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COMPARISON BETWEEN PLAIN AND TWILL DESIGNS BEFORE AND AFTER BEING EXPOSED TO DUST

Amel Suleiman[1], Hashem Ali[2], Elmugdad A.A.[3], Mohamed Ahmed Elgalib [4]

[1,2,4]Textile Department, College of Engineering and Technology of Industries, Sudan University of Science and Technology, Khartoum, Sudan
[3]Chemistry Department, College of Science, Sudan University of Science and Technology, Khartoum, Sudan
Email: amelkorde18@gmail.com[1],hashimsalem @hotmail.com[2], elmugdad @hotmail.com[3]

ABSTRACT

The quality of fabrics is determined by their relevance to function they are produced for and it is evaluated according to a set of criteria which appropriate for each type of fabrics. A fabric testing is one of the most important methods for fabrics evaluation during or after production by using laboratory devices which are relevant to all fabric properties. Sudan has arid areas through which the River Nile flows and this geographical nature creates some climatic factors such as dusty winds that blow periodically through the year. In this study three different types of materials are used: cotton (%100), polyester (%100) and a blend of cotton and polyester (%50 for each). However, these materials are woven into various fabrics: Plain and Twill 2/2. The samples were exposed to dust permeability instrument, then the weight and air permeability tests were carried out.. The plain design got the high test value in weight while the twill got the highest value in air permeability.

Keywords: Plain; Twill; Dust; Weight and Air Permeability

1. INTRODUCTION

Sudan is highly vulnerable to climate change and climate variability. The interaction of multiple stresses—endemic poverty, ecosystem degradation, complex disasters, conflicts, limited access to capital, markets, infrastructure and technology, have all weakened people's ability to adapt to changes in climate.[1]

Other climate-related phenomena—such as dust storms, thunderstorms, and heat waves—also pose a serious threat to local livelihoods, although they occur less frequently. Climate change is expected to intensify these hazards.

According to the International Standardization Organization (ISO 4225 - ISO, 1994),"Dust is defined as: small solid particles, conventionally taken as those particles below 75 µm in diameter, which settle out under their own weight but which may remain suspended for some time". According to the "Glossary of Atmospheric Chemistry Terms" (IUPAC, 1990),"Dust: Small, dry, solid particles projected into the air by natural forces, such as wind, volcanic eruption, and by mechanical or man-made processes such as crushing, grinding, milling, drilling, demolition, shovelling, conveying, screening, bagging, and sweeping. Dust particles are usually in the size range from about 1 to 100 µm in diameter, and they settle slowly under the influence of gravity."[2]

However, in referring to particle size of airborne dust, the term "particle diameter" alone is an over simplification, since the geometric size of a particle does not fully explain how it behaves in its airborne state. Therefore, the most appropriate measure of particle size, for most occupational hygiene situations, is particle aerodynamic diameter, defined as" the diameter of a hypothetical sphere of density 1 g/cm^3 having the same terminal settling velocity in calm air as the particle in question, regardless of its geometric size, shape and true density."The aerodynamic diameter expressed in this way is appropriate because it relates closely to the ability of the particle to

penetrate and deposit at different sites of the respiratory tract, as well as to particle transport in aerosol sampling and filtration devices. There are other definitions of particle size, relating, for example, to the behaviour of particles as they move by diffusion or under the influence of electrical forces. But these are generally of secondary importance as far as airborne dust in the workplace is concerned.

As the particle size of the dust decreases, the available surface area increases, giving a greater capacity for rapid reaction. Therefore, the stickiness of dusts increases as the particle size decreases, and the smaller the particle size the less energy required to ignite the dust cloud. Fine dust can also be thrown into suspension more readily, can remain suspended longer than coarse dust, and will mix more uniformly with air.[3]

Clothing is used to cover the body, to make you feel more attractive and to communicate with others. People wear clothes for many different reasons. Some of these reasons are physical. You wear clothes for comfort and protection. Others are for psychological and social reasons. Clothes give you self-confidence and express your personality. Clothes also help you identify with other people.[4]

All people have basic human needs. Meeting these needs provides satisfaction and enjoyment in life. Clothing helps to meet some of these needs. Knowing something about the role of clothing helps you to understand yourself and others better. Clothing is a complex but fascinating part of everyone's life. Therefore clothes are worn for many reasons.[4]

2. MATERIALS and METHODS

2.1 Cotton

Cotton is obtained from the seeds, the staple fibre measuring (10- 65mm) in length and white to beige in color in its natural state. It is composed basically of a substance called cellulose. As cotton occupies 50% of the consumption of fibres by weight in the world it is called the king of all fibres. Cotton is the fabric for every home and is the most widely produced fabrics today.[5]

All varieties of cotton (botanical name ″gossypium) grew originally in the desert zones of both the old and the new world. The cotton fibre was used probably at the end of the Stone Age in both hemispheres to manufacture strings and maybe also fishing nets.[6]

2.2 Polyester

Polyester fiber looks smooth. The length, width, shape and luster of the polyester fibers are controlled during manufacture to suit a specific end use. It is mostly blended with other fibers to improve its absorbency and to lower static electricity.

Polyester fibres result from the poly-condensation process. When spinning, the melt spinning process is employed .A manufactured polyester fiber is composed of at least 85% by weight of an ester of a substituted aromatic carboxylic acid, including but not restricted to substituted terephthalate units.[7]

2.3 Weaving

Woven fabrics generally consist of two sets of yarns that are interlaced and lie at right angles to each other. The threads that run along the length of the fabric are known as warp ends whilst the threads that run from selvedge to selvedge, from one side to the other side of the fabric, are weft picks. Frequently they are simply referred to as ends and picks. In triaxial and in three-dimensional fabrics yarns are arranged differently.

2.3.1 Plain weave

The plain weave is the most common, nearly all light weight goods are plain woven. In plain weaving, each thread of both warp and filling passes alternately over and under the threads at right angles.

Plain weave is the simplest interlacing pattern which can be produced. It is formed by alternatively lifting and lowering one warp thread across one weft thread.

The diagrams are idealized because yarns are seldom perfectly regular and the pressure between the ends and picks tends to distort the shape of the yarn cross sections unless the fabrics are woven from monofilament yarns or strips of film. The yarns also do not lie straight in the fabric because the warp and weft have to bend round each other when they are interlaced.

2.3.2 Twill Weave

Twill is the most common, being much used for dress goods, sittings, etc. In this weave the intersections of the threads produce characteristic lines diagonally across the fabric, most often at an angle of 45°. The twill may be hardly visible or very pronounced. The simplest twills are the so-called "doeskin" and "prunella." In the doeskin the filling threads pass over one and under two of the warp threads and in the prunella twill over two and under one. The most common twill is the cassimere twill in which both the warp and filling run over two and under two of the threads at right angles.

Table 1. Specifications of samples used

Fabric material	**100%Cotton**	
Weave	Plain	Twill2\2
Warp count(Ne_1)	40\2 s	40\2 s
Ends\cm	36	36
Weft count(Ne_2)	24 s	24 s
Picks\cm	21	21
Fabric material	**100%Polyester**	
Weave	Plain	Twill2\2
Warp count (Ne_1)	40\2 s	40\2 s
Ends\cm	36	36
Weft count (Ne_2)	24 s	24 s
Picks\cm	21	21
Fabric material	**50%Cotton &50% polyester**	
Weave	Plain	Twill2\2
Warp count (Ne_1)	40\2 s	40\2 s
Ends\cm	36	36
Weft count (Ne_2)	24 s	24 s
Picks\cm	21	21

3. Experimental Work

3.1 Weight Test

Weight of fabric can be expressed by one of the two methods, namely the weight per unit area or weight per unit length, and in all cases, you must specify the method of estimation and the unit weight and the unit of measurement used.

There are a range of factors that affect the process of assessing the weight and that must be taken into account such as the accuracy in determining the sample size and accuracy of the sample cut and in the process of weight. The percentage of moisture in the fabric is one of the direct impacts on the accuracy of the results of estimating the cloth weight factors.

The method of obtaining this value was achieved by using SHIMADZU digital scale with a precision of up to 0.01g .Samples were cut from the fabric.

The samples were cut with circular samples cutter, which gives an area of $100cm^2$ for each sample.

The scale digital reading gives directly the fabric weight per $1m^2$ .The average weight was determined of five samples cut from different places of the fabric not including selvedges. This method was performed according to the standard ASTM 3776-85 (1990).

3.2 Air Permeability test

The definition of air permeability of fabric is the air measured by the volume of air in cubic centimeters that passes per second through square centimetres of fabric at the air pressure of 1 cm of water. The sample is installed in the path of the suction stream of air through the pump device, it is controlled by the amount of air pressure flowing through the valve in order to reach a desired pressure and using the indicated amount of air pressure passing. The test sample is placed into a box where exposed to air stream which passes through the circular diameter of 1 inch. The readings of the device is recorded through a number of glass tubes containing moored on buoys cork Light and which are affected by the air stream, that passes through the samples. The reading is determined by the float level.

The apparatus used for air permeability testing is FRAZIER permeability tester using BS NO.5636 (1990).

3.3 Fabric Dust Permeability:

The dust permeability of fabrics is determined by a simple apparatus, which was newly designed by Dr Mohamad Saad in Textile Department, National Research Center, Cairo.

The main purpose behind the design and development of the concerned apparatus is to ensure the efficiency and durability of filter fabrics to avoid risking failure when a proposed filter is introduced.

Using such apparatus may lead to minimizing the cost and to take correct decisions in selecting filter fabrics.

All fabrics tested were successfully used as bag filters in number of filtration applications, where woven and non-woven fabrics are used.

4. Results:

Table 2. Plain fabrics before and after exposed to duste

Sample	Material	Weight of m^2 (g)	
		Before	After
C	100 %Cotton	175	191
P	100%Polyester	186	271
P/C	50%cotton&50% polyester	200	210
Sample	**Material**	**Air permeability ($cm^3/s/cm^2$)**	
		Before	After
C	100 %Cotton	8.73	4.8
P	100%Polyester	4.34	2.8
P/C	50%cotton&50% polyester	7.09	5.1

Table 3. Twill fabrics before and after exposed to dust

Sample	Material	Weight of m^2 (g)	
		Before	After
C	100 %Cotton	174	190
P	100%Polyester	177	185
P/C	50%cotton&50% polyester	176	183
Sample	**Material**	**Air permeability ($cm^3/s/cm^2$)**	
		Before	After
C	100 %Cotton	32.30	21.3
P	100%Polyester	35.00	23.5
P/C	50%cotton&50% polyester	28.50	19.7

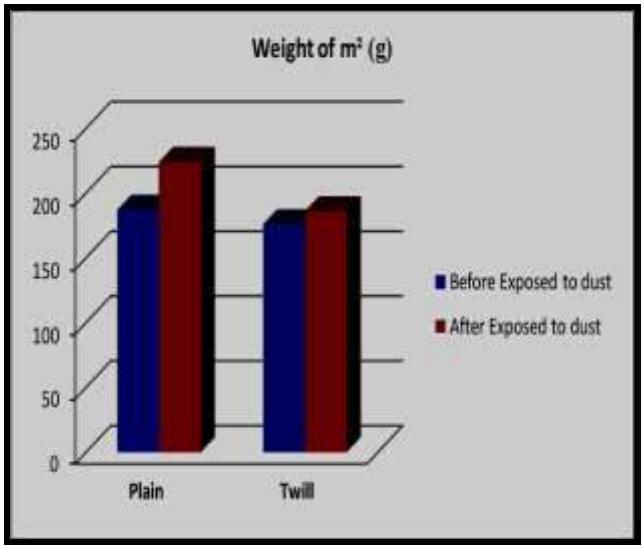

Fig (1) Weight of m^2

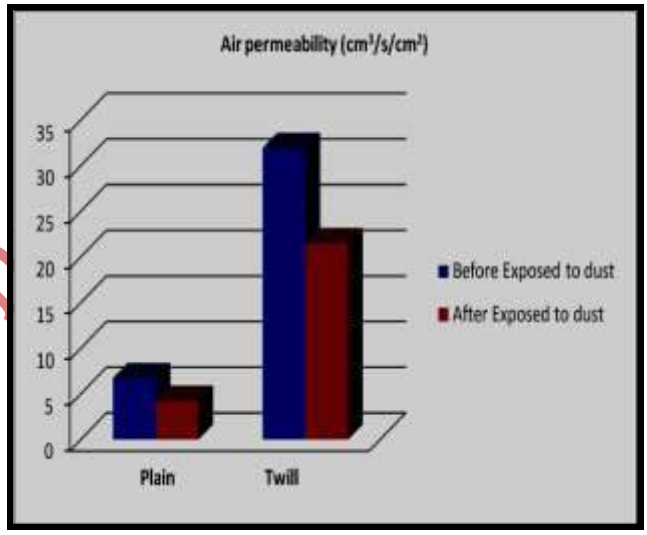

Fig (2) Air Permeability

5. CONCOLUSION

It can be seen from fig [1] that the samples increased in weight after being exposed to dust the effects of design of fabrics on the weight, plain design fabric got the highest value after being exposed to dust. Also from fig [2] the air permeability of the samples decreased after being exposed to dust. The effects of design of fabrics on the property of air permeability before and after when exposed to dust. Plain weave got the lowest value due to its high compactness

6. ACKNOWLEDGMENTS

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