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AN INVESTIGATION ON THE COMFORT PARAMETERS OF CLOTHING FROM TWILL AND PLAIN FABRICS

ИССЛЕДОВАНИЕ ПАРАМЕТРОВ ОБЕСПЕЧЕНИЯ КОМФОРТНОСТИ ОДЕЖДЫ ИЗ ТКАНЕЙ ПОЛОТНЯНОГО И САРЖЕВОГО ПЕРЕПЛЕТЕНИЯ

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In this study have been studied to determine the comfort parameters of twill and plain fabrics: thermal resistance, thermal conductivity, thermal absorptive,

water vapor resistance and water vapor permeability properties of fabrics according to percentage of wool content and density of fabrics.

When considering the results of all tests, it was found that the density is the most affecting comfort parameters of clothing.

В данной работе исследованы и определены параметры обеспечения комфортности тканей саржевого и полотняного переплетения: термостойкость, теплопроводность, тепловая поглощающая способность, сопротивление водяного пара и паропроницаемость в зависимости от процента содержания шерсти и плотности тканей.

При рассмотрении результатов всех испытаний установлено, что плотность является параметром, наиболее влияющим на обеспечение комфортности одежды.

Keywords: twill fabrics, plain fabrics, comfort properties, wool, density of fabrics.

Ключевые слова: саржевое переплетение, полотняное переплетение, параметры комфортности, шерсть, плотность тканей.

The purpose of studies on the clothing comfort is to ensure the perfect clothing comfort by determining optimum values of parameters of comfort, such as thermal resistance, thermal conductivity, air permeability of the fabric.

Many researchers have examined the parameters that cause lack of comfort of fabric. As a result of studies have been found that these following factors are playing fundamental roles in terms of comfort:

– chemical macromolecular structure of the fibers, diameter, cross section and crimp;

– number of yarn, twist and hairiness;

– structure of the textile surface, treatments and additives used;

– model and size of garments.

Thermal conductivity values of the air which embodied in fiber and fabric that the affected main factors of the thermal comfort have been investigated by Greyson [1]. In this study it was found that air is the ideal dielectric material. From the results of this study was obtained the following table (Table 1).

In table 1 was indicated the thermal conductivity of different fiber material in the volume of 500 kg/m³.

Schneider, Hoschka and Goldsmid have measured the thermal conductivity values of fabrics formed from wool, polypropylene, cotton and porous acrylic fiber in wet state and for all samples was observed that the thermal conductivity increased in wet state. Highly absorbent wool fiber has been found that provide better thermal insulation than porous acrylic, polypropylene and cotton under humid conditions [2].

Table 1

Material	Thermal conductivity (mWatt/meter-Kelvin)
CO	71
WO	54
Silk	50
PVC	160
Cellulose acetate	230
PA6.6	250
PES	140
PE	340
PP	120
Air	25

Ren and Ruckman have examined two different waterproof breathable fabrics on the wet water vapor permeability. The obtained results are as follows:

– the transfer of water vapor is increased when the high moisture content and condensation.

– the effect of water vapor transfer is different on the concentration and moisture content. The effect of water vapor transfer on moisture content is greater than the condensation [3].

Hes measured thermal resistance, thermal conductivity, and water vapor permeability values of 11 different plain and twill woven fabric structure in wet state which are widely used in occupational garment to examine the thermal comfort properties of textiles in the wet state. With the increasing percentage of moisture in the fabric, especially more in wet fabric is observed an increase in the thermal conductivity. On the contrary, the thermal resistance was decreased with increasing fabric weight due to absorbed moisture. This is described by the air in the pores was replaced by water wth the higher thermal conductivity. It was also found that the water vapor permeability was increased with increasead humidity [4].

GÜNEŞOĞLU et al. investigated the thermal properties of the futter fabric. Warm-cold feeling of napped half of fabric, was measured with the test device Alambeta in the both wet and dry conditions. The results are as follows:

– heat absorbance of the back and face of the cotton fabric is the highest, thus giving cold feeling when touched;

– heat absorbance of the back and face of the fabric used same type of yarn is higher than others;

– napping process reduces the heat absorbance of the fabric and gives a warm feeling;

– the effect of the warm-cold feeling is important on the fiber type, but this effect is became negligible after napping;

– in all the fabrics the thermal conductivity is higher in wet-state. Thermal absorbance of the napped fabric is greater in the wet state than dry-state. Thermal absorptivity of napped fabric in wet-state is lower than the value of the non-napped fabric in wet state. Therefore it gives a warmer feeling [6].

Hes examined the thermal absorptivity properties of textile products. Among them, the lowest value is stated that the non-woven fabric of PET microfiber lining. The high heat absorbance value gives a cooler feeling to the wearer at first contact [5].

Anand and Rebenciuc compared the thermal comfort parameters of 1x1 and 2x2 rib knitting structure with different dimensional stability and have achieved the following results:

– with decreasing the fabric thickness, the water retention (absorption) and the relative water vapor permeability is increased without affecting the structure of the fabric; thermal resistance is decreased;

– with decreasing the density of all structures, the thermal resistance and water vapor resistance are reduced;

– wet fabric has a lower thermal resistance and higher heat absorbency than dry fabric. This is because the wet fabric is more permeable than dry fabric.

– 1×1 and 2×2 milano structures have low relative water vapor permeability and high water vapor resistance. Because these structures are more compact and tends to be more intense [7].

Holme, with his work on pile and futter knitting found that the pile allows to keep the heat and thus the thermal insulation value rises. And also indicated that wool fibers could be used on surfaces in contact with the body, due to the wool fiber's superior ability to absorb water and to create thermal bumpers [8].

Chen et al. found that clothing thermal insulation decreases during perspiration, and the amount of reduction varies from 2 to 8%, as related to water accumulation within clothing ensembles [9].

In this study, have been studied to determine the comfort properties of twill and plain fabrics. In fig. 1 (thermal resistance, thermal conductivity and thermal absorbivity properties of 1. Group twill fabrics according to percentage of wool content), fig. 2 (thermal resistance, thermal conductivity and thermal absorbivity properties of 2.

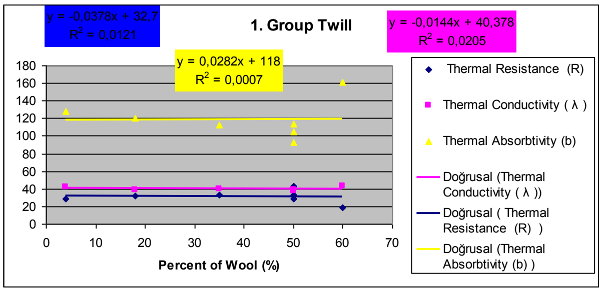

Fig. 1

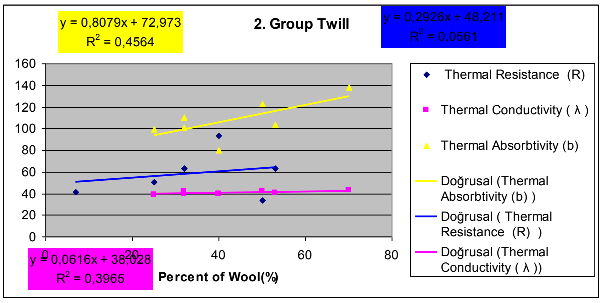

Fig. 2

Group twill fabrics according to percentage of wool content) and fig. 5 (thermal resistance, thermal conductivity and thermal absorbivity properties of plain fabrics according to percentage of wool content) are shown thermal resistance, thermal conductivity and thermal absorbivity properties of fabrics according to percentage of wool content. In fig. 3 (water vapour resistance and water vapour permeability properties of 1. Group twill fabrics according to percentage of wool content), fig. 4 (water vapour resistance and water vapour permeability properties of 2.

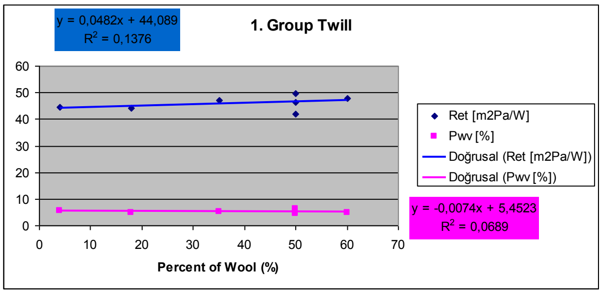

Fig. 3

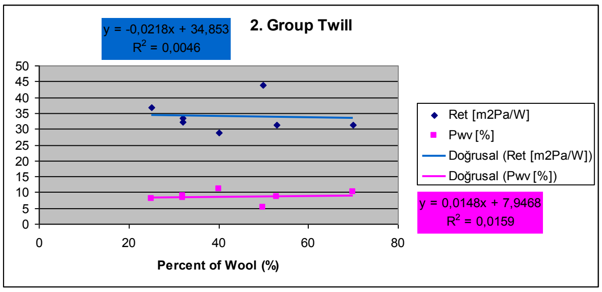

Fig. 4

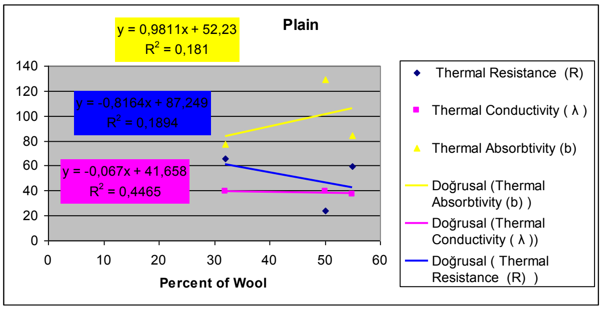

Fig. 5

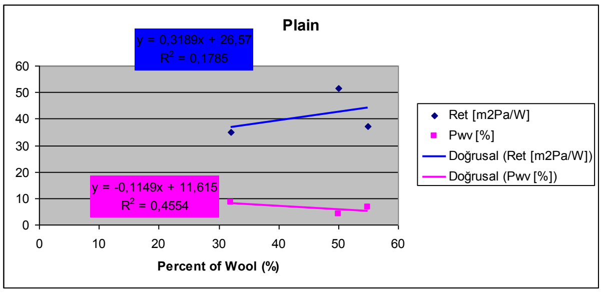

Fig. 6

Group twill fabrics according to percentage of wool content) and fig. 6 (water vapour resistance and water vapour permeability properties of plain fabrics according to percentage of wool content) are shown water vapour resistance and water vapour permeability properties of fabrics according to percentage of wool content. In fig. 7 (thermal resistance and thermal conductivity properties of twill fabrics according to density of fabrics) and fig. 8 (thermal resistance and thermal conductivity properties of plain fabrics according to density of fabrics) are shown thermal resistance and thermal conductivity properties of fabrics according to density of fabrics.

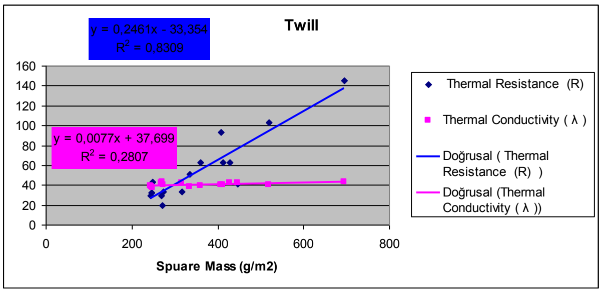

Fig. 7

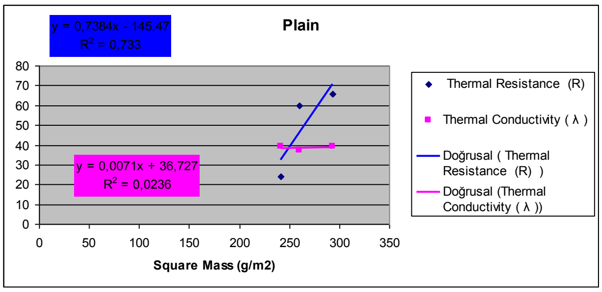

Fig. 8

In fig. 9 (water vapour resistance and water vapour permeability properties of twill fabrics according to density of fabrics) and fig. 10 (water vapour resistance and water vapour permeability properties of plain fabrics according to density of fabrics) are shown water vapour resistance and water vapour permeability properties of fabrics according to density of fabrics [10].

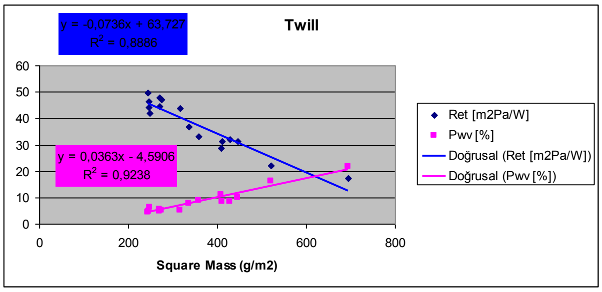

Fig. 9

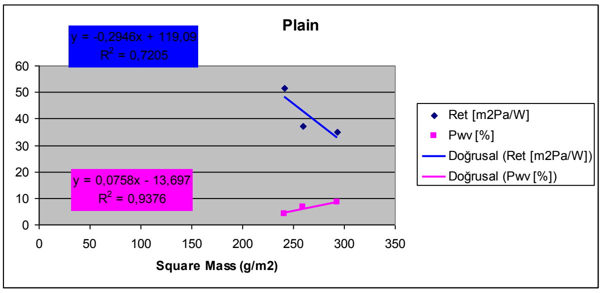

Fig. 10

It is observed that no change in thermal resistance, thermal conductivity and thermal absorbivity properties of 1. Group twill fabrics with the increase of the amount of wool.

It is observed that an increase in thermal resistance, thermal conductivity and thermal absorbivity properties of 2. Group twill fabrics with the increase of the amount of wool.

It is observed that no change in water vapour permeability properties and an increase in water vapor resistance of 1. Group twill fabrics with the increase of the amount of wool.

It is observed that an increase in water vapour permeability properties and no change in water vapor resistance of 2. Group twill fabrics with the increase of the amount of wool.

It is observed that an increase in thermal conductivity and thermal absorbivity and a decrease in thermal resistance properties of plain fabrics with the increase of the amount of wool.

It is observed that an increase in water vapour resistance and a decrease in water vapour permeability properties of plain fabrics with the increase of the amount of wool.

It is observed that an increase in thermal resistance properties and no change in thermal conductivity properties with the increase of the density of twill fabrics.

It is observed that an increase in thermal resistance properties and no change in thermal conductivity properties with the increase of the density of plain fabrics.

It is observed that an increase in water vapour permeability properties and a decrease in water vapor resistance with the increase of the density of twill fabrics.

It is observed that an increase in water vapour permeability properties and a decrease in water vapor resistance with the increase of the density of plain fabrics.

According to the results it is observed that an increase in thermal resistance, thermal conductivity and thermal absorbivity properties of fabrics with the increase of the amount of wool, an increase in water vapour resistance and a decrease in water vapour permeability properties of fabrics with the increase of the amount of wool, an increase in thermal resistance properties and no change in thermal conductivity properties with the increase of the density of fabrics, an increase in water vapour permeability properties and a decrease in water vapor resistance with the increase of the density of fabrics.

When considering the results of all tests, it was found that the density is the most affecting comfort parameters.

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