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## Effect of fatliquor level on the physical quality of Indonesian rabbit fur leather

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**Abstract.** This study aimed to evaluate the effect of fatliquor level on the physical quality of Indonesian rabbit fur leather. A total of 15 sheets of Indonesian local rabbit leather (30 cm long and 26 cm wide) were randomly divided into 5 treatments with 3 replicates. The five treatments were level of fatliquor: 5%, 10%, 15%, 20%, and 25%. In this study, the physical quality of rabbit fur leather was measured in tension, elongation, tensile strength, and tear strength. Data were analyzed using analysis of variance followed by Duncan's New Multiple Range Test. Level of fatliquor affects ( $P < 0.05$ ) softness, elongation, tensile strength, and tear strength of rabbit fur leather. The use of fatliquor up to 20% increased the rabbit leather softness and elongation, but there was a decrease at 25%. The use of 10% fatliquor produces the highest tensile strength. The highest tear strength resulted from the use of fatliquor levels of 5% and 15%. It is concluded that using 20% fatliquor on the fatliquoring process of rabbit fur leather tanning produces the best physical quality.

### 1. Introduction

Rabbit skin has a special characteristic compared to the skin of other mammals (cows, buffalo, goats, sheep) based on the type of fur. Rabbit fur has a smooth appearance and a variety of color patterns. With its uniqueness, rabbit skin can be tanned in two ways: fur tanning and hairless tanning [1,2]. Rabbit tanned leather can be used as raw material for the craft industry, such as jackets, hats, wall decorations, bags, gloves, shoes, scarves, seat covers, wallets, dolls, and many other kinds of crafts [3]. Fur tanning must be carefully treated to prevent fur damage during tanning or as a product [4].

The qualities that need to be considered in tanned leather products include elasticity and strength. High-quality garment products require high skin elasticity. Low skin elasticity will reduce the quality of the product, stiff and uncomfortable to worn [1]. High sewing strength needs to be considered to prevent the separation of stitches. High tear strength can produce garment products that are strong, not easily torn [5].

One of the factors that affect the physical quality of the leather is fatliquoring at the end of the tanning process [6]. Fatliquoring is an oil process that uses fatliquoring material to lubricate the skin fibers, and the skin becomes tensile. Vibration resistance keeps the skin fibers from sticking, makes the skin water-resistant, and produces soft and smooth leather [7]. Oil or fat is an essential component in the skin that functions to soften the skin or as a lubricant for skin tissue in the tanning process which can change the



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essential properties of the skin, including the skin becomes softer, more rigid, softer, stretchable, and the surface is smooth. The oil controls the difference in shrinkage between the grain and corium during the drying process of the skin [8].

**Table 1.** Rabbit skin tanning process formulation.

| Process   | Materials          | Quantity (%)                       | Time (min) | pH    |
|---|--------------------|------------------------------------|------------|-------|
| Weighing  |                    |                                    |            |       |
| Washing and furtigh   | Water              | 100                                | 180        |       |
|   | Teepol             | 2                                  |            |       |
|   | Formalin           | 3                                  |            |       |
|   | Preventol ZL       | 0.5                                |            |       |
| Degreasing  | Water              | 100                                | 60         |       |
|   | Hustapol ND        | 2                                  |            |       |
| Bating  | Feliderm bate 1    | 1                                  | 45         |       |
| Washing   | Water              | 100                                | 5          |       |
| Pickling  | Water              | 200                                |            | 3     |
|   | Salt               | 10                                 | 10         |       |
|   | Asam formiat       | 0.5                                | 3×10       |       |
|   | Asam formiat       | 0.5                                | 3×10       |       |
|   | Preventol cr       | 0.02                               | + 120      |       |
|   | Pickle water       | 30                                 |            |       |
| Tanning   | Novaltan PF        | 1.5                                | 60         |       |
|   | Catalik GS         | 2                                  | 30         |       |
|   | Chromosal B        | 8                                  | 240        |       |
|   | Natrium bikarbonat | 2                                  | 3×15       |       |
| Basifying   |                    |                                    | + 120      |       |
| Agieng, Sammying, Buffing                                   |                    |                                    |            |       |
| Wetting back  | Water              | 300                                |            | 3.8–4 |
|   | Bayclin            | 2                                  | 120        |       |
| Recrome/retanning I   | Water              | 200                                |            |       |
|   | Nofaltan pf        | 1.5                                | 30         |       |
|   | Cromosal B         | 3                                  | 60         |       |
| Neutralizing  | Water              | 200                                |            | 5.2–6 |
|   | Natrium bikarbonat | 2                                  | 120        |       |
| Retanning   | Water              | 200                                |            |       |
|   | Novaltan Map       | 1                                  | 30         |       |
|   | TaniganPr          | 6                                  | 30         |       |
| Fatliquoring  | Fatliquoring agent | Based on treatment (5,10,15,20,25) | 90         |       |
|   |                    |                                    |            |       |
| Fixation  | Formic Acid        | 0.5                                | 3×10       | 3.8–4 |
|   | Preventol cr       | 0.01                               | 15         |       |
| Finishing (Hanging, Conditioning, Staking, Tidying, Toggle) |                    |                                    |            |       |

The 12<sup>th</sup> tanning process used various chemicals. It is well known that vegetable tanning materials used in natural tannin sources are expected to reduce environmental issues and provide sustainability [9]. Therefore, the use of other chemicals in the tanning process also needs to be considered, for example, a fatliquoring agent. Fatliquoring agent is a very important ingredient because it provides physical qualities and anti-bacterial properties [10,11]. Anti-bacterial properties are important because many bacteria live on the skin of animals, humans, and plants [12]. However, excessive use of fatliquor will cause waste that is not good for the environment. In addition, the use of too much fatliquor will increase production costs so that an optimal level is needed. 11<sup>th</sup> it has two alternatives, use environmentally friendly oil or use optimal fatliquor level [13]. For that, this study time to evaluate the effect of fatliquor level on the physical quality of Indonesian rabbit fur leather.

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## 2. Materials and methods

A total of 15 pieces of salted Indonesian local rabbit skin with an average weight of 210 grams were used in this study. Rabbit skins were allotted to a completely randomized design (CRD) with five treatments and three replications. Fatliquoring treatment was the level of fatliquor agent from P1 = 5% oil, P2 = 10% oil, P3 = 15% oil, P4 = 20% oil, P5 = 25% oil.

The tanning process formulation is shown in Table 1. The first steps in the tanning process were weighing, washing, and furling to clean and strengthen rabbit fur. Then degreasing and bating to remove the globular protein; pickling to prepare the skin to enter the tanning process by decreasing the pH; then tanning to make the skin more stable. After that basifying using two percent Natrium bicarbonate followed by one-night ageing. The next step is sammying, buffing, wetting back, and retanning. Neutralizing was done to remove some of the remaining free acids that came from acidification when ageing. After the third tanning process, fatliquoring was done to lubricate hydrated leather fibers during the tanning process. Fatliquor level treatment was implemented in this process [14]. The physical quality data consisted of softness, elongation, tensile strength, and tear strength. Data were analyzed using analysis of variance followed by Duncan's New Multiple Range Test.

## 3. Results and discussion

The fatliquor level affected ( $P < 0.05$ ) the softness and elongation of tanned rabbit fur leather (Table 2). Softness and elongation of rabbit fur leather increased up to 20% fatliquor level treatment but decreased drastically at 25%. Treatment of 20% fatliquor level can be considered as the optimal level for leather softness and elongation. At this level, possibly due to the negative charge on the skin, which is supported by negatively charged oil ingredients ( $\text{SO}_3^-$ ), the fatliquoring ingredients can be emulsified and penetrated well, and spread evenly into the skin's collagen fibers. During the oiling process, oil molecules and skin tissue will physically bind, stronger than the bond between oil and emulsifier, making it difficult for oil to migrate from the skin [15]. The bonding of the  $\text{SO}_3\text{Na}^+$  group with the  $\text{NH}_3^+$  group of amino acids (glycine, proline, and hydroxyproline) can lubricate the cavities in the skin collagen triple helix. This makes the collagen fibers not stick to each other so that the skin has high elasticity and elasticity [16]. Over lubrication by fatliquoring agent will result in excessive softness and raggy leather. However, under lubrication or improper penetration, hard and stiff leather may crack in use.

**Table 2.** Physical quality of rabbit fur leather in different fatliquor level

| Treatment | Softness         | Elongation          | Tensile strength  | Tear strength      |
|-----------|------------------|---------------------|-------------------|--------------------|
| 5%        | 3.0 <sup>a</sup> | 129.47 <sup>a</sup> | 0.96 <sup>a</sup> | 32.43 <sup>c</sup> |
| 10%       | 5.2 <sup>c</sup> | 173.54 <sup>b</sup> | 3.19 <sup>b</sup> | 9.35 <sup>a</sup>  |
| 15%       | 4.3 <sup>b</sup> | 175.44 <sup>b</sup> | 1.75 <sup>a</sup> | 24.05 <sup>b</sup> |
| 20%       | 6.0 <sup>d</sup> | 154.03 <sup>b</sup> | 1.77 <sup>a</sup> | 12.50 <sup>a</sup> |
| 25%       | 4.0 <sup>b</sup> | 81.48 <sup>a</sup>  | 1.05 <sup>a</sup> | 36.82 <sup>c</sup> |
| p-value   | $P < 0.05$       | $P < 0.05$          | $P < 0.05$        | $P < 0.05$         |

<sup>abcd</sup> Different superscript showed significantly different ( $P < 0.05$ )

Rabbit skin treated with 10% fatliquor level produced the highest tensile strength; on the contrary, at 10% level, it produced low tear strength (Table 2). This is in accordance with the previous study [15,17] that using fatliquor more than 10% reduces tensile strength. This is probably because the bonds between the leather fibers have been replaced by oil and become loose. The more  $\text{SO}_3$  content is bound to sulfate oil when applied to leather,  $\text{SO}_3$  will bind to  $\text{H}_2\text{O}$  to form  $\text{H}_2\text{SO}_4$ , damaging the tanned leather. Tear resistance is enhanced by oiling because the oil acts as a lubricant on rubbing leather fibers. The fat layer on the fiber's surface will make it easier for the fibers to rub against each other so that the skin is more flexible or easy to bend. Penetration of oil into the skin causes the skin fibers to fill, and more oil is involved in the cross-linking of the skin's collagen, resulting in increased tear strength [18].

#### 4. Conclusion

It is concluded that using 20% fatliquor on the fatliquoring process of rabbit fur leather tanning produces the best physical quality.

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