



Protective Clothing During COVID-19 and their Testing

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ABSTRACT

The COVID-19 caused by novel coronavirus subsequently named SARS-CoV-2 were first reported by officials in Wuhan City, China. Origin of virus causing COVID-19 was reported in December 2019. COVID-19 pandemic brought the entire world to a standstill, equitably affecting markets and supply chains globally. Consumer purchase of textile and apparel were hit badly due to the global lockdowns and economic recession. The COVID-19 pandemic has made every person to adopt new ways of living by wearing of masks when they go out of home. Even research & development efforts in materials and design to offer better protection for users against airborne pollutants and pathogens were initiated rapidly during this period. It has also opened a window of opportunity and new thinking about the future of the textile industry and, most critically, how it can be reshaped for a more resilient, sustainable and human-centred future. Personal protective kit worn during COVID -19 consists of gloves, coveralls, shoe covers, head covers, masks, face shields, and goggles. These products passed through ISO 16603, ISO 22612: 2005, ISO 16603 and ISO 22612: 2005 standards to be used by consumers.

KEYWORDS: COVID-19 pandemic, airborne pollutants, personal protective equipment, test standards

1. INTRODUCTION

MostThe Indian textiles sector has been one of the worst hit sectors due to the COVID-19 crisis. The unprecedented crisis in the form of COVID-19 flu pandemic has threatened markets and supply chains globally of textile industry. The global apparel consumption is estimated to have shrunk by 22% in 2020. The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and its disease, COVID-19, have been considered a pandemic spread and the most devastating global event in modern medicine^[3]. The first case of that virus was identified in Wuhan, the capital city of Hubei Province, China in December 2019, and in January 2020,

the COVID-19 has become a worldwide pandemic further affected almost all parts of the world, and is seen as one of the worst periods in human history. A new opportunity seems to be medical textile products. There is also an increase in global demand of medical textiles. Sales of medical protective gears including surgical masks and protective clothing have jumped drastically.

STRUCTURE OF PAPER

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the structure, important terms and overall description. In Section 2 we discuss about personal protective kit. In

Section 3 we have the complete information about the standard and certification for personal protective kit. Section 4 tells us about the future scope and concludes the paper with references.

2. PERSONAL PROTECTIVE KIT

Personal protective kit has become an essential during coronavirus (COVID -19) epidemic. Appropriate use of personal protective equipment significantly reduces risk of viral transmission. According to Health Ministry guidelines, a PPE kit consists following items – goggles, face-shield, surgical/non surgical masks (surgical/N-95), gloves (surgical/examination), coverall/gowns (with or without aprons)^[2].

Gloves

There are two types of gloves. Nitrile gloves and latex gloves. Nitrile gloves resist chemicals, including certain disinfectants such as chlorine. They are made from synthetic rubber. Latex gloves are made of natural rubber that fits comfortably and protects from viruses and bacterial^[5].

Face shields and goggles

Contamination of mucous membranes of the eyes, nose and mouth could have affected with droplets generated by cough, sneeze of an infected person. Hence protection of the mucous membranes of the eyes, nose and mouth by using face shields and goggles is an integral part of standard. The flexible frame of goggles provides good seal with the skin of the face and it covers eyes and surrounding areas.

Coveralls

They provide full protection because they are designed to cover the whole body, made of two layers of polypropylene fibers. Outer layer is spun bound layers and provides physical strength and inner layer is made with melt blown fibers that are able to filter chemicals and dry particles and provides protective qualities. Shoe covers are made up of impermeable fabric. These are used over shoes to facilitate personal protection and decontamination. These are made of polypropylene.

Mask

Corona viruses target mainly the upper and lower respiratory tracts. Mask protects person from the airway from the particulate matter generated by droplets or aerosols prevents human infection. Using masks are crucial while dealing with a suspect or confirmed case of COVID-19 performing aerosol generating procedures.

The 3-ply surgical mask is commonly used in the COVID-19 pandemic. The 3-ply surgical mask is made up of 3 different layers of nonwoven fabric with each layer having a specific function. Masks manufacture from nonwovens and methods of making nonwoven fabric for surgical mask are spun bond and melt blown process. The process combines the spinning and sheet formation process into one continuous, nonwoven manufacturing system. The microfibrils produced in melt-blown are much finer and the pore size of the nonwoven fabric can be much smaller. Therefore, due to the finer pore size, melt-blowing is the typical process used to fabricate the middle filtering piece of the 3-ply surgical mask. The surge in demand worldwide for commercial face masks during the COVID-19 pandemic has led to a global shortage of supplies for both physical products as well as raw materials. People were started preparing masks at household level using household materials^[4].

3. STANDARDS AND CERTIFICATION

All items to be supplied need to be accompanied with certificate of analysis from national/ international organizations/labs indicating conformity to standards. Manufacturers have to seek a certification from the Ministry of Textiles for their products and they have to get their products approved by a government-accredited laboratory^[1]. The other regulatory requirements depend on the specific item being produced.

Table 1: Standards need to be accompanied with certificate of analysis from national/ international organizations/labs

S. NO.	Standards	Test
1.	ISO 16603	Synthetic Blood Penetration Resistance Test
2.	ISO 22612: 2005	Resistance to penetration by biologically contaminated solid particles
Coveralls should be taped at the seams to prevent fluid/droplets/aerosol entry		

Table 2: Standards need to be accompanied with certificate of analysis from national/ international organizations/labs for various product

S. No.	Product	Test	Standard
1	Medical Gloves for Single Use	Water tightness test/ Freedom from Holes	EN 455-1 Specifies the requirements and gives the test method for medical gloves for single use in order to determine freedom from holes. It covers the requirements of the gloves. It also covers a description of the water tightness test for detection of holes.
2	Plastics/ Polymer Compound	Determination of aqueous extractable proteins in natural rubber gloves using modified Lowry assay	EN 455-3 specifies requirements for the evaluation of biological safety for medical gloves for single use.
3	Protective clothing	Determination of resistance to penetration by a spray of liquid Determination of resistance to penetration by a jet of liquid	EN 14605 Protective clothing against liquid chemicals. Performance requirements for clothing with liquid-tight or spray-tight connections, including items providing protection to parts of the body.
4	Personal Protective Equipment clothing	Ergonomic Size designation	BS EN ISO 13688 Specifies general performance requirements for ergonomics, innocuousness, size designation, ageing, compatibility and marking of protective clothing and the information to be supplied by the manufacturer with the protective clothing
5.	Medical Textile Surgical drapes Gowns & clean air Suits	Resistance to dry microbial penetration	ISO 22612 Specifies a test method for assessing the resistance to penetration through barrier materials of bacteria-carrying particles
6.	Medical Textile Face Mask	Resistance to Penetration by Synthetic Blood	ASTM F1862 Standard Test Method for Resistance of Medical Face Masks to Penetration by Synthetic

			Blood (Projection of Fixed Volume at a Known Velocity)
7.	Medical Textile Face Mask	Evaluation of the Bacterial Filtration Efficiency of Surgical Face Masks.	IS 16288 Evaluation of the Bacterial Filtration Efficiency of Surgical Face Masks

4. FUTURE SCOPE AND CONCLUSION

Human beings are forced to wear mask due to COVID-19 pandemic which has become a new way of living. Covid-19 has also accelerated research and development in medical textiles to protect user from pathogens and against airborne pollutants. There is increased awareness regarding health issues and concern for standards and certification among manufacturer of PPE kit to safeguard consumers.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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