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AESTHETIC ANALYSIS OF THE RELIEF EFFECTS USING THERMOPLASTIC STRUCTURED YARNS TO DESIGN AND PRODUCTION OF WOVEN FABRICS

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ABSTRACT

It is seen that the woven fabric which has great significance within the textile products varies based on the effects of different production methods and raw materials. In woven fabrics, material and method are the two most important factors that lead to the occurrence of different surface appearances for physical and aesthetic purposes. The usage of thermoplastic structured yarns that shape permanently under thermal processing also enables the creation of aesthetically innovative and creative surfaces. The aim is to design and produce effective, functional, able to form aesthetics and taste shapes and innovative and creative woven fabrics with high added value within the industry-art cooperation in the 21th century in a modern, simple designing perspective. Within the thesis study, the relief effects acquired from the thermoplastic textured yarn used in the design and production of the woven fabric were analysed by considering the factors which effect the design in terms of aesthetics and it was aimed to get fabrics with innovative appearances in function-aesthetic sense.

Key Words: Woven fabric design, thermoplastic yarn, heat-setting, relief effect, aesthetic

1. INTRODUCTION

Relief effects in woven fabrics occur by giving different volumes by considering the usage of the thermoplastic textured yarn and the factors effecting the design and production technically and aesthetically. Thermoplastic yarns -having permanent plasticity feature when applied thermal processing- as well as weave, weaving method, material, density and colour factors [1] enable to design and produce relief-featured fabrics. These fabrics are also called *self-shaping fabrics* [2]. The purpose of the relief effects formed on the fabrics woven by thermoplastic yarns are to increase the aesthetic value of the woven fabrics and design and produce innovative looking fabrics with function and aesthetic. Thermoplastic yarns are the ones that melt and can take form at different temperatures according to their raw

materials and keep their shapes permanently when heat dies out. They are able to take form by being exposed to permanent deformity owing to the heat barrier called *heat-set* [3]. In time, this deformity has been turned to advantage in design and creativity context. Relief subjected to the study is defined as embossment on the surface; inward or outward, high or low embossment [4]. Being one of the visual effects in the design of the woven fabrics, relief effects are defined as partial shadow effects that highlight the impact of light on embossed surfaces. Structures with different effects, either genuine or artificial, are in every aspect of life and with the emergence of modern designing awareness, they have begun to shape simple, effective and functional designing ideas and aesthetics and taste forms [5]. Designing a product which is already functional aesthetically or bringing function to an aesthetic product is only possible with a creative idea [6]. Therefore, apart from design and creativeness, one of the features expected from the woven fabrics is to bring benefit in terms of aesthetics. Today, thermoplastic yarns are used widely in the woven fabric design and production. The conclusion aimed in this study is that when thermoplastic structured yarns, which are used in the design and production of woven fabrics, are applied thermal processing, they not only get functions but also have innovative surface appearances with relief effects in an aesthetic way.

2. EXPERIMENTAL

Not only the productions method but also yarns are significant in woven fabrics with relief appearances. Factors such as the type of the yarn, physical and chemical features of the fibre, yarn twist and the thickness and slimness of the yarn enable the occurrence of differences [7]. Apart from yarn and latticing, relief effects can also be applied by density, finish and different methods. Applying all these factors together also diversify the relief effects in design and production of woven fabrics.

2.1. Material

Being dyed or undyed of the thermoplastic yarns is determinant that affects their shrinking and permanent plasticity features [8]. Therefore, undyed thermoplastic structured textile fibres have been preferred. In this study, since warp yarn, which was aimed to get a permanent form by shrinking in thermal processing, doesn't have enough tensile strength, only weft yarn was used.

Therefore in all fabrics, 150 denier polyester yarn was used. The weft yarns in number 1-a, 1-b, 1-c and 1-d fabrics are 300 denier polyester yarns, and 4nm micro polyester chenille yarn. The weft yarns in number 2-a, 2-b, 2-c and 2-d are 300 denier polyester shrinked yarn, 300 denier polyester yarn and 4nm micro polyester chenille yarn. The weft yarns in number 3-a, 3-b, 3-c and 3-d are 300 denier polyester shrinked yarn and 1800 denier air jet textured polyester yarn.

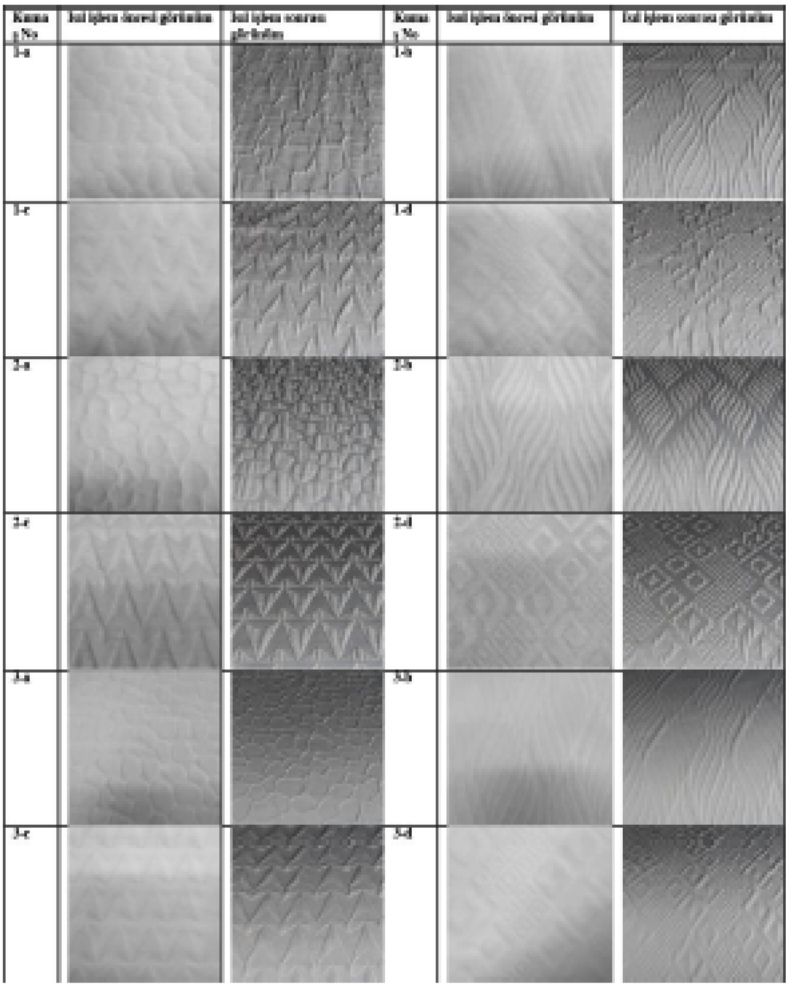
2.2. Method

During the process of design and production of relief effected woven fabrics, as a method, weave was fasten by using plain weave and 3/3 warping ribs was used as edge weave. Fabrics were woven on 2400 platinized Somet-Staubli jacquard loom in double layered circular weave. All fabrics were woven in 66 yarn / cm warp density. While weft density was 20 yarn/ cm in number 1-a, 1-b, 1-c and 1-d, 3-a, 3-b, 3-c and 3-d fabrics, the weft density in 2-a, 2-b, 2-c and 2-d was 21 yarn/ cm. By applying thermal processing on 170 cm wide – 12 fabrics, shrinking and getting permanent forms of thermoplastic yarns were ensured. These thermal processing methods were applied by Monforts Ram Toptex/ Monfortex 8000. On fabrics with 20 or less yarn/ cm weft density 155 ^{0}C and on fabrics with 21 or more yarn/ cm weft density 165 ^{0}C thermal processing were employed. Thermal processing of the fabrics with 20 and less yarn/ cm weft density was applied as 16 m/ min while on the ones with 21 and more yarn/ cm weft density it was applied as 14 m/ min. After thermal processing, fabrics were measured as 140 cm by shrinking in a- 17.64 % proportion towards weft.

3. RESULTS

While evaluating woven fabrics in terms of aesthetics, the fabric feel, drape, brightness, colour, wrinkle recovery, bulkiness, transmittance, stiffness, softness and hairiness features as well as their care features and being dirt repellent feature are taken into consideration. It is seen that thermoplastic yarns and non-thermoplastic yarns and the design are significant when the images of 12 fabrics' relief effects before and after thermal processing are compared in terms of aesthetics. Considering the materials that are used, it is seen that fabrics have different relief effects as well as feel, volume and stiffness.

Table 1. Appearances of the relief fabrics before and after thermal processing.



4. DISCUSSION

Comparing the aesthetic features of all fabrics before and after thermal processing, the somewhat acquired volume of the fabric thanks to the double layered circular weave before thermal processing feels as if the pattern was weaved with yarns in different colour values. The reason of this perception is the shadow effect that is acquired by the areas with height difference based on light.

It is seen that number 1-a, 1-b, 1-c and 1-d fabrics in which 300 denier polyester yarn in weft with 4nm micro polyester chenille yarn was used, have high relief effects. It is seen that the formless areas in circular form in 1-a had a broken wave look and this look deepens and lessens according to the angle of light incidence. The wave pattern used on 1-b formed a flowing surface appearance. Angular patterns composed by the unit repetitions in 1-d has increased the light-dependent variability of the relief by forming opposite areas. In 1-d, the pattern formed by the angular thin and thick telescopic areas enabled the coexisting of high and low relief effects. Because of the chenille yarn, the feel of the fabrics is soft and they are half draping and have semi-dull brightness. They hardly have light transmittance. Because of the applied thermal processing, the relief effects of the fabrics have been preserved in terms of physicality and appearance. They are suitable for using in indoor textile especially as upholstery fabric.

Number 2-a, 2-b, 2-c and 2-d fabrics in weft woven with 300 denier polyester yarn, 300 denier shrinked polyester yarn and 4nm micro polyester chenille yarn are a somewhat stiffer when compared with number-1 fabrics as two different yarns were used in weft yarn. Because of the circular weave, It is seen that the formless areas in circular form in 2-a has had volume and this appearance deeps -lessens according to the angle of light incidence. The wavy pattern applied in 2-d has formed a flowing surface appearance and horizontal stripped areas in circular weave has formed relief effects by having volume. Angular patterns composed by the unit repetitions in 2-c has increased the light-dependent variability of the relief by forming opposite areas. In 2-d, the pattern formed by the angular thin and thick telescopic areas enabled the coexisting of high and low relief effects. Circular weave areas on number -1 are weaved accordingly to the number 2 fabrics to form a surface. There have been diversities in relief effects since these areas are different. There appeared both low and high reliefs in terms of appearances on fabrics with sharp lines. When compared with number-1 fabrics, the fabrics have normal touching, semi-dull brightness and are half draping because of the thin polyester yarn used in weft. They hardly have light transmittance. Because of the applied thermal processing, the relief effects of the fabrics have been preserved in terms of physicality and appearance. They are suitable for using in indoor textile as upholstery fabric and drapery fabric are The fabrics of 300 denier polyester shrinked yarn and 1800 denier air jet textured polyester yarn in weft in number 3-a, 3-b, 3-c and 3-d are stiffer than

the others because of the air jet texture yarn. The stiffness of this fabric caused the circular weave textured areas to puff in a more plain and low way after thermal processing. It is seen that the formless areas in circular form in 3-a had a broken wave – circular weave look and this look deepens and lessens according to the angle of light incidence. The wave pattern used on 3-b formed a flowing surface appearance. Angular patterns composed by the unit repetitions in 3-c has increased the light-dependent variability of the relief by forming opposite areas. In 3-d, the pattern formed by the angular thin and thick telescopic areas enabled the coexisting of high and low relief effects. These fabrics have a stiff feel and a non-flowing bright texture. They hardly have light transmittance. Because of the applied thermal processing, the relief effects of the fabrics have been preserved in terms of physicality and appearance. Compared to other fabrics, they have less relief and volume, but are more slippery. The stiff feel of the fabrics enables them to be used indoor textile as wall panel and roller blind.

5. CONCLUSIONS

Apart from thermal processing, applied weft, fabric texture, raw material, density and colour are also significant for forming the relief effect in woven fabric design. With the variability of these factors, practically infinite kinds of fabric type can be manufactured. During this research, limited only to variability of the yarn, the designed fabrics has formed a basis for the next research which is expected to be made with the variability of other factors.

The most significant function of these fabrics is that they can be used longer without a deformation during the washing and using periods depending on the permanent form they got thanks to the thermoplastic yarn. This helps this product to allow for the use of slow fashion concept also in home textile by having a sustainability. The aesthetic contribution of this function which enables the consumer to use indoor textiles, produced with thermoplastic yarn, longer is that the relief effects of shady areas that changes according to the angle of light incidence can present consumer more than one image with a single product.

According to this information, it has been concluded that in order thermoplastic structured yarns to be effective on woven fabrics in terms of forming relief effects, they should be used together with non-thermoplastic

yarns; features of non-thermoplastic yarns such as thickness- slimness, softness- stiffness and winding are effective on having a permanent form of thermoplastic yarns by being exposed to thermal processing; fabrics designed with double layered circular weave have better relief effects and all of the factors that have an impact on design should be considered by the designer inseparably. When evaluated in terms of aesthetics; it was observed that the features of digger yarn used with thermoplastic yarns increase or decrease the relief effects and change the aesthetic characteristics by changing the features such as feel, drape, brightness, wrinkle recovery, bulkiness, transmittance, stiffness-softness, slipperiness and hairiness. Furthermore, thermoplastic yarns enable fabrics to be used longer by preserving the appearance as they have a permanent form through thermal processing.

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