

Designing, executing and producing patterned face masks on jacquard weaving looms for protecting from corona virus

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Research problem:

The research problem is the following question:

Can a woven mask be made for protection from the virus- with aesthetic features?

Keywords

mask - jacquard - corona virus - Covid 19

Research objectives:

- 1- Produce masks from woven fabrics on jacquard machines with heavy sets (which mainly work for the production of upholstery fabrics).
- 2- Producing new types of multi-layer masks from woven fabrics instead of existing non-woven fabrics that its raw materials are imported. This reduces the cost of the product.
- 3- Produce masks with attractive aesthetic designs and shapes instead of the one color only masks.
- 4- Fulfilling the needs of the local and international market from masks with various designs in line with the natural development of all products.

Research importance:

- 1- Exposure to a modern, vital, health and aesthetically important topic.
- 2- Approving new types of masks after proving their functional efficiency.
- 3- Enriching the Arab library and the international market with a large number of designs.
- 4- The world's first search for inserting Jacquard designs into masks.

Research limits

1- Temporal limits: June 2020.

2- Spatial limits:

For design (a computer with a specialized textile design program).

For weaving (textile machine with two head jacquard - and jc5 electronic jacquard controller).

3- Technical limits

A- Warp yarns performing research: warp 2 color -4 designs executed on another machine with a single white warp.

B- The maximum number of weft colors available on the machine is only 5.

C- The number of designs: 40 designs, they were all woven.

Research Methodology

An experimental approach comes in two aspects:

- 1- The design aspect: by employing the aesthetic values of innovative textile designs that are implemented on Jacquard looms to enrich the masks production to achieve technical and formal treatment.

2- The executive side: through the implementation of these designs by the appropriate methods and the appropriate techniques with which the aesthetic and functional dimension are achieved in the form of woven masks

Theoretical framework

What is Corona virus?

Corona Viruses are a large family of viruses that cause disease in animals and humans, they cause infections in the respiratory system.

Respiratory infection intensity ranges from common colds to more severe diseases such as Middle East Respiratory Syndrome (CIRS) and severe acute respiratory syndrome (SARS) and the newly discovered Corona virus called Covid-19 disease, as shown in

The main methods of infection:

Corona virus is transmitted from one person to another through respiratory droplets caused by coughing or sneezing.

There are other methods of infection, summarized in.

Studies have shown that the virus that causes Covid-19 can stay on plastics and stainless steel for 72 hours, on copper less than 4 hours, and on cardboard (carton) less than 24 hours.

Are you looking for advice to prevent corona virus?

Textile materials vary in medicinal purposes. And all the fibers used in the medical field must be non-toxic.

Causing allergies or cancerous diseases in addition to their ability to be sterilized without any change in their physical or chemical properties - including the patient's urine and the surgeon - lightweight non-woven clothing used for medical protection.

The emergence of a pandemic affecting the respiratory system led to the request of face masks. There is limited knowledge available about the performance of the various fabrics available and commonly used in cloth masks.

More importantly, there is a need to evaluate filtration efficiencies as a function of the particle size of an aerosol in the range of 10 nm, on we conducted these studies for many common fabrics including cotton, silk, and chiffon.

We expect that the improved hybrid performance is likely due to the combined effect of mechanical and electrostatic filtration. Cotton, the material most used for cloth masks, performs better at a higher weave density (i.e. the number of yarns) and can make a huge difference in filtration.

How important the mask is to you?

It is the first and most important means to protect the individual and others so you will be banned from people if you are ill or hurt them if you are healthy.

Quality conditions masks:

- 1- The level of risk or exposure to the person who will wear it.
- 2- The type of material made of the cloth, the type of fabric, the density of yarns / inch, the type of stitches, and the method of sewing.
- 3 -Are there treatments on the fabric surface that do not allow bacterial and viral activity, and prevent water infiltration, and allow breathing? what to look for when purchasing a mask

Mask components:

1- The outer layer: It is made of spun-bond polyester using a method that allows the polymer to be flattened in the form of threads and then compressed together in the form of thermal fabric. This layer is often blue or green in color and has anti-tear properties and anti-moisture counter. ... Static, Anti – Bacterial.

2-The middle layer: it is the filter layer, an important layer made of polyester only by the melt-blown method, which is a method that depends on the polishing of the polymer and then puffing it strongly on a spool so that it is grouped in the form of superimposed and crossed fabric and this does not give it the ability of filtering because it helps, it has to capture the bodies between its tissues and achieve high absorption capacity.

Sterilization methods for reuse:

Also, there are many layers on top of each other, to provide much higher protection than the three-layer surgical masks, and their lifespan is longer and more expensive.

In view of the lack of medical supplies in the world, the FDA has allowed the reuse of high-efficiency N95 masks after sterilization with autoclaves to protect the medical staff on the one hand and to overcome the lack of personal protective equipment for workers in the health care field on the other hand.

-types that are spread in the Egyptian market are imitation of the surgical mask with a single layer with blue color made from non-woven fabrics, another kind is from knitted fabrics with black color.

-In this research, I discussed the third type, which is masks that were designed and woven from more than one layer. In response to a previous research recommendation. Machine cut it as masks, not meters, then separate. The implementation was done on the jacquard machines with designs that add an aesthetic aspect to the mask. The following was done:

1. Produce masks from woven fabrics (more than one continuous or separate layer.)
2. Patterned masks (currently all are solid, one color only.)
3. Enter the implementation method of the jacquard machines in producing masks. It is dedicated to the production of upholstery fabrics, woven curtains and... etc.

Jacquard sets what about:

Jacquard devices are used to weave fabrics of large designs of various types that cannot be woven on dobby machines, designs that consist of more than 24 variations of intersections and for designs of complex shapes with hundreds or even thousands of yarns that work differently. The Jacquard loom does not have a circle but an individual healds_eyes. The lifting of each needle is controlled by a series of perforated cards, but almost all of these systems are replaced by small computers that control the lifting of the healds_eyes and its warp threads.

The use of modern mechanical and automatic looms gave the opportunity to manufacture and produce free-textured designs with multiple themes and provided the opportunity to use color tests in complete freedom and at high speed.

The function of the jacquard sets, no matter how different their models and the various means of control, they are limited to controlling the movement of hooks and working to raise them to the upper layer of the shed or stop them on the lower layer where they are affected and dependent on.

The textile structures used to show the desired pattern and design through the interweaving of the weft threads with the warp threads attached to the jacquard frames attached to the top of the textile machine and the means of linking the hooks to the threads is the harnesses.

The use of multiple and advanced computer programs has contributed to managing and adapting the multiple textile data in order to facilitate obtaining the final textile image that represents the final textile product as required in its most accurate form and in the fastest possible time.

The practical framework for the research:

-According to the recommendation of previous research that the use of multi-layer woven fabrics will give better protection than its non-woven counterpart - **also from virus instability research on woven fabrics the following has been done:**

- Number of designs: 40 innovative designs (7 groups).-
- Designed and implemented in designing specialized textile, design programs-
- The histological structures were developed for each group (10 groups of weaves)
- It has been implemented by weaving it on various jacquard machines, each of them with electronic jacquard (2 jacquard 2688 hooks) with controllers unit JC5 .
- The product of these machines is not a fabric by the meter; it can be used as a mask. But the masks are marked with commas, which are easy to separate

Technical specifications for innovative masks:

First: The basic Specifications

1. With a specific area produced on the machine. Mask size: width 18 cm - height from 16 cm to 18 cm:
 2. The mask is provided with a basic textile frame with it to resist the splicing of the limbs and prevent the strings from sliding off together.
 3. Add places to fasten and fix the fixing tape to the head or the ear. Using 4 holes in the corners and also 2 side tapes consisting of two layers (separate in some designs) to dismantle the fixing tapes.
- 1- It can be reused after washing, several use.

Second: The preventive job specifications

- 1 .All masks are from two to four layers (double separate and coherent).
- 2 .Difference of weaves structures (10 groups) from innovative weaves.
3. The difference in the materials used for warp and weft
 - All-polyester warp (36 designs executed in two colors: white and black - while only 4 designs are executed in one color white.)
4. weft: of different materials as follows:
The first weft is white cotton (for the layer adjacent to the face) for all masks. To avoid carcinogenicity
Some designs are made of polyester wefts - others – polypropylene – filling wefts.
- 5 .The set (the number of threads / cm) are different, as follows: 5 groups.
In the first group, 14 design number of edges of poison = 25 weft / cm.
The second group 4 designs 49 weft / cm - the third, fifth and seventh groups 37.5-40 wefts / cm - the fourth group 20 wefts / cm - the sixth group 25-28.5 weft / cm.

6 .thickness:

First: the thickness of the threads (count)

The warp in all masks No. 150/1 denier - Weft: The first weft in all designs is Cotton 20 E.

The rest of the wefts in the first group are all polyester number 300 denier.

Second: the thickness of the fabric: the thickness of the fabric varies from one group to another.

7 .The presence of a space (in some masks) that allows opening of the mask layers and the possibility of placing between them other layers of other materials to double protection from the virus.

8. All the masks (the side facing the face) appeared from the white warp with white cotton weft (there are no colored strings except rarely in some masks) to prevent carcinogenicity.

Third: Aesthetic Specifications:

1 -Innovative designs and various decorative units, including historical, plant and engineering and various topics, including the national, religious, children's drawings.

2-Variou designs suitable for many ages and tastes. 3 -The frame is beautifully decorated

Fourth: Economic aspects:

1- Less expensive than other types.

2- It can be reused after washing it for several times (it is distinguished from the masks produced from non-woven fabrics that are used for one time)

Research results:

A surveys is designed to measure both the aesthetic and the functional sides of the masks, the final results are as follows:

It can be seen from Table (12) that the design No. 17 designed with warp2 color and weft 4 color is the best in terms of overall evaluation with an arithmetic average (2.89) and a relative weight (96.27%), followed by the two numerical designs 18 and 19 with warp2 color and weft 4 colors with an arithmetic average (2.88) and a relative weight (96.05%) for each, and after that the rest of the designs come according to their relative weights. Diagram (5) illustrates that:

** the proposed designs in terms of overall evaluation according to their relative weights:

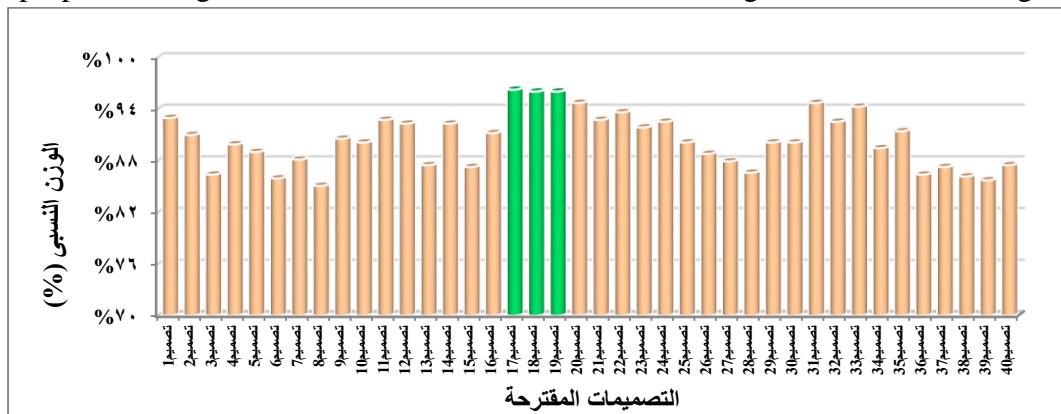


Chart no (5) the proposed designs in terms of overall evaluation according to their relative weights.

Summary of results:

Agreement of specialists' opinions on achieving the aesthetic and functional aspects of the proposed designs.

Research recommendations:

- 1- Encouraging scientific researches related to healthy living matters and fully supporting such research.
- 2- I recommend conducting more researches on masks produced from this research and treating them against bacteria and viruses.
- 3- I recommend that such masks would be produced in workshops of industrial schools and specialized colleges and presented in the market at the appropriate price to create a price balance for the offered items.

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