International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Effect of Time Difference in Batting Process on Sheep Skins Using Shortfloat Tanning Measured by Chemical and Physical Properties

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Abstract**—** *Batting is the process of removing globular and non-collagen proteins. Bromelin can be found in all parts of the pineapple plant with different amounts and properties. Bromelain can be used as a batting agent in the tanning process. The purpose of this study was to determine the effect of protein erosion at different times on the sheepskin of shortfloat tanned from its chemical and physical properties. The research was conducted in November 2020 at the Yogyakarta Center for Leather, Rubber and Plastics. The research material used 30 sheets of sheepskin obtained from RPH Yogyakarta City and pineapple fruit. The method used in this research is a completely randomized design experiment (CRD) and uses different drum rotation times P0 (60 minutes), P1 (30 minutes), P2 (45 minutes), P3 (60 minutes) and P4 (75 minutes). The variables observed were protein content, skin thickness, wrinkle temperature, skin tensile strength and tear strength. Statistical analysis used one way analysis of variance (ANOVA) and was in accordance with statistical models*.

Keywords**—** *Bromelain, batting Process, sheep skins*.

I. INTRODUCTION

The skin is the outermost structure of humans, animals and plants. The skin that can be used in the manufacture of products is finished leather, which is leather that has been tanned or processed using chemicals with a certain dose and time calculation. Leather has unique properties and characteristics that are not shared by other materials. One sheet of skin may have different properties, so the knowledge to determine the quality of the skin is very necessary. Kholifah, Darmanto and Wijayanti (2014) state that leather tanning is a processing process to convert raw hides and skines into tanned leather. Raw skin rots easily when dry, hard and stiff, while tanned skin has the opposite property. Tanning is intended to obtain skin that is not easily damaged and strong. Batting is the process of eroding globular proteins including unsabbed fat and breaking the polypeptide chains in skin tissue collagen proteins with the aim of opening up collagen fibers so that they easily bind to the tanning material. Batting agents that are commonly used are oropon and feliderm and most of the batting agents used are imported materials. To reduce the amount of imported batting materials, other alternative materials were sought using protease enzyme activity. Protease enzymes come from plants (papain, bromelin, and ficin) and from Rhizopus sp. (Setiawan, Riyadi and Sumardianto 2015). Bromelain can be found in all parts of the pineapple plant with different amounts and properties. Bromelain can be used as a protein abrasive agent in the tanning process. Bromelain is used in the leather industry for pre-tanning, softens skin and removes protein, improves the coloring properties of protein fibers and breaks down all or part of the soluble protein fibers from silk and wool (Ketnawa et al. 2011). This study aims to determine the effect of the time difference during the batting process on the quality of the leather that will be produced measured by its chemical and physical properties.

II. MATERIALS AND METHOD

A. Location and Time

This research was conducted in November 2020 located at the Yogyakarta Leather, Rubber and Plastics Center (BBKKP).

B. Research Material

The material use for this research was 30 sheets of sheepskin from slaughterhouse at Yogyakarta city and pineapple fruits.

C. Research Methods

Additional materials used are non-iodine salt (NaCl), sodium sulfide (Na2S), quicklime Ca (OH) 2, ammonium sulfate (ZA), feliderm, formic acid, sodium formate, sulfuric acid (H2SO4). Supporting tools are analytical scales, fleshing machines, fleshing knives, gloves, plastic buckets, pH paper, thermometer.

The method used is a laboratory experiment. The research design used in this study was a completely randomized design (CRD) using 5 treatments and 3 replications. The treatm ents used with the use of pineapple at different times were as follows:

P0 = Use of the Batting agent (Feliderm) with 60 minutes playing time
P1 = Use of pineapple fruit with 30 minutes rotation time
P2 = Use of pineapple fruit with 45 minutes rotation time
P3 = Use of pineapple fruit with 60 minutes of rotation time
P4 = Use of pineapple fruit with 75 minutes rotation time

D. Data Analysis

The data obtained in this study were processed using Microsoft Excel. The data obtained were analyzed using *Analysis of Variance* (ANOVA) at the level of 5%. Research

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data If the results are significantly different, it is followed by *Duncan's* Multiple Range Test (DMRT).

III. Results and Discussions

The results of the study erosion proteins with long rotation time tanning drum at a speed of 13 rpm / min at a tanned sheepskin *shortfloat* measured from the chemical nature of the concentration of the addition of pineapple and a shopping passage and longer rotation time in the tanning drum *batting* d ith each treatment used -masing 60 minutes for P0, 30 minutes for P1, 45 minutes for P2, 60 minutes for P3 and 75 minutes for P4. Where the results of data analysis indicate that the effect of the difference in playing time of the sprinkler drum on the *batting* process is carried out. The results of data on the comparison of the difference in drum playing time in the *batting* process can be seen in Table 1.

TABLE 1.

Treatment (Time)	Variable				
	Protein Levels (%)	Thickness (mm)	Shrinkage temperature (°C)	Tensile strength (N/mm)	Tearing strength (N/mm)
P0 (60 minutes)	50,24±3,78^{b}	0,83±0,05	92,33±2,08^{a}	163,41±2,19^{ab}	16,08±0,63^{a}
P1 (30 minutes)	41,09±3,72^{a}	0,73±0,05	95,67±0,57^{bc}	153,07±2,89^{a}	15,79±1,17^{a}
P2 (45 minutes)	45,62±4,16^{a}	0,80±1,36	93,67±0,57^{ab}	173,53±8,56^{bc}	17,43±2,04^{ab}
P3 (60 minutes)	49,40±1,37^{b}	0,87±0,05	96,33±0,57^{c}	181,20±8,12^{c}	23,32±3,23^{bc}
P4 (75 minutes)	53,83±1,54^{b}	0,90±0,1	97,33±0,57^{c}	210,78±0,70^{d}	28,96±3,86^{c}

Protein Levels

The results of the study of protein levels after batting obtained an average of 50,24 % at P0, 41,09 % at P1, 45,62 % in P2, 49, 40% in P3 and 53, 83 % in P4. The difference in the results of the batting was influenced by the enzyme concentration and also the batting time. This indicates that the different spin time with the tanning drum speed of 13 rpm has an effect on the protein content of the skin after tanning.

The P1 treatment was the lowest compared to the others because the pineapple used was 0,5 % but had a high protease activity so that it was able to erode the globular protein in the skin. P1, P2, P3 treatment showed not too different results because it is both used pineapple as a *batting*. According to Syafie et al. (2013) *Rhizopus* has proteolytic activity of 392.89 µ/mg protein. According to Hayati et al. (2013) protease activity in all treatment concentrations of the *batting agent was* able to degrade non-collagen protein which inhibits the penetration of the tanning agent into the skin tissue.

Based on their molecular structure proteins can be grouped into two forms namely *fibrous* protein (*fibrous*, fibrous, fibrous) and *globular* proteins (round) and *globular* proteins (round). Protein *fibrous* insoluble in aqueous solvents, either dissolved salts, acids, bases and alcohols. Fibrous protein primarily functions to form tissue structures, skin and cartilage, and *myosin*, the main contractile protein in muscle, keratin, the main protein in hair and skin, and *fibrin*, a protein in blood clots. Protein *globular* soluble in saline solution and diluted acids, also easily change under the influence of the concentration of salts, acids and alkalis and solvents, as compared to protein *fibrous*. In addition, these proteins are more easily denatured to changes in the arrangement of their molecules are followed by changes in their physical and physiological properties.

1) Thickness

The thickness of the tanned skin is very important because it affects the quality of the leather product and the purpose of making the product. Hak (2013) states that leather is a potential byproduct to be used as raw material for the tanning industry because it has a specific shape and skin surface pattern and it has different from other skin and has a thickness and area that allows it to be used as leather products such as wallets, bags, sandals and etc.

Treatment of P3 and P4 be treated with tanned skin thickness value most in the amount of 0,87mm and 0,90mm. Results obtained from the treatment of materials using *batting* pineapple with rotation time 60 minutes and with a rotation time 75 minutes. In this case non collagen protein in the skin is quite significant. Farid, et al. (2015) stated that *batting* is a process to remove part or all of the skin substance that is not collagen in order to obtain a finished skin that has the desired luster. The *batting* process in leather tanning will cause unnecessary skin substances such as globular protein to be lost, thereby facilitating the binding of chromium to skin collagen.

Treatments P0, P1 and P2 showed lower results compared to treatments P3 and P4. This can happen because the protein erosion process is not optimal due to the insufficient percentage of the batting material. Purnomo E. (1985) stated that thicker skin will provide more resistance than thinner skin.

2) Shrinkage temperature

The temperature obtained with the highest wrinkle temperature was 97.33°C by P4 with a rotation time of 75 minutes. The high temperature of the wrinkle is influenced by the binding of the skin proteins with the tanner. The penetration of the tanner causes the stability of the skin's protein against heat to increase. This causes the skin to have a higher wrinkle temperature.

The reaction between chromium and skin collagen will increase skin stability due to the cross-linking that occurs, so that the skin structures that were originally separated become joined together to become a stronger structure (Hidayati et al., 2015). The next highest temperature was treatment P4 of 97,33°C with a rotating time of 75 minutes while the lowest wrinkle temperature was in treatment P2 of 93,67°C with a rotating time of 45 minutes and treatment P1 of 95,67°C with a rotating time of 30 minutes. One of the standards for leather quality in SNI requires that the leather produced by the

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tanning industry be "ripe". To find out whether the tanned skin is "cooked" or not, it is necessary to test the skin shrinkage temperature. The skin shrinkage temperature is the temperature reached when the skin shrinks a maximum of 0.3% of the initial length, if the skin is slowly heated in a heating medium. Heating was carried out at a rate of 2°C/min and the shrinkage temperature was recorded when the skin was seen to shrink. The shrinkage temperature needs to be known, especially for garment skins that require washing or ironing so that the washing or ironing process can be carried out at temperatures below the shrinkage temperature to avoid skin damage (Syaiful et al., 2016).

The overall results with the addition of pineapple fruit produce values above 90 °C, which is the lowest in P2 treatment with a value of 93,67°C which has shown a good value where the higher the wrinkle temperature obtained will indicate the skin will be stronger in resisting physical disturbances. especially heat, according to Setiawan et al. (2015) stated that shrinkage temperature is closely related to skin maturity, the more skin fibers that bind to the tanning material, the higher the maturity of the resulting skin so that the wrinkle temperature is higher. The higher the skin wrinkle temperature, the better the product quality because the skin's resistance to heat (hydrothermal) is getting higher. Leather products that have a wrinkle temperature greater than 70°C will last longer because they have higher heat resistance (hydrothermal). The use of Feliderm with a rotating time of 60 minutes in treatment P0 and addition of pineapple fruit with a spin time of 30 minutes in treatment P1 showed the highest results with a high cross-linking density as well. not yet cooked, so it is more capable and resistant to the physical forces that attack it, including boiling water as well as the elongation of the tanned skin (Kasim et al., 2013).

3) Tensile strength

The tensile strength of the skin is the maximum force required to pull the skin when it is pulled until it breaks, expressed in kg/cm2. The tanned skin has a stronger tensile strength than the non-tanned skin due to the bond between the collagen fibers of the skin and the tanning material used. The test results of tensile strength tanned sheep in the use different lengths of rotating time on a drum with a speed of 13 rpm with a different concentration of pineapple fruit in P0 treatment with a batting time 60 minutes showed a tensile strength of 163,41 N/mm and P1 treatment with batting time of 30 minute showed tensile strength of 153,07 N/mm, in P2 treatment with a batting time of 45 minutes had a tensile strength value of 173,53 N/mm, the P3 treatment with batting time 60 minutes had a tensile strength values of 181,20 N/mm and P4 treatment with batting time 75 minutes had a tensile strength value of 210,78 N/mm. All treatments show that it is in accordance with SNI 06-0234-1989 which states that the minimum limit is 150 N/mm or 14% according to SNI while according to the opinion of Syafie, Y., Suharjono, T., and Ambar, P. (2013) Enzymes work optimally to hydrolyze non-collagen proteins causing the skin tissue structure to be more open and the tanneries more easily interacting with the skin resulting in a high tensile strength value.

The tensile strength of the tanned skin depends on the tanner used (type and concentration) and on the tanning process (liming and batting processes). According to Sumarni, Sri (2013) the use of high concentrations, tanners have a faster penetrating power into the skin. Excessive liming and batting process causes the skin tissue to be exposed so that the tensile strength will be reduced. The tensile strength of the tanned skin is influenced by the fat content, width and thickness of the skin, the higher the oil/fat content, the lower the tensile strength of the tanned skin. The high fat/oil content causes the skin to become limp, easily stretched and the skin to become loose. This condition results in a reduced ability of the skin to withstand the tensile loads.

4) Tearing strength

The tear strength is the maximum force required to tear the skin. Thin skin has less collagen fibers so that it has lower tear power when compared to thicker skin (Hergiyani, et al., 2018)

The tear strength of the tanned sheep skin is affected by the collagen content in the tanned sheepskin. Hergiyani, et al., (2018) stated that the structure of the skin tissue (collagen) affects the strength of the skin. Collagen fibers are arranged in collagen bundles which are interwoven. The angle formed by the webbing and the solids of the collagen fibers determines the high and low tensile strength. The tensile strength and elongation also affect the tear strength of the leather. The greatest value of the tear strength test on the skin of the tanned sheep was obtained in treatment P4 which was equal to 28,96 N/mm and the smallest result was obtained in treatment P1 which was equal to 15,79N/mm. This occurs presumably because the use of different concentrations of *batting* materials has an effect on the erosion of skin substances other than collagen. This statement is the same as Farid, et al. (2015) who stated that the batting process in tanning skin will cause unnecessary skin substances such as globular protein to disappear, thereby facilitating the binding of chrome with skin collagen.

Another factor that affects the tear strength of the tanned sheepskin is the use of the chromium concentration and the thickness of the skin. Mustakim, et al. (2007) stated that the higher the concentration of the chrome tanner used in the tanning, the higher the tear strength of the leather. This can occur due to the entry or bonding of the tanner into the protein molecules that make up the skin which results in the formation of a cross-link between the tanning material and the polypeptide chain which determines the physical strength of the leather. The more stable and the more chromium that enters the skin tissue, the physical strength of the leather will increase. Increasing the concentration of the chromium tanner in the tanning will increase the coordination of chromium into the carboxyl group of skin proteins during a longer tanning process, which will result in more chromium bound to collagen.

The efficiency of the chromium tanning depends on the concentration of chromium in the solution which is also a determining factor in the dispersion of the tanner. If the concentration of chromium that enters the structure of the collagen fibers is high it will result in a high reaction speed between collagen and chromium, and vice versa at low

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concentrations, the reaction speed between collagen and chrome is also low. Kusmaryanti, et al. (2016) stated that the thickness of the skin affects the tear strength of the tanned skin. Thin skin has loose collagen fibers, so it has less tear strength compared to thicker skin. The resulting tear strength value is influenced by the thickness of the skin, the direction of the collagen fibers, the angle between the fibers and the grain layer and the location of the sample on the skin. The skin thickness affects the tear strength value because thick skin has more collagen fibers that bind together. Based on the tear strength test on the tanned sheepskin produced from the use of a binding agent with different ingredients and concentrations, it has met the quality requirements of SNI 06-4586-1998 with a minimum number of 12,5 N/mm.

IV. Conclusions and Suggestions

The results of the analysis of the addition of pineapple juice as a bating agent in the sheepskin tannery produced a very significant effect. The concentration of the addition of pineapple juice with different rotating time treatments in the batting process has a very significant effect on the skin in accordance with SNI and ISO provisions.

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