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SEWABILITY PROPERTIES OF GARMENT LEATHERS TANNED WITH VARIOUS TANNING MATERIALS

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Abstract: *Chromium tannage is the most used technology in processing of garment leathers. Due to environmental requirements and demands on natural products there is an increasing interest on alternatives to chromium tannage especially on vegetable tanned leathers. Leather properties vary in a very wide range depending on the animal type it is obtained from and the process type and chemicals used in the manufacturing. In this study, the effect of various tanning materials to the sewability of garment leathers was investigated. For this purpose, vegetable, chromium and chromium-vegetable combination tanned garment leathers from the same animal origin were supplied from a garment leather manufacturing factory. Needle penetration force and the sewability values of these leathers were determined by using L&M Sewability Tester. It was found that material properties and sewing properties showed differences regarding to the tanning material used even in same type of raw material. Chromium tanned leathers had sewability values of 13.4% horizontal and 14.2% vertical which are considered good to fair. Vegetable tanned leathers and chromium-vegetable tanned leathers had sewability values of 38.2% horizontal, 49.2% vertical and 98% horizontal, 98.5% vertical respectively which are considered poor. The results of the study conclude that, there is a big difference in material properties when the tanning technology and material is changed which also affects the sewing properties.*

Key words: *Leather, Sewability, Garment, Tanning materials.*

1. INTRODUCTION

Leather processing can simply be defined as, modification of hides/skins by a sequence of chemical and physical treatments. Although leather processes and the preferred chemicals have big contribution to designation of final leather characteristics, the type of the raw material, type and amount of tanning material used, have the most important effect [1]. Modern tanning chemistry can be classified by mineral, vegetable, oil, aldehyde, and organic tanning and syntans [2].

Chrome tanning is one of the most popular tanning systems because of the excellent qualities of chrome tanned leather such as high hydrothermal stability, good dyeing characteristics and softness [3]. Although vegetable tanning materials are generally used in production of saddlery, harness, belt, shoe upper and sole leathers requiring less elasticity, high shape retention and firmness; their use in garment leather production has increased due to natural look and feel they

confer to leathers and high demands on natural products in last decades. The vegetable tanning process is flexible, and can produce leathers with a very wide range of characteristics [4]. Besides, combination of various tanning materials and chemicals provide a possibility to combine their characteristics or even to enhance properties with their synergistic effect. This can lead to produce leathers with better properties than the leathers tanned with a single type of tanning material.

Leather clothing differs in its origin, tannage and mechanical or physical properties. It is necessary to distinguish between pig, goat and sheep leather, and cowhide, which differ both in their properties and in their surface appearance. Leather clothing is affected both by its basic mechanical properties and usage characteristics and by the manufacturing features of the leather [5].

Apparel making is the process of making shell structures from flat fabrics or leathers to match the shape of human body. During this process, leathers are subjected to various types of mechanical stresses, which are indispensable for the garment appearance [6]. In garment manufacturing, a two dimensional structure is converted into a three dimensional structure. During the process of sewing, the needle is subjected to repeated tensile stresses, heat, bending, pressure and wearing. These stresses repeatedly act on the thread as a result of which leather is subjected to various types of mechanical stresses which are low stress in nature [7].

The term sewability can be defined as the ability and the ease with which the 2-D fabric components can be qualitatively and quantitatively be seamed together to 3-D garment [8]. Better sewability means greater ease of formation of shell structures and styles with the absence of fabric distortion and seam damage. The appearance and durability of seams form an important component of the quality of the finished product [9]. Damage of the structure of the fabric occurs when the fabric is penetrated by the needle. The needle can penetrate at any point in the fabric. The structure of the fabric can be deformed beyond its elastic limit or can literally be destroyed [10].

The sewing needle penetration force which is one of the most significant technical parameter in the sewing process is the quantitative measure of the damage that appears in a garment as the result of the sewing process [11]. A high penetration force means a high resistance of the fabric and thus a high risk of damage [12]. The sewing needle penetration force is affected by various factors such as type and amount of layers of the sewing material, needle size, shape of needle point, stitch speed of the sewing machine, and treatment of the sewing material, among others [13]. The fabric should withstand the needle penetration without any damage to the fabric [10].

Although many sewability studies have been carried out on textile fabrics, there is not much study related to sewability of garment leathers. It is accepted that leather as a material needs more penetration force for the needle. However leather properties vary in a very wide range depending on the animal type it is obtained from and the process type and chemicals used in the manufacturing. The present work aims determination of the sewability properties of garment leathers tanned with various tanning materials which are chromium, vegetable and chromium-vegetable combination. Sewability of these garment leathers were compared with each other in terms of the average needle penetration force (gf) and the sewability value (%). A good seam is a measure of quality in leather garments. The results of this study will give data to be considered in sewing to obtain better seams for manufacturing of high quality leather garment products.

2. MATERIAL AND METHOD

2.1 Material

In this research 3 chromium, 3 vegetable and 3 chromium-vegetable combination tanned garment leathers (English origin sheep skins) obtained from a garment leather manufacturing factory were used. The samples were analyzed by using L&M Sewability Tester as three parallels vertically and horizontally.

2.2. Method

Sampling of leathers were done according to TS EN ISO 2418. The tests were carried out at the same conditions according to TS EN ISO 2419. The thicknesses of test samples were measured according to TS 4117 EN ISO 2589. Apparent density of leathers was calculated according to TS 4121 EN ISO 2420 [14-17].

Fig.1: *L&M Sewability Tester*

The sewability properties of the leathers were determined by using L&M Sewability Tester (Fig. 1). It enables consecutive readings of force for penetration of the fabric by a selected needle to be measured on a small sample of fabric at a rate of 100 penetrations/min [18]. This device measures the penetration force exerted by a sewing needle on the fabric. A strip of fabric passes through a zone in which a sewing needle operates. A nominal value (threshold) of penetration force is determined based on the fabric mass per unit area according to the fabric type, and then the number of times this value is exceeded is recorded. Fabric sewability corresponds to the number of points that exceed the threshold previously set, related to the over-all tested points and expressed as a percentage. The sewing operation will be more difficult as the sewability parameter increases [19].

In this study the device setting was maintained constant for all the tests; the total count per leather was 100; the force range chosen was 500gf, and the threshold value for sewability determination was 150gf. The number of high recordings which exceed the threshold value, which is called the "sewability value", was also recorded.

3. RESULTS AND DISCUSSION

The weight and thickness properties of garment leathers tanned with chromium, vegetable and chromium-vegetable combination were determined and are given in Table 1. Vegetable tanned leathers are known to give denser and thicker leathers; contrary chromium tanned leathers are famous with their light, soft and thinner character. Apparent density of chromium tanned leathers and vegetable tanned leathers vary between (0,680 - 1,000 g/cm^3) and (0,780 - 1,150 g/cm^3) respectively [20]. When the apparent density figures in Table 1 are considered, they are in accordance with the reference limits. Although thickness of leathers are adjusted by mechanical operations to give a uniform distribution across the whole area; vegetable tanned leathers were found thicker than chromium-vegetable combination tanned leathers and chromium-vegetable combination tanned leathers were found thicker than chromium leathers.

Table 1: *The properties of garment leathers.*

Leather type	Weight (g/m^2)	Thickness (mm)	Apparent density (g/cm^3)
Chromium	*290,62*	*0,52*	*0,71*
Chromium-Vegetable combination	*363,96*	*0,59*	*0,79*
Vegetable	*420,95*	*0,61*	*0,87*

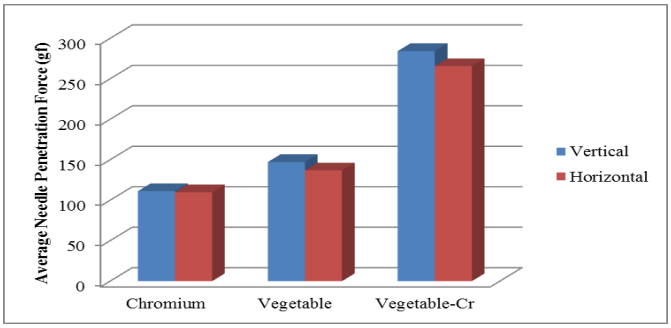

Fig. 2: *Average Needle Penetration Force of Different Tanned Leathers.*

As it can be seen from **Fig. 2**, the values of needle penetration force were varied between 111 gf and 284 gf.

Vegetable tanned leathers had higher needle penetration force and sewability values than chromium tanned leathers. However semi-vegetable leathers had the highest needle penetration force and sewability values in both directions. These findings could be related to physical properties of the used leathers. Ork et al. (2014) also found that semi-vegetable tanned leathers came into prominence with their high strength and low extension set properties which are important for garment leathers. When physical test results of leathers tanned with different tanning types were statistically evaluated, it was concluded that tanning type has important effect on the physical properties of leathers even from the same origin. Physical properties of the leathers were varied due to the tanning material used in their production [1].

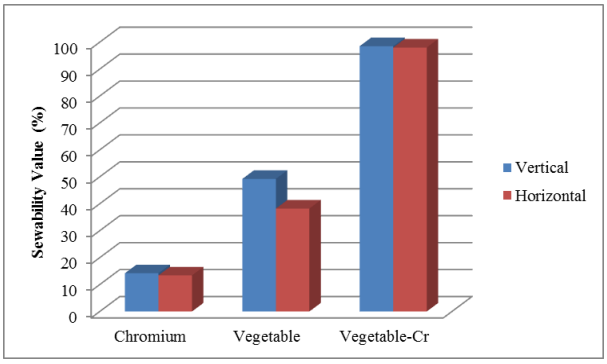

Fig. 3: *Sewability values of Different Tanned Leathers*

When sewability values ranged between 0 and 10%, the fabric sewability was considered good; between 10 and 20% sewability was considered to be only fair even though no great difficulties arose during sewing [21].

As it can be seen in **Fig. 3**, sewability values of chromium tanned leathers were found 13.4% horizontal and 14.2% vertical which could be accepted a fair value close to good. However vegetable tanned leathers and chromium-vegetable combination tanned leathers had sewability values of 38.2% horizontal, 49.2% vertical and 98% horizontal, 98.5% vertical respectively. So the sewabilities of these samples are considered poor. This means that an extra attention is required to obtain seam quality in production of garment leathers tanned with vegetable or vegetable-chromium combination tannage.

Ork et al. (2014) found stitch tear values of chromium, vegetable and chromium-vegetable tanned leathers as 334 N/cm, 518 N/cm and 786 N/cm respectively [1]. Although stitch tear resistance test is a static test which is done in tensile testing equipment and sewability test is a dynamic test done with L&M sewability tester, there seems a consistent relation between the results as seen **Fig. 4**.

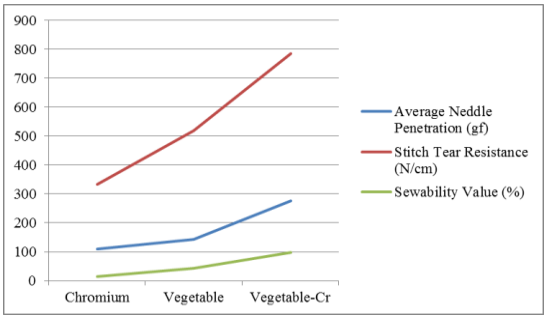

Fig. 4: *Average Needle Penetration, Stitch Tear Resistance and Sewability values of Leathers*

5. CONCLUSIONS

In the last decades there is a demand on natural products in leather industry as in many industries. Vegetable tannins which are known to give heavy, strong and durable leathers are now being used in the production of soft, light and elegant garment leathers either alone or in combination with mineral tanning materials. Undoubted, tanning materials have a significant effect on the material properties of leathers produced. In this study, sewability of garment leathers tanned with chromium, vegetable and vegetable-chromium combination tanning agents has been determined and the following conclusions have been found:

- Chromium leathers were found having the lightest weight, the thinnest and the less apparent density followed by chromium-vegetable combination and vegetable tanned leathers. Vegetable tanned leathers had come closer to the characteristics of chromium tanned leathers; however there are still some differences in properties.
- Average Needle Penetration Force was found lowest for chromium tanned leathers, followed by vegetable and chromium-vegetable tanned leathers in order. That means chromium tanned leathers can be sewn with a less needle force, and more needle force is required for vegetable and chromium-vegetable tanned leathers.
- Chromium tanned leathers had sewability values of 13.4% horizontal and 14.2% vertical which are considered good to fair. Vegetable tanned leathers and chromium-vegetable tanned leathers had sewability values of 38.2% horizontal, 49.2% vertical and 98% horizontal, 98.5% vertical respectively which are considered poor.
- When the results of dynamic sewability test are compared with static stitch tear test, the relation among the data was found consistent, even the tests have totally different principles.

Leather is a luxury product due to limited supply, high cost of material and labor. This luxury product should maintain all the quality and environmental requirements. Besides; garment design and manufacturing quality have also big importance. The design should meet the fashion, comfort, aesthetic expectations of the consumer. Leather garments contain many joining and ornament seams due to small patterns related to animal size. These seams should be proper to meet the quality aspects. The results conclude that, there is a big difference in material properties when the tanning technology and material is changed which also affects the sewing properties.

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