive association between short-term increases in gaseous components and PM with the risk of hospitalization or death from congestive heart failure.

Although it is intuitive that air pollution is an important stimulus for the development and exacerbation of respiratory diseases, such as asthma, chronic obstructive pulmonary disease, and lung cancer, there is generally less public awareness of its substantial impact on cardiovascular disease. Historically, the 1952 Great

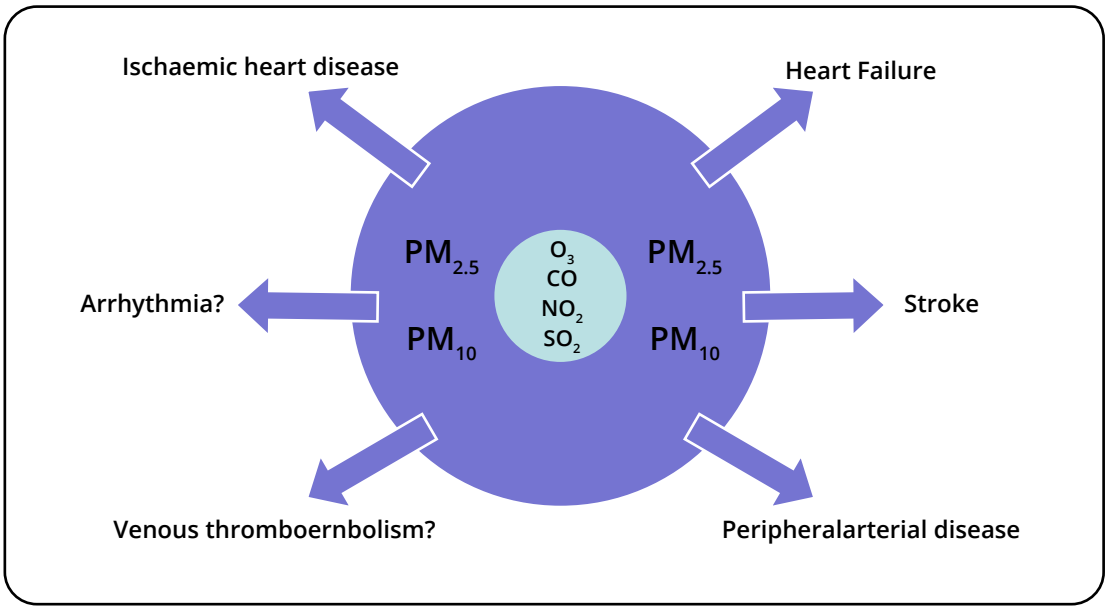

Figure 2. Established and unsettled clinical outcomes related to air pollution (gaseous and particulate) (12)

Smog of London led to an increase in cardiovascular death as well as deaths due to respiratory disease.

In a news article, Sundeep Salvi, Director of the Pune-based Chest Research Foundation (CRF) also mentioned that air pollution of finer matter enters the heart apart from the lungs through the blood stream and causes ischaemic heart disease, heart attacks and blood pressure problems (13). Air pollution has been identified for the first time as a major contributor for stroke leading to death and disability, mainly in developing and middle-income countries like India. Every year an estimate of more than 1.2 million people get affected in India by stroke, making it the one of leading cause of death and disability in the country. Globally, about 15 million people suffer strokes every year, of which nearly 6 million people die and 5 million are left disabled including loss of vision or speech, paralysis and confusion (14). In an another study, it is reported that exposure to particulate air pollution increases mortality and morbidity related to respiratory and cardiovascular diseases especially among susceptible individuals such as the elderly and people with pre-existing lung- and heart disease (15).

Air Pollution; Its Effect on Human Lung

A research study by one of the researchers Thuan Quoc Thach from the University of Hong Kong has shown that long-term exposure to particulate matter has been associated with mortality mainly from cardiopulmonary causes and lung cancer. Chronic exposure to particles contributes to the risk of developing lung cancer along with other issues like cardiovascular and respiratory disorder, too. Indoor air pollution from solid fuel use is also a major risk factor for chronic obstructive pulmonary disease and lung cancer among adults.

Excessive O3 in the air can have a marked effect on human health, material, and vegetation. It can induce breathing problems, trigger asthma, reduce lung function, and cause lung diseases (5).

Air Pollution; Its Effect on Human Neurological Disorder

In the recent past, study has shown that air pollution is also associated with diseases of the central nervous system (CNS), including stroke, Alzheimer's disease, Parkinson's disease, and neurodevelopmental disorders It has also been demonstrated that various nano-sized particles existed in air pollution can easily translocate into the CNS where they can activate innate immune responses. Emerging evidence suggests that air pollution induce neuro-inflammation, oxidative stress, microglial activation, cerebrovascular dysfunction in human body. More research is needed for understanding the potential negative effects of environmental pollution on neurological health and more attention should be given to this particular area of concern (16).

Air Pollution; Its Effect on Kidney

Several studies have shown there is positive link between kidney issues with air pollution. Although the effect is reported as weak but still it poses a threat to human body. Long-term, elevated exposures to nitrates and nitrites (pollutant of air pollution) can cause an increase in the kidneys' production of urine (diuresis), increased starchy deposits and haemorrhaging of the spleen (4).

Conclusion and Future Direction:

Extensive research around the world have been done and still continue to be going on in this field of air pollution and its immense negative effect on the human health. Air pollution is a poison that slowly affects the human body without knowing its dangerous repercussion in the long run. Government policies are also in place for regulating the violators who violate the ecological rules in nature and contaminates the air. But mere punishment would not serve the purpose. People's awareness and a mass movement in controlling these far-fetching effects of air pollution are needed. A long-term strategic vision should be in place for providing a safer, greener environment to our future generation. Otherwise, the Mother Earth is going to be submerged in a big gas chamber, full of hazardous and harmful gases that are going to surely affect everyone, to suffocate them, irrespective of their status, power and economic strength in developed and developing countries alike.

The People of India should exercise their basic rights and demand laws that may ensure 'Rights to Clean Air' to all its citizens for having cleaner air and greener environment to pass on to its future generation for their better living on this earth. Similarly, people should also have their choices to 'Rights to Reject to Polluted Air' in a way so that they can emphasise their very basic rights to having access to the clean air and nobody has any right to contaminates that, bringing everyone's attention towards the negative impacts of air pollution.

Personal protective equipment such as masks, air filters, filter cartridge are available in the market to provide protection against polluted air, but the question arises how many of these products are functionally suitable for giving enough protection to the wearer and at the same time making it aesthetically appealing so that the wearer wears it with confidence and takes pride in it.

There lies the scope for the Indian innovators and the designers to explore new vistas in the field of face masks and its filters by adopting filter design innovation as well as filter material innovation. With these distinctive approaches in innovation and a large pool of talents, India can achieve greater height in manufacturing indigenous high quality face masks or

filter for face masks and become a self-reliant 'Atmanirvar' country in the world, reducing its dependency on the imports from other countries. This would, in turn, encourage Indian voices for 'Vocal for Local' and can give a determined focus on making 'Make for World' campaign a successful one.

This way, the nation can contribute positively in curbing the notorious air pollution and thus, help bring down its effects on human health

References:

(1). Indian J Community Med. 2013 Jan-Mar; 38 (1), pp.4–8.

(2). Bhola R. Gurjar, Luisa T. Molina, and Chandra S.P. Ojha, Air Pollution Health and Environmental Concerns

(3). A systematic Analysis for the Global Burden of Disease Study 2010, Lancet, Vol. 308, 2012, pp. 2224-2260

(4). US Environmental Protection Agency (EPA), National Primary Drinking Water Regulations: Technical Fact Sheets. Washington, DC: http://www.epa.gov/OGWDW/hfacts.html, 1999.

(5). Bhola R. Gurjar, Luisa T. Molina, and Chandra S.P. Ojha, Air Pollution Health and Environmental Concerns

(6). Kalra V, Chitralekha KT, Dua T, Pandey RM, Gupta Y. Blood lead levels and risk factors for leadtoxicity in children from schools and an urban slum in Delhi. J Trop Pediatr. 2003;49, pp. 121–123.

(7). Indian J Community Med. 2013 Jan-Mar; 38(1), pp. 4–8.

(8). Times of India article, June 10, 2016

(9). H. Behrendt, W.M.Beckar, et. Al., Int Arch Allergy Immunol, 1997, 113 , pp. 69-74

(10). Lawrence I. Ibhafidon, Daniel O. Obaseki, et al., Niger Med J. 2014 Jan-Feb; 55(1), pp. 48–53.

(11). WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global update 2005, Summary of risk assessment. [last accessed on 25th August, 2019].

(12). David E. Newby, Pier M. Mannucci, et. Al., European Heart Journal, December, 2014

(13). Times of India article, June 7, 2016

(14). Time of India article, June 11, 2016

(16). Dorina Gabriela Karottki1, Michal Spilak, et al, Environmental Health, 2013, 12, pp.116.

(17). Sermin Genc, Zeynep Zadeoglulari, Stefan H. Fuss, and Kursad Genc, Journal of Toxicology, Volume 2012, pp.23

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The author is a Textile Engineer by training, an Associate Professor by profession, working currently at NIFT, Kolkata. He holds master's degree in textiles having special interest in textile material innovation in medical textiles and its chemical processing. Air pollution and its effects on human health is an area where the author is actively working on in the recent time. Innovative filter media development is a part of that effort that aims to better human health by providing better personal protection. Alongside, the author enjoys solving real-life problems and designing systems for simplification of processes, especially related to medical textiles.

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INTRODUCTION TO TECHNICAL TEXTILE & MEDICAL TEXTILE

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Introduction:

Textiles are flexible material consisting of either fibers, yarns, or fabrics formed from yarns. Cloth may be used synonymously with fabric but is often a piece of fabric that has been processed. There are subtle difference lies always between these terms of fibers, yarns and fabrics. Textiles have variety of uses, most common of which it is clothing and in some case in bags, domestic uses such as bedsheets, curtains and towels and in crafts such as quilting, embroidery. Beside this textile have many other uses such as for industrial purposes, and chosen for characteristics other than their appearance, are commonly referred to as technical textiles. This type of textile is mainly used for non-aesthetic purposes where its function is the most wanted thing.

What is technical textile?

Textile materials and products manufactured primarily for their technical and performance properties rather than their aesthetic or decorative characteristics or in other words textiles which are defined as technical fibres, materials, and support materials meeting technical rather than aesthetic criteria. Though its industrial uses are more, it can be applied for clothing purpose such as protection from heat, cold, flame, biological, chemical and ballistic threats.

Some terms which are relate to technical textile are follows:

- Alternative materials: lightweight, flexible, soft, multifunctional, and durable.
- New technologies: flexible, continuous, versatile.
- Functional components: reliable, multifunctional, cost-effective, user-friendly parts of large technology systems.
- Material substitution: replacement of traditional materials such as steel and cement by more environmentally sustainable materials.

Areas of technical textile:

Agrotech	agriculture, horticulture, forestry and fishing
Buildtech	building and construction
Clothtech	functional components of shoes and clothing
Geotech	geotextiles and civil engineering
Hometech	products used in the home; components of furniture and floor coverings
Indutech	filtration and other products used in industry
Medtech	hygiene and medical
Mobiltech	transportation construction, equipment and furnishing
Oekotech	environmental protection
Packtech	packaging and storage
Protech	personal and property protection
Sporttech	sports and leisure technical components

List of some fibers applied in technical textile:

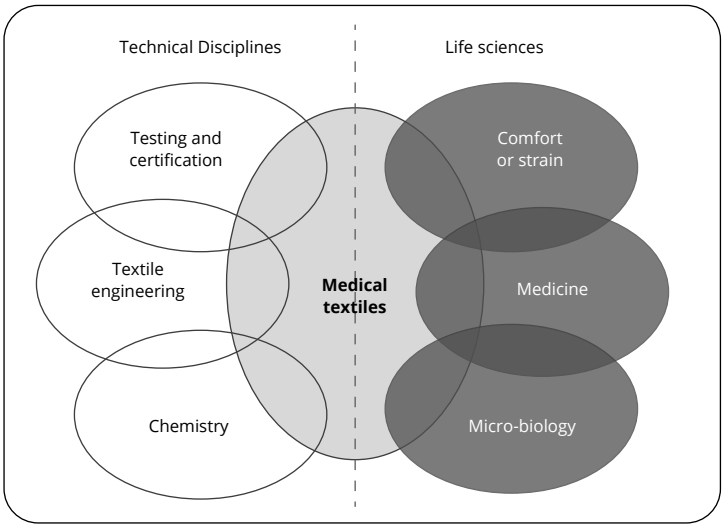
- Natural fiber – cotton, jute, flax, hemp etc.
- Regenerated fiber - viscose, FR Viscose, Lyocell
- Synthetic fiber - Nylon (Dacron), Polyacrylic (Oasis), Polyolefins (PE, PP)
- High strength & High Modulus fiber - UHMWPE (Dyneema, spectra), Kevlar
- High chemical and combustion resistant organic fiber – Nomex, PBI (polybenzimidazole), Panox (Oxidized acrylic fiber)
- High performance inorganic fiber- Carbon, Glass, Asbestos

Market view of technical textile:

The global technical textile market size was estimated at USD 175 billion in 2019, growing at a compound annual growth rate (CAGR) of 4.5% from 2020 to 2027. According to Euratex, the technical textiles industry in the EU represents roughly 30% of the total turnover in textiles (excluding clothing. It could represent a higher percentage market share in some member states such as technical textiles production is estimated at 50% of total textile production in Germany, 45% of total production in Austria and approximately 40% in France. The combination of protection with aesthetic and comfort requires some research, development, complex technologies including smart textiles, nanotechnology, special properties production textile, and engineering. All these factors are resulting in the increase in the cost of the manufactured technical textile product which hinders the growth of the market for technical textiles. Manufacturers are focusing on efficient and effective distribution channels to omni-channel supply of the products. As a result, companies are likely to establish partnerships with online portals to ensure that buyers have on-time access to the products. In addition, buyers are entering into agreements with emerging and small-scale manufacturers to expand their network.

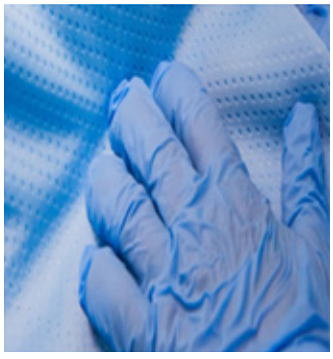
Medical textile – a part of technical textile:

An important and rising part of the textile industry is the medical, healthcare and hygiene sectors. The extent of the growth is due to joint collaborations of both textile technology and medical procedures. Textile materials and products that have been engineered to meet particular needs are suitable for any medical and surgical application. It is a combination of strength, flexibility, and sometimes moisture and air permeability factors. Materials used for medical textile generally include biodegradable yarns, monofilament and multifilament yarns, woven, knitted, and nonwoven fabrics, and composite structure. Medical textiles is considered as a part of the wider category of technical textiles for example, in the operation theatre, protective textiles are used which are similar to other kinds of protective clothing such as that used for chemical, bio-hazard protection.



Source: Woodhead handbook of medical textile

Medical textiles are not only a research area, but are also extremely important if it is considered economically. Starting from simple cotton fabrics in the last century, medical textiles have shown . rapid development over the last few decades. This progress affects nearly all textile sectors: New, bio-degradable fibre constituted implants; recent textile machines allow for three-dimensional spacer fabrics; and silver-ion based finishes effectively reduce bacteria growth. On the one hand, representing the technical aspect, we find textile engineering, chemistry and testing and certification; while on the other, there is life sciences like medicine, microbiology and comfort.



Fibre used in medical textile:

Fibres	usages
Natural fibre- cotton, flax, hemp	Surgical mask, gowns, surgical uniforms,
Fibre based on regenerated source – alginate, lyocell, polylactic-acid(PLA), collagen, viscose, chitosan.	Implants, sutures, nonwoven felts and meshes, and modern wound dressings
Fibre based on synthetic source – polyamides, polyester, polypropylene, PTFE	Surgical mask, gowns, surgical uniforms, protective clothing, masks, surgical covers

Properties requirements of Medical textile products:

- Non toxic
- Non allergenic
- Non carcinogenic
- Should withstand sterilisation condition without any physical and chemical changes.
- Bio compatibility (implantable products)
- Good dimensional stability and elasticity
- Free from contamination

Segments of Medical textile

- Non-implantable materials: wound dressings, bandages, plasters, etc.
- Implantable materials: sutures, vascular grafts, artificial ligaments, artificial joints, etc.
- Extracorporeal devices: artificial kidney, liver, and lung
- Healthcare/hygiene products: bedding, clothing, surgical gowns, cloths, wipes, etc.

Non-implantable materials:

These materials are used for external applications on the body and may or may not come in contact with bare skin of the body. In most of the case these materials are made from co-polymer of two or more amino acids. Common wound dressings are made of composite materials consisting of an absorbent layer which is in between a wound contact layer and a flexible base layer The absorbent pad absorbs blood or plasma and provides a cushioning effect to protect against the wound. Bandages are designed with whole varied speciality and it's functionality depends upon the final medical requirement. Non-implantable material can be woven, knitted, or nonwoven and are either elastic or non-elastic and manufactured from cotton,viscose and even in some case. The most common application for bandages is to hold dressings over wounds.

Implantable materials:

Implantable materials are used in effecting a repair to the body, such as wound closure (sutures) or replacement surgery (vascular grafts, artificial ligaments, etc.). Bio-compatibility is one of the most important material in this implantable materials. Implantable material are made from polyamides, polylactic acid fibre, polyester, collagen fibre, and polytetrafluorethylene fibre. Some of the deciding factors of implantable material:

- Porosity is the most important factor, which determines the rate at which human tissue will grow and encapsulate the implant material.

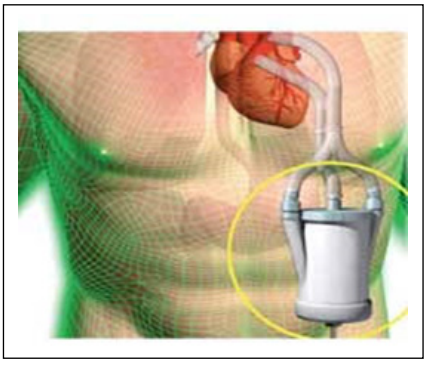
- Small circular fibres are better encapsulated with human tissue than larger fibres with irregular cross-sections.
- Toxic substances must not be released by the fibre polymer, and the fibres should be free from contaminants like lubricants and sizing substance.
- The properties of the polymer will influence the success of the implantation in terms of its biodegradability also in future.

Sutures:

Sutures are medical materials which are used for wound closure. Sutures are made up of either monofilament or multifilament threads that can be biodegradable or non-biodegradable. Biodegradable sutures are used mainly for internal wound closures whereas non-biodegradable sutures are used to close exposed wounds which are removed when the wound is completely healed. The desired fibre polymer properties possessed by a good suture are good security, inertness, adequate tensile strength and strength retention inside the body's environment, and good healing characteristics. Synthetic aliphatic polyester sutures obtained from glycolide homopolymer, glycolide/lactide blended copolymer, and polydioxanone are commonly used as absorbable sutures.

Extracorporeal devices:

Extracorporeal devices are mechanical organs that are used for blood purification, which include the artificial kidney (dialyser), the artificial liver, and the mechanical lung. The function and performance of these devices both benefit from fibre and textile technology. Extracorporeal devices must possess certain requirements, such as bacterial resistance, and they must be anti-allergenic and non-toxic, have good breathability, and possess the ability to withstand sterilisation. Hollow viscose fibre, hollow polyester fibre, hollow polypropylene fibre are used in manufacturing extra-corporeal device



Healthcare/hygiene products

Healthcare and hygiene products are an important for medicine and surgery. The aura of products available in the market is vast but they are generally used in operation theatre, hospital ward for the hygiene, care and safety of medical staffs and patients. Research is always going on int his hygiene product care sector by the use of organic and inorganic compounds, antibiotics, heterocyclics, quaternary ammonium compounds etc. In the last few decades, several innovative projects has been carried out in developing technologies to enhance antimicrobial activity on textiles, by using different synthetic antimicrobial agents such as triclosan, metal and their salts, organometallics, phenols, and quaternary ammonium compounds. the synthetic anti- microbial agents are very effective against a range of microbes and provide a durable effect on textiles. Hence, there is a need and demand for antimicrobial textiles based on eco-friendly agents, which not only help to reduce the ill effects associated due to microbial growth on textile materials but also act along with the statutory requirements imposed by the regulating agencies.

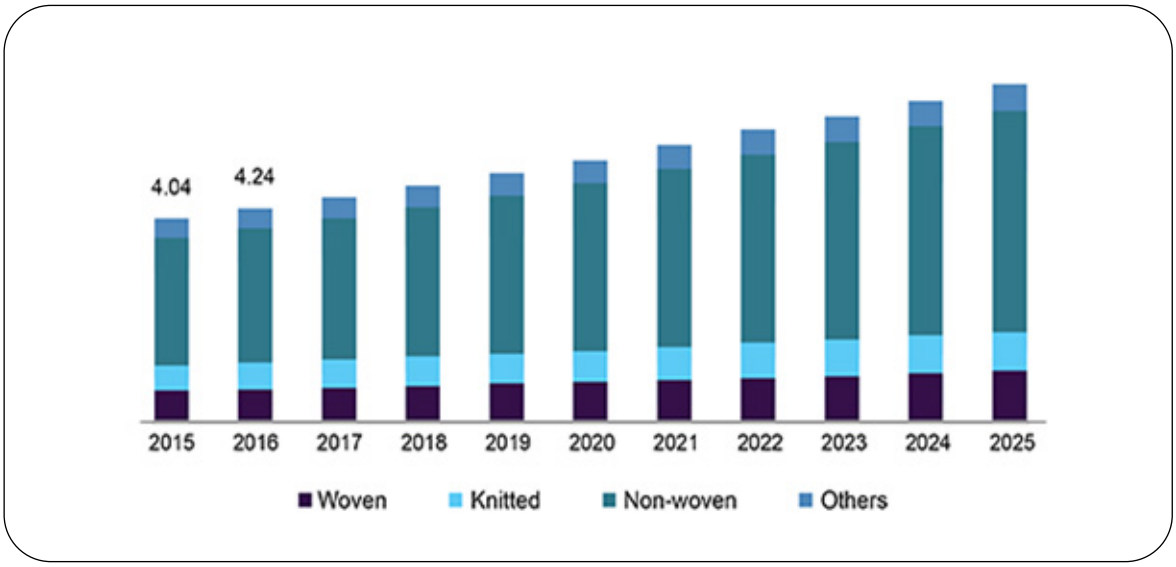
Key players of medical textile on a world-wide basis

- Bally Ribbon Mills
- Freudenberg
- Vestagen Technical Textiles

- Bluestar Silicones
- ATEX Technologies Biomedical Structures
- Imedex Biomateriaux Halyard Health
- Cardiva Integral
- Solutions

Market size of medical textile:

The global medical textiles market is expected to reach USD 20.23 billion by 2022, according to a new report by Grand View Research, Inc. The rise in the number of elderly populations, ongoing technological advancements and increase in health consciousness are fueling the growth of global medical textiles market. The non-woven segment of medical textile is expected to grow at a CAGR of over 5.0% from 2015 to 2022. Nonwoven fabrics are used in wound dressings, adhesive tapes, cotton pads, disposable surgical clothing, bandages etc.



Source: Medical Textiles Market Size, Share & Trends Analysis Report By Fabric (Non-woven, Knitted, Woven), By Application And Segment Forecasts, 2019 – 2025

Conclusion:

Technical textiles are the fastest growing and the most promising areas that fall under the larger textile industry. With the pace of time, along with the advancement of technology, textile is not only restricted to clothing, nowadays even some components of space shuttle and space suit are made of textile material. Technical textile has proven its worth in the field of automotive, electronics, power generation in google jacquard project and so on. Material technology and material science is one of the trending areas with which textile sector can proceed its collaboration for further development of mankind.

References:

(1). https://www.businesswire.com/news/home/20200612005300/en/Global-Technical-Textile-Market-2020-2027--

(2). https://niti.gov.in/technical-textiles-sun-rising-sector-indian-textile-industry

(3). Technical Textile: Towards a smart future (Technotex 2016 – fifth international exhibition & conference on Technical Textile April 21-23, 2016, Mumbai, India.

(4). https://www.technicaltextile.net/articles/technical-textiles-and-their-applications-3922

(5). An Introduction to HEALTHCARE and TEXTILES MEDICAL Wen Zhong, Ph.D. University of Manitobat

(6). https://indiantextilejournal.com/articles/FAdetails.asp?id=1887

(7). Medical Textiles Market Size, Share & Trends Analysis Report By Fabric (Non-woven, Knitted, Woven), By Application And Segment Forecasts, 2019 – 2025

(8). Handbook of Medical textile, Woodhead publishing.

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Nilargha Saha is pursuing master's degree in Fashion Technology from NIFT, Delhi. He has graduated in Textile Technology from Government college of engineering and textile technology Serampore. Technology enthusiasts with creative spirit in the field of fashion. He has industrial experience exposure in Nahar Fabrics lalru Punjab as well as in a Textile chemical processing plant in Bengal. Explorer of new ideas and fruitful solutions in adverse situations. Loves to compose contemporary content in the arena of fashion, clothing, technology, and textile in literary approach.

FACE MASKS, RESPIRATORS AND COVID-19

Prabir Kumar Banerjee | Professor (retired) IIT Delhi

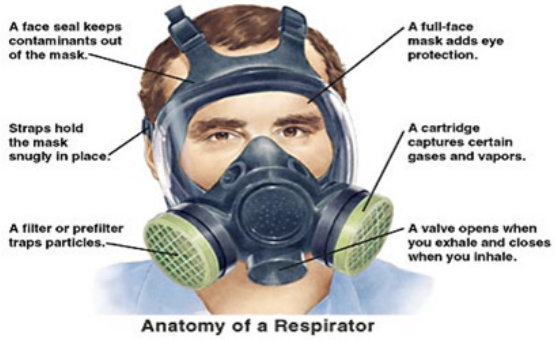
Introduction:

A mask is employed either for the purpose of disguise or for concealment or for protection or even for a combination of some of these functions. A valuable painting may be masked for enhancing its longevity or a person may use mask for creative entertainment. A face mask in the current context is aimed purely at protecting human respiratory tract from invasion of undesirable aerosols, but not of contaminated air, while permitting normal inhaling and exhaling processes. Fig. 1 illustrates one common and one somewhat innovative face mask.

Fig.1- Face Masks: Source of the Images- 1. https://www.grainger.com/product/ALPHA-PROTECH-Procedural-Mask-29DZ42
2. https://www.medgadget.com/2020/04/clear-face-masks-for-the-deaf-and-hard-of-hearing.html

Fig.2: White, disposable Standard N95 filtering face piece respirator; https://en.wikipedia.org/wiki/Respirator

Face masks can be considered to be simplified version of respirators. Respirators are employed in more challenging environments to ensure the



Anatomy of a Respirator

Fig. 3: A half-face elastomeric air-purifying respirator. This kind of respirator is reusable, with the filters being replaced periodically.
Source: http://poc.select.kramesstaywell.com/Content/healthsheets-v1/understanding-respirators

user filtered breathable air free of aerosols as also of contaminants.

Respirators may source air either from the surroundings – which is also the source of air for face masks – or from an independent supply. A suitably designed face piece that ensures secure fit and is held firmly to the user's head by an additional element is an important feature of all respirators (Fig. 2). Replaceable filter cartridges that are mounted on reusable face pieces serve the purpose of purifying air from the surrounding, inhaled by the user (Fig. 3) or the filtered air may be pumped into the breathing zone by a Powered Air Purifying Respirator (PAPR, Fig. 4). Respirators which are supplied with filtered air from an independent source owing to highly contaminated ambient air, do not exhibit such cartridges (Fig. 5). These are also known as Self Contained Breathing Apparatus or simply SCBAs.

Corona virus is a member of a family of large single-stranded RNA viruses that have a lipid envelope studded with club-shaped spike proteins which resemble solar corona flares. Covid-19 is a corona virus disease that surfaced at first locally in 2019 and then spread rapidly across the globe, transmitted by modern day globetrotting humans. Corona viruses cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV). The novel corona virus (nCoV) or Covid-19 is a new strain that has not been identified previously in humans [WHO website] and hence there is as yet no medically established covid-19-specific treatment.

Fig. 4: Powered air purifying respirators; Source: https://www.whirlpoolcorp.com/collaboration-manufacture-and-donate-respirators/

Genesis

Ever increasing air pollution level around the globe as also current global scourge of Covid-19 has resulted in face masks becoming an important protective gear that every human being is compelled to use outdoors – and on many occasions even indoors – for avoiding deadly pulmonary ailments. Indeed this is one item that transgresses all divides: children, young and the aged; males and females; Aryans, Mongolians or Negroids; the ultra rich and the very poor; bus drivers, shopkeepers or prime

ministers and so on and so forth. Just as every human being needs to shield his/her body from elements of nature by using outerwear of diverse nature, so must a living person henceforth use a suitably designed protective gear to prevent unwanted ultrafine air borne materials from entering the respiratory system. This compulsion has been growing in importance over the past few years, but the sudden arrival of the deadly Covid-19 has only enhanced its absolute and immediate necessity. Consequently there has been a global rush for laying hands on a suitable face mask that would ensure safety, reacting to which some opportunistic entrepreneurs have started marketing all kinds of products at fancy prices with unsubstantiated or even patently false claims. Simultaneously serious research has also been taken up globally by a large number of agencies for developing a medicine that when popped in or injected into the body can destroy the virus before it can cause serious damage to humans.

The Covid-19 virus has not only disrupted human life globally but also massively weakened the highly interconnected global economy. No one really knows as to how long this chaos would continue. However in order to emerge from such chaos it is necessary to take a dispassionate view of this problem for working out viable and sensible solutions in a rational manner.
The menace of Covid-19 may subside after a period of time but harmful aerosols and contaminants in one form or the other would continue to haunt us in future. It would therefore be prudent to develop a scientific defence system against such invasions.

Fig. 5 PAPR with air supply [Self Contained Breathing Apparatus or SCBA]
Sorce: https://en.wikipedia.org/wiki/Self-contained_breathing-apparatus

The Issue

To start with one may safely make the following statements.

- A face mask or at least the active part of it belongs to the domain of Protective Textile. It is therefore a member of the broad category of technical textiles and hence needs to be designed scientifically so as to fulfil certain functions defined in clear terms of quantified specifications and tolerances. One should therefore have prior knowledge of the type of aerosol one has to deal with as also its expected load in terms of density (percentage of space occupied in an unit volume of air breathed in) and its kinetic energy, which the barrier created by a face mask has to prevent from passing through. A simple and economic method of cleaning the mask after each use must also be developed so as to permit multiple uses that would make the product economically viable and environmentally friendly.

- A face mask is to be worn

by humans for securely protecting the breathing orifices, namely nostrils and mouth, from being invaded by unwanted aerosols. These are however highly sensitive organs of human anatomy and perform more than one critical function. For example, the olfactory glands in nose provide humans with important messages about the surrounding while the many glands within as also in front of mouth have their own important medical and social functions. For the hearing and speech impaired humans, a clear view of lip movement is essential for interpreting sign language used in communication. Thus, by covering up these segments of face with a badly designed mask, one not only runs the risk of choking a person from want of sufficient quantity of air, but also of suppressing other important functions to the overall detriment of quality of life. An exact quantification of the permissible debilitating limits to which a person could be subjected to while using a certain type of face mask must therefore be spelt out in advance before one is offered the use of such a product.

- The facial skin around mouth and nose of a human being is highly sensitive and therefore the comfort aspect of wearing a face mask is of paramount importance. A face mask should not result in itching or cause an allergic reaction nor should it promote sweating in humid environs. Comfort and compatibility are therefore to be kept in view before a specific product is offered for specific type of person for use in specific environmental condition.

- A person's beauty and personality is often conveyed by one's facial appearance. Therefore a face mask should ideally be designed to augment rather than detract from one's appeal to fellow humans. Hence a suitably designed face mask can be viewed both as a technical textile and a fashion wear.

- A face mask should permit a desirable rate of air flow in and out of the system without stressing the wearer. Suitable vents built along the inner wall can streamline the flow of air breathed in and out. Sensitive areas around nostrils and lips should also be free of contact with the mask and sufficient free space should be left in this region. This would not only reduce discomfort but also ease verbal communication. Indeed some sort of amplifier and speaker system might need to be embedded in the system to improve audibility among masked persons stationed some distance apart.

- A masked person is a potential security threat to normal human activities, Hence opaque masks may become a useful tool for criminals.

From the above one may surmise that detailed information about the targeted end-user should form the starting point for designing a face mask. The environment in which the user is expected to use the mask also needs to be considered for ensuring a degree of comfort. Moreover, the nature of aerosol in terms of particle size, density load and kinetic energy should constitute vital inputs to the design process. Similarly, reusability and ecofriendliness must be viewed as non-negotiable requirements while affordability should be an important goal parameter during optimisation. Ease of air flow in and out of the system as also of undistorted and amplified verbal signals need to be

accorded due importance while designing the inside of the mask. A face mask should also be an article of fashion for the wearer while making it completely transparent would help speech and hearing impaired humans and discourage its unwanted use by criminals.

It is evident from the above that a one-mask solution for the entire humanity even if to only prevent invasion by aerosols, is a highly irrational approach, while haphazard attempts at somehow keeping the breathing orifices covered during certain activities may create more problems than solve any. It is also clear that a face mask/respirator must satisfy multiple requirements and therefore the tendency of many researchers/developers to focus on just one issue, such as the pore size distribution or antibacterial/antiviral nature of the active surface of mask/respirator, is quite misplaced and simplistic. Instead a multidisciplinary approach needs to be adopted to design protective gears tailored to satisfy well defined requirements of a specific group of humans from a specific location involved in a specific type of activity. Hence developing the design concept and not the actual product should be the first priroty.

Some concerns

Aerosols can take the form of fumes (solid material vaporized and then cooled resulting in particles ranging in average diameter between 0.01 to 1 microns), dusts (small particles in the range of 0.5 to 10 microns, resulting from breaking up of larger particles) and mists (atomized liquids in the range of 5 to 100 microns). Incidentally, common viruses that are carried by aerosols vary in size ranging between 0.01 to 0.1 microns [Rajhans & Pathak (2002)].

The Covid virus is reportedly transmitted among humans by droplets emitted by infected persons during speaking, coughing or sneezing. It is reported that droplets ranging in diameter between 0.5 to 1000 microns are emitted through sneeze and cough [Han, Weng & Huang (2013), Chao (2009] and between 0.5 to 1300 microns through speech whereby majority of the speech and cough droplets measure 5 microns in size and those through sneeze measure around 100 microns. The velocity of air-flow near the mouth for sneeze, cough and speech is ca. 30-100, 11.7 and 3.9 m/s respectively.

It appears from the above that a filter that can arrest particles between 0.5 to 5 microns should prove effective in preventing virus transmission through droplets. However a material of 0.5≤ O95 ≤5 microns would also be very dense and its air permeability may be too low for permitting air-flow required for normal inhaling and exhaling activities.

Air-flow required by an individual for easy breathing varies with age as also the type of work one is engaged in. For a light workload, air flowing in at the rate of twenty litres per minute may suffice while for heavy to very heavy workload this value can go up by three to four times [Rajhans & Pathak (2002)]. It is indeed a tall task to design a filtering medium with specifications of 0.5≤ O95 ≤5 and 20 ≤ air flow rate in litres/min ≤80.

Depending on wind speed, droplets thrown up on coughing by an adult human may travel as far as 6 m or even beyond and that too at a height from ground of around 1.6 m, risking infection of persons standing apart even by 2 m [Dbouk & Dmitris (2020)]. Indeed the WHO recommendation for social distancing is based on work done by Wells [Wells (1934)] for ambient conditions of zero wind speed, temperature of 200 C, RH of 50% and a ground surface temperature of 150 C. While droplets coming out of mouth would evaporate more quickly in drier & hotter conditions, their flow dynamics, and therefore extent and nature of their

spread would depend considerably on wind speed & turbulence.

The conundrum

It would appear that the entire humanity has suddenly been caught on the wrong foot by the invisible and nondescript Covid-19. The chaotic search for a working solution has only thrown up more questions resulting in a certain kind of fatigue and submission by persons in authority as also by the common person on roads. Admittedly masks have never been designed for prevention of virus invasion – even surgical masks, by design, do not filter or block very small particles in the air that may be transmitted by coughs, sneezes, or certain medical procedures - and respirators are too elaborate and cumbersome for the common man. Moreover keeping people confined indefinitely in their dwellings and asking them to always stay apart by a large distance and follow strict hygienic measures goes against the very ethos of human society. Homo Sapien the intelligent human is now facing a unique challenge for survival. Such a situation calls for an out-of-the-box solution aided probably by a bit of fantasy.

A fantasy

Masks and respirators are indeed too crude and vulgar for negotiating a highly evolved element of nature such as the virus. Just as one should not use cannon balls to kill mosquitoes but employ sophisticated means to destroy the larvae or even render the species barren, so must the tiny corona virus be arrested in its path or even destroyed by means that incapacitate its protein spikes or even the RNA. It is suggested that this invisible adversary should be negotiated by means that are also invisible, visibility being after all a matter of scale and perception.

The frantic search for medicines and vaccines against viruses, which when administered would ultimately alter our body chemistry that is fraught with unforeseen consequences in the form of short term and long term side effects, is also in the long run a futile battle. Development of such products involves enormous time and expenditure and quite often ends up in failure. Moreover, as soon as the cure for one type of adversary is established after a very prolonged and elaborate exercise, another form of virus appears on the horizon and a new exercise must begin from scratch. Experts are predicting more frequent pandemics in the coming days in view of shrinking space for wildlife and a very rapid global circulation of man and material dictated by economic compulsions.

Clearly we must think differently and get away from the well trodden path of fighting sophisticated natural challenges with the somewhat primitive tools of medicines, vaccines, masks et al. One must develop completely new battle strategies that would lead to long lasting solutions, as beautiful and as simple as the equation $E = m c^2$.

Accordingly, one can fantasise a futuristic protective gear, for example in the form of a stylish headband adorning a human forehead and equipped with embedded electronics, designed to radiate energy from multiple point sources that fan out and downwards in the form of a shield covering the entire face of a human being most elegantly and creating an impregnable but invisible safety bubble, rendering in the process all types of air borne viruses, even if they mutate into new forms, forever ineffective against humans.

Taking a cue from the foregoing one may surmise that for designing a superior defence system, it is important to search for information on characteristics of viruses that may reveal their most vulnerable features. The principle of dialectics which reveals that the greatest strength of any system

simultaneously carries seeds of its biggest weakness can be used as a broad guideline in this search. For example, investigations by Bedson and Bland, published in 1928, as also by Michen and Graule, published in 2010, point to an interesting aspect, namely the charge carried by viruses. Depending on the pH of the surrounding fluid, this charge may be either negative or positive. Clearly, creating the shield of a suitably charged field could be an elegant solution for preventing invasion by viruses. There may be other types of vulnerability which have already been reported by researchers in literature but remain unexplored for want of urgency. Now is the time to look for such information in order to detect the most glaring weaknesses of the adversary based on which suitable armoury could be designed subsequently.

Summary

Doing away with the traditional methods of employing mechanical barriers in the form of masks and respirators, a strategically new approach for preventing invasion of respiratory tract by air borne virus, such as Covid-19, has been suggested. Viewed against the backdrop of limitations and disadvantages of the traditional mechanical barriers as also the extremely complicated challenges posed by continuously evolving virus strains, the proposed concept of employing a facial envelope of suitable energy field that targets specific vulnerable aspects of the invaders while allowing the user to perform normal social activities without any hindrance, merits serious attention owing to its simplicity and sophistication.

Reference

(1). Rajhans G S and Pathak B P (2002), Practical guide to respirator usage in industry, 2nd edition, Butterworth-Heineman n

(2). Han Z Y, Weng W G and Huang Q Y (2013), Characteristics of particle size distribution of the droplets exhaled by the sneeze, Journal of Royal Society, J R Soc Interface 10: 20130560. http://dx.doi.org/10.1098/rsif.2013.0560

(3). Chao C Y H, Wan M P, Morawska L, Johnson G R, Ristovski Z D, Hargreaves M, Mengersen K, Corbett S, Li Y, Xie X & Katoshevski D (2009), Characterization of expiration air jets and droplet size distributions immediately at the mouth opening. J. Aerosol Sci. 40, 122–133.

(4). Dbouk T & Dimitris D (2020), on coughing and airborne droplet transmission to humans, Physics of Fluids 2020 May 1; 32(5): 053310. doi: 10.1063/5.0011960

(5). Wells W F (1934), on air-borne infection: Study II: Droplets and droplet nuclei, American J. Epidemiology. 20, 611–618

(6). WHO Website; http://www.emro.who.int/health-topics/corona-virus/about-covid-19.html

(7). Michen B and Graule T (2010), Isoelectric points of viruses, Journal of applied microbiology, 109, 388-397

(8). Bedson S P and Bland J O W (1928), A simple method for determining the electrical charge carried by virus particles, British Journal of experimental pathology, 10 (1) 66-70

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ANTIVIRAL TEXTILES IN COMBATING PANDEMIC: HOPES & CONCERNS

Soumyadeep Saha | MFTech from NIFT, New Delhi

It would be hard to contradict to the fact that this pandemic has brought the whole world to its knees and textile industry has been one of the worst affected. This effect has been seen with the closure of factories, decline in exports, disrupt in the market etc. but it has also been able to create specific opportunities for niche new products. Among them, personal protective equipment such as bodysuits, masks, gloves, etc. has been able to make an exponential increase in demand as people get more and more dependent on them for their protection.

Until now most of the PPE requirement has been from the healthcare department as the world was under lockdown. Now, as more and more people get out of confinement for their day-to-day living they are looking for options to keep them protected from the virus and not look like someone from a containment zone. This led to the emergence of chemical treatment in textiles to prevent contamination from the coronaviruses named anticorona/antiviral fabrics. These fabrics from big textile and apparel companies are claiming to act as a shield against the virus with the added luxury of being in style for the post-lockdown lifestyle.

Antiviral/ antibacterial fabrics have been around from a long time and for most of the fabrics, these are chemicals that are added at the final stage of the textile manufacturing process. Thus amid this ongoing pandemic, this treatment has been upgraded to anti-corona chemicals which are being made and claimed specifically to be effective against the coronavirus. These arrises questions whether these are the solution to this current crisis, protection equipment or just a marketing gimmick.

By now we are all aware that COVID-19 transmitted from an infected person stay for a long period over any surface. Textiles in such cover more than 90% of the human body and thus can become the host for the viruses to thrive on its surface increasing the probability for exposure to the infection. This makes it very important to prevent the textiles from becoming the host surface for such harmful viruses to reduce the risks for transmission and contamination. Following are such companies with their products who are at the forefront of bringing this technology to the Indian market accompanied by Indian textile manufacturers.

Anticorona Solutions

Claiming to such, Swiss-based technology company HeiQ has been one of the very first company to come up with such an idea by their product Viroblock NPJ03. With this, they have been able to effectively reduce 99.99% of the virus such as SARS-CoV-2, COVID-19 in mere 30mins. Viroblock is an anti-viral textile treatment technology containing advanced silver and vesicle components that

can be applied to any fabrics to make them extra resistant to viruses and bacteria. According to HeiQ, the silver here works to kill any bacteria or viruses on the fabric surface while the vesicle technology, a cosmetic grade Liposome works to aid the process by depleting the viral membrane. Along with testing on the coronavirus, Viroblock also demonstrated improved reduction of viruses such as Influenza types H1N1, H5N1, H7N9, and Respiratory Syncytial Virus (RSV). The treatment has been extended not only to wearable textiles but also to home textile, medical non-woven such as masks, bodysuits, mattresses etc. and can withstand at least 30 gentle washes at 60°C (140°F) and with the woollen product up to 5 dry cleanings. Viroblock with its pending patent has been tested against ISO 20743, ISO 18184 as strong antiviral and antibacterial against enveloped viruses and bacteria and is EU REACH and US FIFRA compliant, OEKOTEX® certified, ZDHC and bluesign® homologized product.

Partnering with **HeiQ**, Indian apparel manufacturers such as Arvind, Dornear Industries have launched anti-viral products in apparel namely Intellifabrix and Securo respectively and are already available in the market. For now, these fabrics are available to suiting and shirting from respective companies and do come cheap but is always better than no protection.

Similar to this, an Australian-based biotech company **HealthGuard** came up with their anti-corona range of fabric, HealthGuard AMIC which guarantees 99.94% effectiveness against SARS-CoV-2 within 10min and completely abolished the ability for the virus to be infectious within an hour according to Prof. Damian Purcell at University of Melbourne. He also stated that only 2% of HealthGuard AMIC treatment applied to the weight of goods to textile substrate reduced the infectious virus to undetectable levels, resulting in SARS-CoV-2 being non-infectious. The antiviral treatment can also be extended to any products such as clothing fabric, upholstery fabrics, masks, fibres and foams. The treatment also has an added advantage compared to other metal-based chemistry products is not dissolving in water thus can withstand 20-30 cycles of home laundering and is also smooth and soft in feel.

Partnering with **HealthGuard**, Indian textile manufacturers such as Vardhaman and Welspun has come up with antiviral products both in apparel as well as home furnishing under the brand travelshield, SPACES and Welapun Health respectively. These products are claiming to be tested thoroughly at international labs with an added benefit of being sustainable in the making.

Anticorona Solutions

These are the prominent companies among the many who are at the forefront about such treatments and are thus marketing to lure in health cautious buyers. For most of the companies, it is to be noted that these claims are for the chemical treatment/finishing and not on the fabric on which it is being applied. Thus the fabric is only antiviral until it completes its defined laundering cycle, after which there will be compromises on its prevention claims. Also noted from these technologies, these solutions while being safe do not guarantee against any infection and should not be thought off as a cure. Thus as a consumer, one must still take other measures to ensure that they are not in contact with the virus through other sources.

Prominent market approach

With such uncertainty, it is of much importance that these products are being

approved for safe use by consumers as failing them can have a huge consequence on the consumer as well as the manufacturing company. These products should not be rushed to the market deliberately on false claims and should be approved based on standard tests methods. This will prevent these companies from misleading the consumer to provide a false sense of security and also help with authenticity. Along with that, these technologies should also be released to the public domain through research papers and media as it will help in building up of trust among consumers. Till date, there has been no such guidelines for use of such product from the government with medical experts referring to this as marketing gimmicks that can lead to potential scamming of consumer.

With the world starting to move on, the technology will improve, and manufacturing companies will be more transparent on their claims about the science behind such properties, working process, effectiveness, test results etc. But for now, keeping everything in mind there still is uncertainty about the degree of protection on the use of such products and should take addition protection.

About the Author:

Soumyadeep Saha holds master's degree in Fashion Technology from NIFT, New Delhi. He holds a degree in Apparel Production & Management from Government College of Engineering and Textile Technology, Serampore. He is an author at Apparel Blogging site "Online Clothing Study" with articles on a wide range of topics related to the Apparel Industry. His area of interest includes Quality and technology implementations in Production.

TANTU WEBINAR 2020

This year in June, TANTU had organized six webinars on the following topics for the global participants. All the webinars were appraised by participants. Webinar topics and presenters' details are shown in the following webinar banners. You can watch the webinar recording for the first four webinars.

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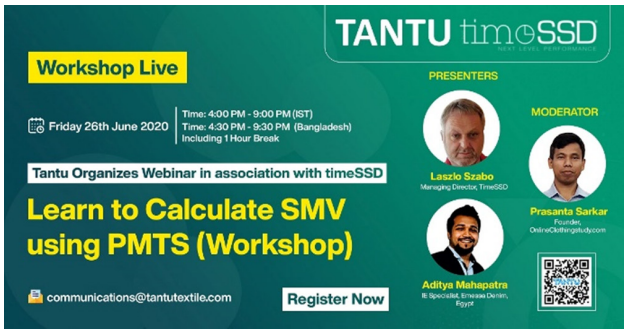


SEMINAR REPORT 2019: IT'S IN YOUR JEANS

TANTU has successfully concluded its 7th Annual Seminar on the 14th of September at India International Centre, New Delhi, India. The seminar was dedicated to highlighting the problems in the jeans manufacturing industry and the jeans market and to creatively suggest effective solutions in the key areas.

Jeans being a classic has become an integral part of mankind and is likely to stay that way. The reason could be its adaptability. Jeans can be incorporated in our looks in several ways be it in terms of colors, lengths, fits and styles. The popularity of the fabric and the garment is expected to rise, let alone decrease. The 7th seminar of Tantu aptly emphasizes this.

In his welcome speech, Dr. Prabir Jana, the president of TANTU, addressed the history of TANTU and the role it intends to play in the Textile and Apparel industry. Tantu seminars serve the purpose of bridging the gap between the problem experiencers and the solution providers. It stands as a platform to take up the issues and has experts from various backgrounds deliberate over the cause and effects of such issues in the industry. Unlike most forums, TANTU believes that a panel discussion is a right way to confront the problems and deduce solutions. The technicalities of the process that makes a product has been the key area of discussion.

Mr. Sunder Belani, Managing Director, Ramsons, the title sponsor expressed that unlike popular belief that there is a decline in business, there is a change in the way of doing business. There is a shift in the demand towards sustainability. There ingenious one stop laundry solutions incorporate high tech ozonators and nanotechnology. There Laser Tex and Jet spray Vertostar machines have successfully reduced the water required to wash denim from 60 tonnes to 10 tonnes.

The first panel discussion was titled "Jeans manufacturing – An art or Science". The panel included eminent members such as Abhijit Ghosh, Munir Syed Sayeed, Jasim Uddin, Subrata Ghosh and was moderated by Dr. Prabir Jana. Most of the panelists agreed that the Jeans manufacturing might have been a science 20 years back, but it is more of an Art now. It all starts with conceptualizing the likes and dislikes of the customer into a design and this art is backed by scientific innovation. The forum also discussed the popularity of

Mr. Sunder Belani

Mr. Subir Mukherjee

striped denim. It was observed that there was a demand for striped denim, but due to complications in its manufacturing, it is more costly. However, the real challenge lies in producing checked denim as indigo dyed weft yarns is not fast to denim wash and the resultant look is not very appealing.

M Sai Navneethan from Ramson continued to demonstrate the need of sustainability. He said the next great switch in this direction would be from horizontal to front loading finishing machine and jet spray will reduce water consumption even further. The MLR of the front loading machine is half of that of horizontal loading machine. The Go Green Machine saves upto 95% compared to the conventional washing technologies by using a spray of chemical solution for finishing instead of dumping the product in tonnes of water. Their Conveyorized Dryer is a form of line drying which uses steam resulting in reduced cycle time and water consumption. Their other disruptive technologies include Ozone and lazer technologies.

Ram Sareen, CEO, Tukatech, with experience in the apparel industry for 50 years, he exclaimed that the most important aspect that needs serious intervention is fit. As per him, that fit is the one thing that decides the faith that of a garment taken from the rack to the trial room. In an online space, problems stemming from fit accounts for 54% of returns. Fast fashion has also contributed to an increase in styles and a decrease in stock-keeping units. This has resulted to more inventory, that ultimately goes into a landfill. Tukatech aims at helping visualizing the different styles without having to produce samples and thereby reducing cost and wastage. The organizations use their software to create virtual 3D samples of garments which can be shared with the buyer for approval and for further improvements. The future will further bridge the gap between virtual and real garments. The new business model entails designing, developing and selling digitally and then making what you sold.

The second panel discussion titled "Jeans Finishing – Environmental Reboot" had innovative minds such as Manuj Kanchan, Dipankar Bose, Kishan Daga, and moderator Suvodeep Mukherjee critiquing the existing Finishing processes and how they are evolving to suit the environment. To understand the severity of the environment issues, Dipankar Bose highlighted that Humans have been on this planet for 3 seconds if we consider the planet to be 24 hours old. The impact of those 3 seconds has been drastic and to some extent irreversible. In a span of 75 years, the chemical waste generated has increased multifold, but all is not lost. The key takeaways from this discussion were that there is

M Sai Navneethan

Ram Sareen

an increased awareness among domestic players. There is a real deficit of start-up integrating the processes of fiber to fabric using eco-friendly means throughout. The decline in the market will favour the industry as only the business with the right long-term motives will sustain. The panel also discussed if the carbon footprint of cotton is more than that of manmade fibers. The panel concluded, polyester being a synthetic cfiber has a lower carbon footprint because cotton ultivation requires a lot of water and moreover there is a rising demand for recycled synthetic fibers.

The 2nd panel discussion was followed by a presentation by Vinod Krishnamurthy of Fortuna Colours, the man credited with introducing digital print to India. Digital print is better than traditional printing. He spoke about climate capitalism being the next big thing in which people will be investing more on technologies that in one form or other will contribute to maintaining the ecological balance. His company not only trades and develops new technology in Inkjet printing but also provides services to see to it that their technology is used in the right and in an optimum way.

Rahul Mahajan of Datatex demonstrated, how their IT solutions have helped in measuring and managing the activities of an organization be it ERP, machine scheduling etc. B.K. Mohanty of Macpi, a final finishing machine provider demonstrated how their machine by the name “Finisher for Trouser” helps combat shrinkage in jeans and folds efficiently the treated garments with high productivity.

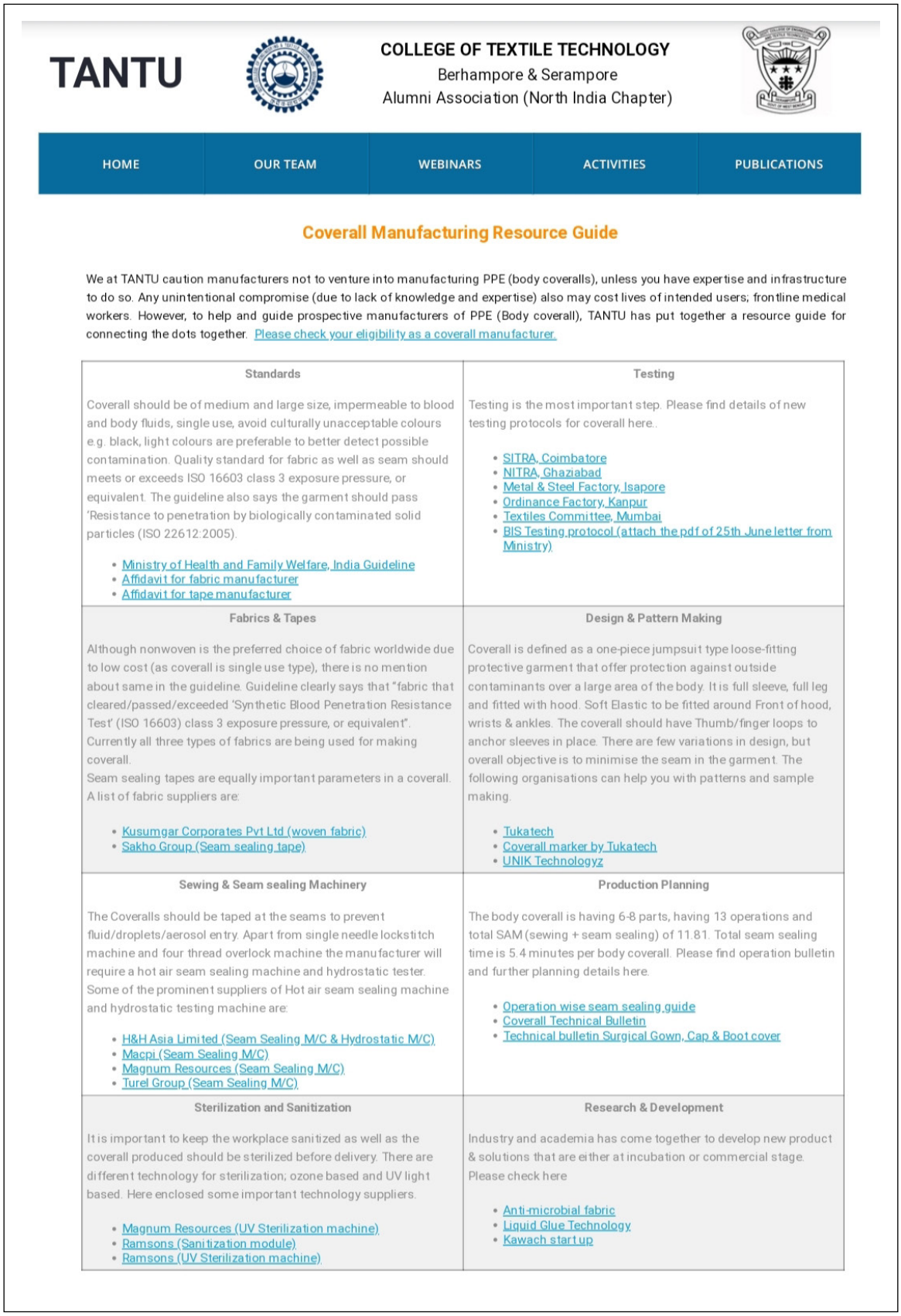
cfiber has a lower carbon footprint because cotton ultivation requires a lot of water and moreover there is a rising demand for recycled synthetic fibers.

Mr. Jay Nagessure from Sip Italy explained that automation was the right way forward. He exclaimed the importance of SMV in the apparel industry and how their wide range of automated/semi-automated machines helps to meet the target SMVs.

The third panel titled "Start-up in Blue Space" included entrepreneurs driving the apparel industry. The discussion was moderated by Mr. Pranav Khanna and the panelists included Sartaj Singh Mehta, Sanjay Goel, Padma Raj Keshri. The discussion arrived at the conclusion that key to running a business in this ear is winning the heart of the customers. Businesses are more focused on doing away with the middleman and captivating the customer directly. It is very important to manage to sustain the environment on one hand and sustaining your business on the other.

The seminar ended with a vote of Thanks by Kingshuk Pandit, Vice President of Tantu. It was indeed a time spent well learning about the engaging trends in the Jeans industry in terms of new technologies, perceptions, experiences, and processes.

COVERALL MANUFACTURING RESOURCE GUIDE



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Coverall Manufacturing Resource Guide

We at TANTU caution manufacturers not to venture into manufacturing PPE (body coveralls), unless you have expertise and infrastructure to do so. Any unintentional compromise (due to lack of knowledge and expertise) also may cost lives of intended users; frontline medical workers. However, to help and guide prospective manufacturers of PPE (Body coverall), TANTU has put together a resource guide for connecting the dots together. Please check your eligibility as a coverall manufacturer.

Standards

Coverall should be of medium and large size, impermeable to blood and body fluids, single use, avoid culturally unacceptable colours e.g. black, light colours are preferable to better detect possible contamination. Quality standard for fabric as well as seam should meets or exceeds ISO 16603 class 3 exposure pressure, or equivalent. The guideline also says the garment should pass 'Resistance to penetration by biologically contaminated solid particles (ISO 22612:2005).

- Ministry of Health and Family Welfare, India Guideline
- Affidavit for fabric manufacturer
- Affidavit for tape manufacturer

Testing

Testing is the most important step. Please find details of new testing protocols for coverall here..

- SITRA, Coimbatore
- NITRA, Ghaziabad
- Metal & Steel Factory, Isapore
- Ordinance Factory, Kanpur
- Textiles Committee, Mumbai
- BIS Testing protocol (attach the pdf of 25th June letter from Ministry)

Fabrics & Tapes

Although nonwoven is the preferred choice of fabric worldwide due to low cost (as coverall is single use type), there is no mention about same in the guideline. Guideline clearly says that "fabric that cleared/passed/exceeded 'Synthetic Blood Penetration Resistance Test' (ISO 16603) class 3 exposure pressure, or equivalent". Currently all three types of fabrics are being used for making coverall.
Seam sealing tapes are equally important parameters in a coverall. A list of fabric suppliers are:

- Kusumgar Corporates Pvt Ltd (woven fabric)
- Sakho Group (Seam sealing tape)

Design & Pattern Making

Coverall is defined as a one-piece jumpsuit type loose-fitting protective garment that offer protection against outside contaminants over a large area of the body. It is full sleeve, full leg and fitted with hood. Soft Elastic to be fitted around Front of hood, wrists & ankles. The coverall should have Thumb/finger loops to anchor sleeves in place. There are few variations in design, but overall objective is to minimise the seam in the garment. The following organisations can help you with patterns and sample making.

- Tukatech
- Coverall marker by Tukatech
- UNIK Technologyz

Sewing & Seam sealing Machinery

The Coveralls should be taped at the seams to prevent fluid/droplets/aerosol entry. Apart from single needle lockstitch machine and four thread overlock machine the manufacturer will require a hot air seam sealing machine and hydrostatic tester. Some of the prominent suppliers of Hot air seam sealing machine and hydrostatic testing machine are:

- H&H Asia Limited (Seam Sealing M/C & Hydrostatic M/C)
- Macpi (Seam Sealing M/C)
- Magnum Resources (Seam Sealing M/C)
- Turel Group (Seam Sealing M/C)

Production Planning

The body coverall is having 6-8 parts, having 13 operations and total SAM (sewing + seam sealing) of 11.81. Total seam sealing time is 5.4 minutes per body coverall. Please find operation bulletin and further planning details here.

- Operation wise seam sealing guide
- Coverall Technical Bulletin
- Technical bulletin Surgical Gown, Cap & Boot cover

Sterilization and Sanitization

It is important to keep the workplace sanitized as well as the coverall produced should be sterilized before delivery. There are different technology for sterilization; ozone based and UV light based. Here enclosed some important technology suppliers.

- Magnum Resources (UV Sterilization machine)
- Ramsons (Sanitization module)
- Ramsons (UV Sterilization machine)

Research & Development

Industry and academia has come together to develop new product & solutions that are either at incubation or commercial stage. Please check here

- Anti-microbial fabric
- Liquid Glue Technology
- Kawach start up

Visit the full resource guide here http://www.tantutextile.com/coverall-manufacturing.html

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