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Comparable Analysis of the End-Use Properties of Woven Fabrics with Fancy Yarns. Part II: Abrasion Resistance and Mass

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Abstract
Fancy yarns with colour and/or structure effects are often used in clothing fabrics. These yarns give decorativeness and improve the appearance of a garment. However, fancy yarns can change the end-use properties of a fabric. Therefore, the influence of the use of fancy yarns of different structure in clothing fabrics on such end-use properties of these fabrics as abrasion resistance and mass is analysed in this article. The influence of fancy yarn structure, raw material and fabric weave on the above-mentioned properties of fabrics with fancy yarns was established during the investigation, in which the influence of the above-mentioned parameters of yarns and fabric on the abrasion resistance and mass of fabrics with fancy yarns was estimated.

Key words: *woven fabric, fancy yarn, structure yarn, abrasion resistance, mass.*

Introduction

Creating new high quality textile products and analysing their properties as well as usage possibilities is an especially pressing and important problem today. Designing woven fabrics always poses the problem of how to predict their technological and end-use properties. These properties depend on many different factors, i. e. the raw material of yarns, fibre fineness, yarn count, yarn type, the tensile and hairiness of yarn, weave, setting etc. [1 - 4]. Of course, the yarn structure, especially fancy yarn structure, changes the end-use properties of fabrics with these yarns. Fancy yarns are used for woven and knitted fabrics as they give decorativeness and improve the appearance of a garment [5 - 7]. Fancy yarns can be produced by a one or two process manufacturing method. Using one process, it is possible to produce fancy yarns with very different effects, such as loops, waves, knots, a spiral structure, as well as combined effects with different particular properties etc. [8, 9].

Ortlek and Ulku found that the material type, twist level and pile length have a significant effect on the abrasion resistance of chenille yarns. According to these authors, the abrasion resistance of cotton chenille yarns is higher than that of acrylic or viscose chenille yarns [7]. Nergis and Candan proved that the overfeed ratio, the binding yarn in the twist direction and the twist amount affected the stitch density, thickness and abrasion behaviour of knitted fabrics from bouclé fancy yarns [6]. Kaynak and Topalbekiroğlu observed that the weave pattern and number of rubbing cycles have a significant effect on the abrasion resistance property of woven fabrics [2].

The aim of this research is to analyse the influence of fancy yarn structure on the abrasion resistance and mass of woven fabrics with fancy yarns.

Materials and test methods

In this study, such end-use properties of woven fabrics with fancy yarns in the weft as abrasion resistance and mass were analysed and predicted.

Woven fabrics of different structure (with slubs, loops and a spiral structure) and raw material with fancy yarns in the weft were analysed during the investigation. Fancy yarns were produced by a one process method using a fancy-twisting machine - Jantra-PrKV 12 (‘Jantra’, Bulgaria). Fabrics were woven on a Picanol Gama rapier loom from PES 16.7 tex multifilament textured yarn in the warp and cotton of 20 tex × 2 yarn and fancy yarn in the weft in sateen and twill weaves.

The yarns were tested on standard test equipment using standard test methods. Evaluation of the abrasion resistance of the samples of fabric with fancy yarns was performed on a Martindale Abrasion and Pilling Tester MESDAN-LAB, Code 2561E (SDL ATLAS, England), in accordance with the standard [10]. An entire description of the materials and values of the Martindale Abrasion and Pilling Tester setting used is in the study ‘Comparable Analysis of the End-use Properties of Woven Fabrics with Fancy Yarns. Part I: Abrasion Resistance and Air Permeability’.

Microscopical analysis of the fabrics before and after abrasion was performed using a SMZ 800 Nicon Stereoscopic Microscope and Coolpix 4500 Digital Camera.

The samples cut were weighted by an EW 150-3M electronic balance (Kern & Sohn GmbH, Germany) to determine the mass at the beginning and after a certain number of abrasion cycles.

The fabrics were conditioned at a temperature and relative humidity of 20 ± 2 °C and 65 ± 2%, respectively, as specified in the standard [11].

Statistical and regression analysis was done using a Microsoft Excel Analysis Tool Pak.

Results and discussions

The appearance of the fabrics changed after abrasion, i.e. the thread became finer, pilling covered the fabric surface, the thread spacing became bigger, and holes appeared in the fabrics.

The influence of the fancy yarn structure on the fabric mass during abrasion was analysed as well. The dependencies for sateen fabrics with fancy yarns of different raw material are shown in ***Figure 1***.

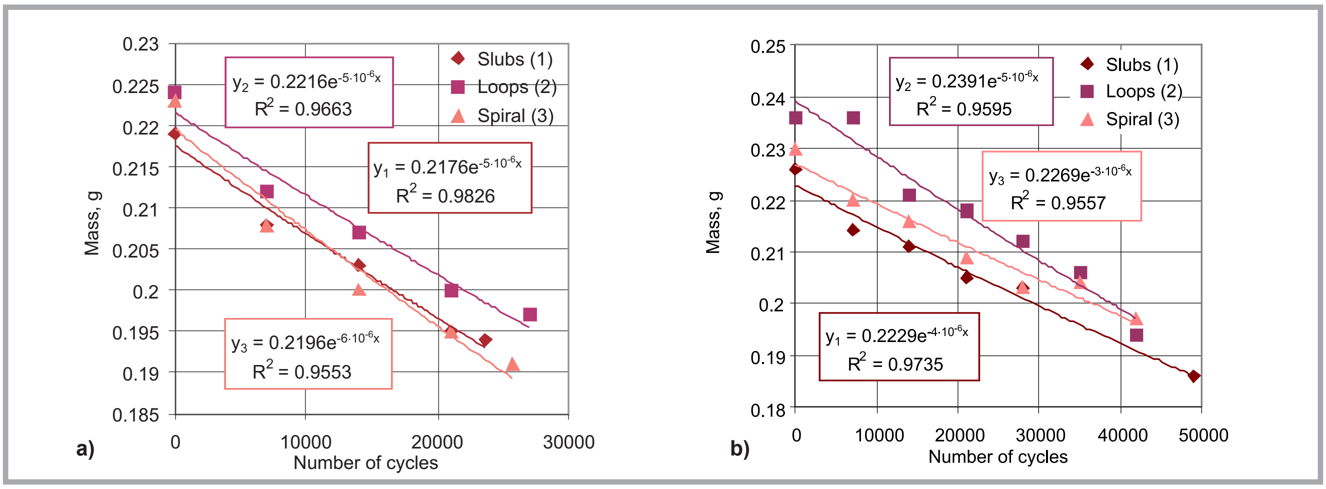

***Figure 1.** Dependencies of the fabric's mass on the number of abrasion cycles for sateen fabrics with fancy yarns of different structure: a - for fabrics with synthetic yarns and b - for fabrics with wool yarns; ♦ Slups (1), ■ Loops (2), ▲ Spiral (3).*

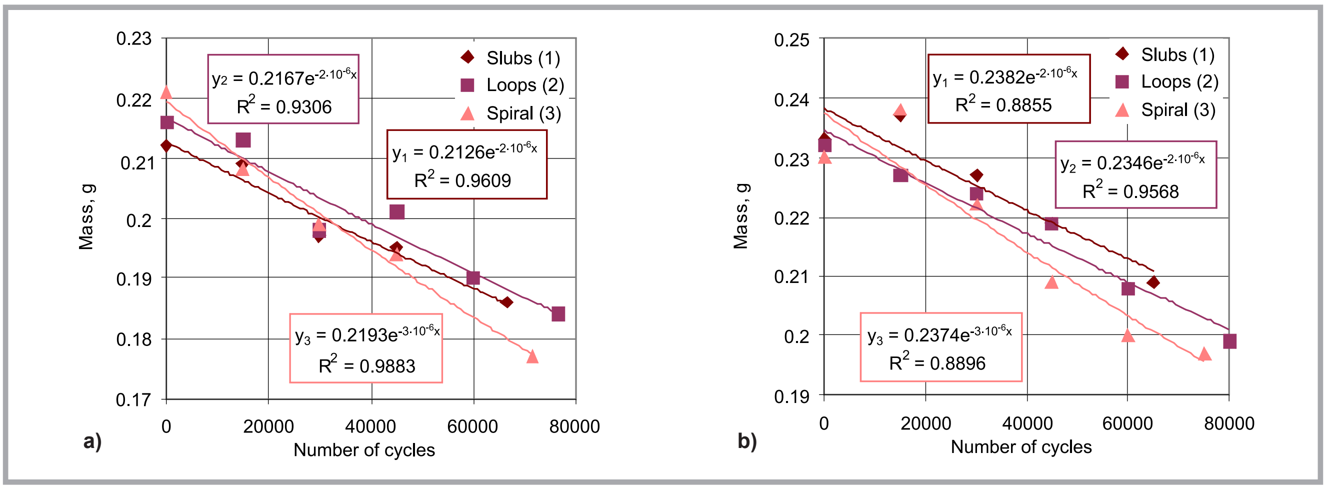

***Figure 2.** Dependencies of fabric's mass on the number of abrasion cycles for twill fabrics with fancy yarns of different structure: a – for fabrics with synthetic yarns and b – for fabrics with wool yarns.*

When the number of abrasion cycles increases, the mass of fabrics with fancy yarns decreases because of the breaking of the fabric's thread, resulting in the separation of the fabric surface and holes appearing in the fabric during abrasion. It can be seen that the fabrics of both raw materials with loop yarn have the highest mass, whereas the fabrics with slub yarn have the lowest, an explanation of which can be that the frequency and regularity of effects in fancy yarn influence these tendencies. Exponential equations describe the dependencies quite well (the determination coefficients are over 0.95).

By analysing the tendencies of mass changes in twill fabrics during abrasion (***Figure 2***), other results are obtained, although the basic tendency - when the number of abrasion cycles increases, the mass of fabrics with fancy yarn decreases - remains the same. Fabrics with synthetic loop yarn and fabrics with wool slub yarn have the highest mass. The curve rise angle for spiral yarn is higher than that for the other two curves in the cases of both raw materials. However, in both cases the values of the mass of fabrics with spiral yarn are the lowest in the biggest part of the curves because the effects of these yarns are distributed the most regular, and the dimensions of effects are the lowest.

Furthermore, there are dependence of the mass on the number of abrasion cycles for fabrics woven with the different weaves and yarns of different raw material. These dependencies were established for the fabrics with slub, loop and spiral yarns. In this article, the dependencies of fabrics with slub yarn are shown only. The dependencies of the fabric's mass on the number of abrasion cycles for fabrics of different raw material are shown in ***Figure 3***, see page 46. It can be seen that in the case of both weaves, the fabrics with wool yarns have the higher mass because the linear density of the effect component of these yarns is higher and the dimensions of the effects are higher. The difference in the mass in the case of the sateen weave is lower than in the case of the twill weave.

The dependencies of the fabric's mass on the number of abrasion cycles for fabrics of different weave with synthetic and wool slubs yarns are shown in ***Figure 4***, see page 46. The sateen fabrics have the highest mass, because in this weave the thread is more loosely connected and has more possibilities of shrinkage. Because of this reason the setting of the thread becomes higher and the fabric's mass increases. The difference between the masses of sateen and twill fabrics for the fabrics with synthetic yarns is lower than for the those with wool yarn.

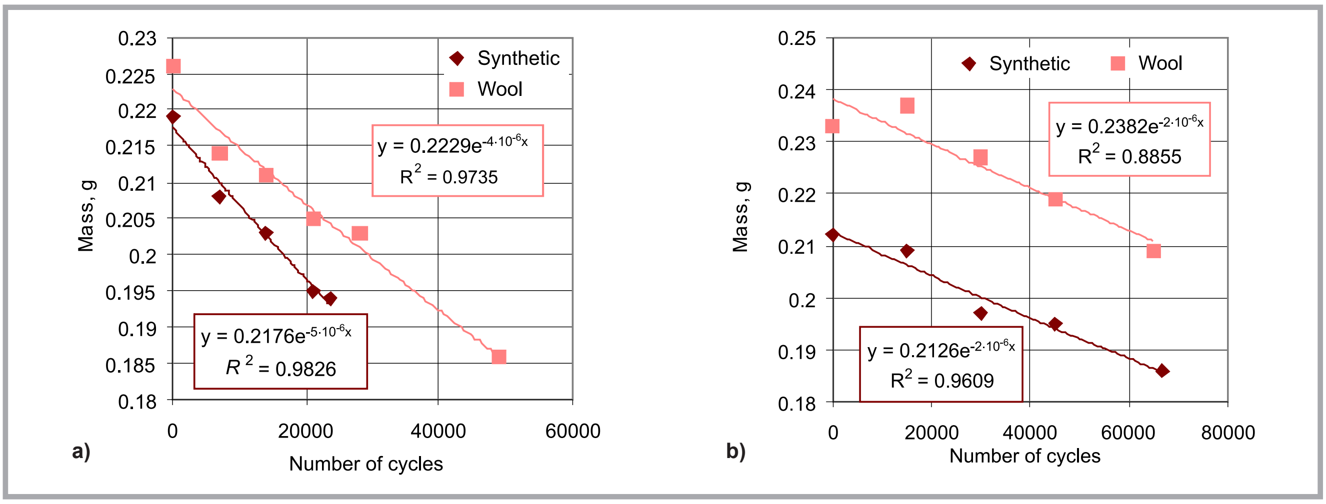

Figure 3. *Dependencies of the fabric's mass on the number of abrasion cycles for slub yarns of different raw material : a – for sateen fabrics and b – for twill fabrics.*

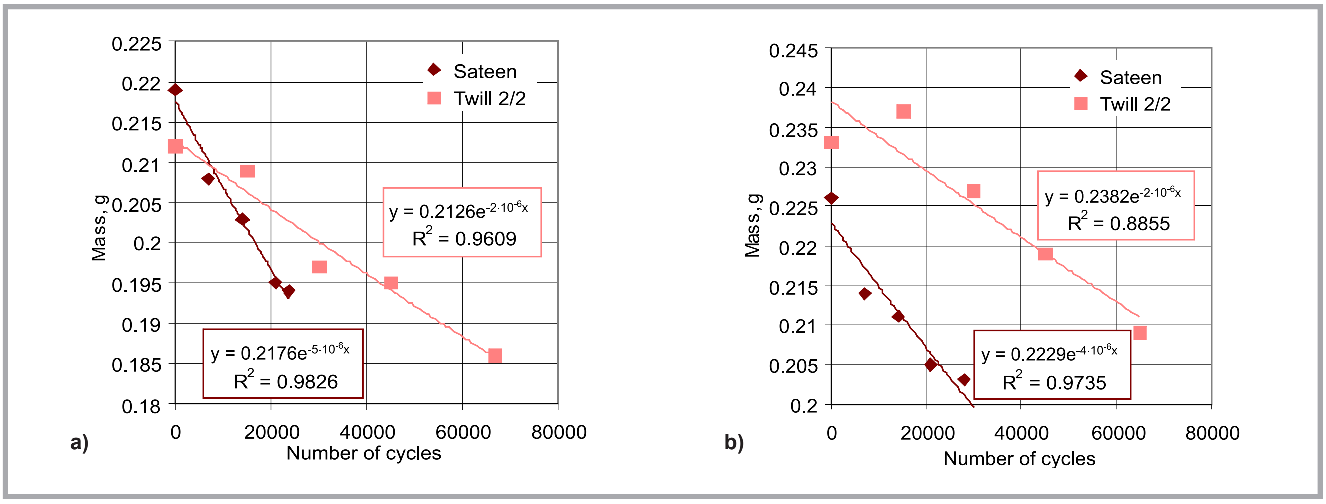

Figure 4. *Dependencies of the fabric's mass on the number of abrasion cycles for different weave fabrics with slub yarns: a – for fabrics with synthetic yarn and b – for fabrics with wool yarn.*

Conclusions

- The appearance of the fabrics changed after abrasion, i.e. the yarns became finer, pilling covered the fabric surface, the thread spacing became bigger, and holes appeared in the fabrics.
- The mass of fabrics with fancy yarns decreases during abrasion. The fabrics of both raw materials with loop yarn have the highest mass and the fabrics with slub yarn have the lowest.
- The curve rise angle for spiral yarn is higher than that for the other two curves in the cases of both raw materials. With an increase in the number of abrasion cycles, the mass of fabrics with fancy yarn decreases.
- It was established that the fabrics with wool yarns have the highest mass, because the linear density of the effect component of these yarns is higher. The difference in mass in the case of sateen weave is lower than in the case of twill weave.
- The sateen fabrics have the highest mass. The difference between the masses of sateen and twill fabrics for the fabrics with synthetic yarns is lower than for those with wool yarn.

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