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GREEN TECHNOLOGY ON TANNING PROCESS BY EXHAUSTED TANNING SYSTEM

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Abstract

This study aims to determine the difference of chromium absorption into the skin and difference the shrinkage temperature in chrome mineral tanning by exhausted tanning system and conventional tanning system. The material used were sheep skins. The first treatment by conventional tanning process. The second treatment was tanning process by exhausted system. Tanning process with exhausted system was done by adding polycarboxylic material during repickle and then proceed tanning process. All the data were analyzed by descriptive data analysis and Independent Sample T-Test analysis. The results showed that chrome absorption into chromium was higher when using tanning system exhausted tannery. The difference between two types of tanning process by polycarboxylic material and without polycarboxylic material (conventional tanning) was very significant with significance of $P < 0.01$. The shrinkage temperature for skin with exhausted system tanning has a higher value than conventional

tanning system. It can be said that exhausted tanning system can be used for eco-friendly tanning system.

Keywords

Tanning, Exhausted, Sheep, Technology

1. Introduction

A chrome tanning process with chrome tanning agent has been used for many years. Most leather industries use chrome as the main tanner. Chrome was chosen by other tanners because of its several advantages. In fact, a lot of research has been done to replace chrome tanning materials, but there have been no satisfactory results (Sundar et al., 2011b cit Sundar, 2013). Various ways are done to reduce the impact of chrome waste. One of them is the use of polymers in pretanning (Monem, et al., 2017)

The use of excessive chromium also cause an increase in chromium waste is wasted, mainly because of absorption of chromium in leather limited. Therefore, it is important to find a method in chrome tanning process in order to reduce chrome waste disposal. This can be done either by the methods exhausted chrome tanning. This is a conventional tanning process in general but differ on the use of tanning fluid.

Exhausted tanning process is the first step to reduce the amount of chromium waste disposal. In addition, it should also be seen how the results of the dyed crust leather tanning process is exhausted this process. All results of the tanning process will eventually be used for the industry to support the leather business. Therefore, certain conditions must be met.

Tanning is a process that serves to protect the skin from microbial degradation, heat, sweat, or moisture, etc. During the tanning process, a more stable collagen will be produced. The tanneries can use minerals, vegetable, aldehyde or other ingredients (Erdem, 2006).

The tanning process consists of several long steps, one of which goes through the stage of the tanning process. The tanning process aims to turn raw skin into a more stable against microorganisms. The most widely used tanning material is chrome. (Hauber and German, 1999). Chrome is a tanning material that is most widely used in the tanning industry. Various skin articles are produced with chrome tanneries (Wachsmann, 2001). On the other hand, chrome tanning agent gained the leather better characters other tan tanning agents such as high thermal stability, light weight and high strength properties (Bieniewics, 1983; Srearam et al., 2003).

Usually, more than 80% of the tanning industry in the world use chrome as tanning agent (Hauber and Germann, 199). All cit by El-Monem, et al, 2014).

Torras (2012) said that a sustainable method for recovering chromium from exhausted chromium plating baths generated by the surface treatment industry and their further use in the tanning industry. Exhausted baths show a high chromium concentration (about 110g/l Cr). After appropriate treatments, it will lead to a Cr (III) solution with higher concentration than that of tanning liquor (about 20g/l Cr). Thus, an evaporation process to concentration the solution is not necessary in this case.

There are many things that can be done to increase the chromium uptake in to the skin. Based on Liu (2016) nanocomposite can increase the amount of chrome penetrated in the skin and improve the distribution of chromium in the skin. The nanocomposite assisted less chrome tanning effluent shows reduction in BOD_5, COD_{Cr}, and SS of wastewater as compared to control process.

In tanning process, the old trick of adding formaldehyde (safely replaceable by glyoxal) to the pickle would free more carboxyls to react with chrome polymers. This is because during basification, equilibrium is driven to the right by alkali as the freed acid is neutralized. This results in a better chrome uptake. The process will thus become more efficient, so that a lower of chrome will still provide good tannage and less waste (Rabinovich, 2008). It is therefore important to know the chrome uptake in the skin and shrinkage temperature between the conventional method and exhausted tanning system.

1.1 Research purposes

1. To determine the absorption of chromium in the skin
2. To determine the shrinkage temperature

1.2 Benefits of research

This research is expected to be material information in the development of education in the leather tannery.

2. Material And Methods

2.1 Matter

Tools. Tools used in this research are drum process, knife, scale.

Materials. Material used in this research are 6 sheep skins, Chromosal B, Na-asetat, Novaltan MAP (polycarboxylic), Formic acid, NaCl, Sulphited Fish Oil, MgO, $NaHCO_3$.

2.2 Methods

6 sheep skin divided in to 2 conditions. a). Conventional tanning process b). Exhausted tanning process, each with 3 repititions.

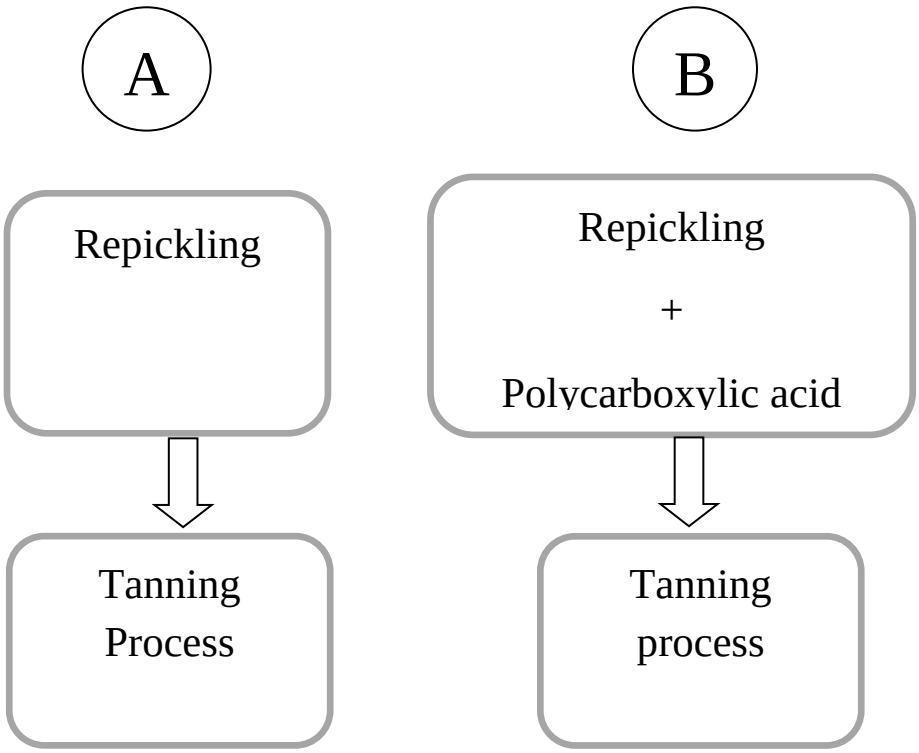

Figure 1: *The difference of Tanning Process*

A: Conventional tanning system

B: Exhausted tanning system

Tanning process with conventional system was done by doing tanning general process that were 1) repickle by 75% water, 7.5% NaCl, 0,2% FA; 2) tanning sheepskin by 100% water, 8% Chromosal B, 2% Na Acetate, 2% Sulphited fish oil, 0.6% MgO, and 0.65% $NaHCO_3$. Tanning process with exhausted system was done by adding polycarboxylic material during repickle and then proceed tanning process. Repickle 75% water, 7.5% NaCl, 0.1% FA, 2% Novaltan MAP, then tanning sheepskin by 100% water, 0.3% FA, 8% Chromosal B, 2% Na Acetate, 2% Sulphited fish oil, 0.6% MgO, 0.2% $NaHCO_3$.

Analysis

A. Chromium Uptake

The chromium content present in the skin was analyzed according to SNI standard.

All the data obtained were analyzed by Independent Sample T-Test using IBM SPSS 22.

B. **Measurements of shrinking temperature**

The shrinking temperature (Ts) was tested using manual instrument. Shrinking temperature represents the hydrothermal stability of the skin (Covington, 2009).

3. Results And Discussion

A. Chromium Uptake

Table 1. Demonstrates that the use of a polycarboxylic-containing material may increase chromium absorption into the skin. If without the use of polycarboxylic materials, the absorption of chromium into the skin of 1,518.84 mg / kg, while with the use of polycarboxylic material can increase the amount of chromium absorbed ie with the material 58.623,86 mg / kg.

Table 1: *The Differences of Chromium Uptake on Conventional and Exhausted Tanning System*

Tanning Process	N	Mean (mg/kg)	t	Sig (2 tailed)
Exhausted	9	58623,86 ± 46,59	-3658,044	0,000[a]
Conventional	9	1518,84 ± 4,76	-3658,044	0,000[b]

a, b : different of superscript in the same line showed the highly significant difference ($P \leq 0.01$)

Table 1. Indicates that there is a difference in the absorption of chromium into the skin between the tanning process using a polycarboxylic material with no polycarboxylic material. Table 1 shows a very significant difference between two types of tanning process by polycarboxylic material with no polycarboxylic material (conventional tanning), with significance of $P < 0.01$.

The use of materials with a high content of polycarboxylic can increase chromium uptake into the skin. Chromium is a chemical that can bind to a carboxylic (COO-) group of skin. Therefore, if the amount of carboxylic content in the skin increases can increase the amount of chromium uptake in the skin. Furthermore, with the increasing amount of chromium uptake in the skin can reduce the chromium content to waste.

Chromium absorption in the skin can be increased by the presence of exhausted tannning system. The advantages using high exhaust tanning salt are saving in chrome and reduce chrome load in waste water. A high exhaustion chrome-tanning method has been developed using a combination of aluminum-based syntan with chrome-tanning salt. The treatment shows exhaustion levels of above 90% of chrome are possible and the resultant wet blue leathers possess the required hydrothermal stability (Sundar, et al., 2002).

Exhausted tanning system tanning system can increase the absorption of chrome tanner into the skin. The more chromium absorbed into the skin, the lower the chromium waste in the waste. Surely this can reduce environmental pollution.

Tanned leather with chrome tanning is only able to bind chromium ± 60%, the rest is wasted in the waste. It is certainly very dangerous for environmental conditions. Therefore, with the exhausted system can increase the absorption of chrome into the skin. So chrome that wasted in the environment can be minimized. This helps in preserving the environment.

According to Ma et al., (2016), the use of chromium as a tanner can provide a high chromium discharge. Therefore, with the presence of chromium iron tanning agent in addition to providing good quality on the skin, it can also reduce the amount of chrome used and reduce chrome waste disposal.

Most of the available collagen carboxyl groups have been reached by the reached of chrome. This condition is characterized by the approximation to boundary value, with corresponds more or less to 100% of chrome binding (Rener, et al., 2013).

B. Shrinkage Temperature

Shrinkage temperature of both treatments shows the difference. This can be seen in Figure 2.

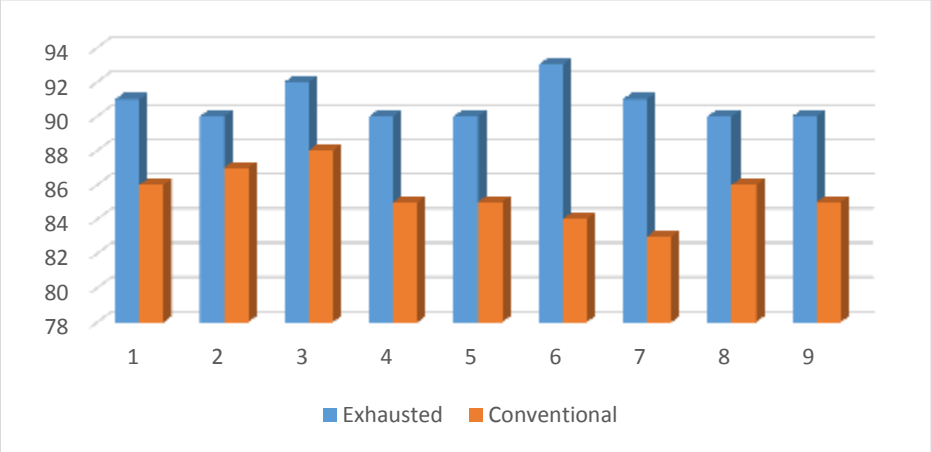

Figure 2: *The Shrinkage Temperature of Tanning Process*

Table 3: *Average of Shrinkage Temperature*

Parameter	A	B
Shrinkage Temperature	85^0C	90^0C

**A = conventional tanning system*
B = exhausted tanning system

Table 3 shows that the shrinkage temperature for skin with exhausted system tanning has a higher value than conventional tanning system ie 90^0C. This shows that tanning with exhausted tanning system has higher heat resistance than other treatments. Skin which has a high heat resistance can be used for products that require high heat resistance. The skin becomes resistant to exposure to sunlight as well as the process of molding with high temperatures. The more chromium content on the skin the higher shrinkage temperature (Ts) on the skin.

The shrinkage temperature of leather is the most commonly quoted measurement of hydrothermal stability, certainly in technical publications and specifications. The shrinkage temperature is noted when the sample visibly shrinks. Chrome tanning confers high hydrothermal stability, a shrinkage temperature of 110^oC is easily attainable (Covington, 2009).

4. Conclusion

This research seeks to improve the tanning process to be more environmentally friendly. The mineral tanning process should be able to be increased by reducing the residue of chrome in the waste produced. This can be done by increasing the chrome absorbs into the skin, one of which can be done by renewal of tanning technology. Exhausted tanning system can increase the absorption of chrome tanning agent into the skin. Tanning with exhausted tanning system has higher heat resistance than other treatments. It can be said that exhausted tanning system can be used for eco friendly tanning system.

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