

The Influence of Tanning Material Difference on the Physical Quality of the Skin of Puffer Fish (*Arothron reticularis*)

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ABSTRACT: The aim of study was to investigate the influence of tanning material difference on the physical quality of the skin of puffer fish (*Arothron reticularis*) in relation with the usage of Natural Resources, particularly fishes, i.e. puffer fish skin. Puffer fishes are famous for being toxic, very dangerous and have many bones in the skin, which is being its characteristic and specification. To make the bone not too sharp, two types of tanning are performed, i.e. chrome and vegetable tanning. To discover any tensile strength and elongation difference between vegetable skins and chrome skins, independent t test was performed. The result of the test |t count| of tensile strength = 3.511, and elongation 6.098 > t table (0.05:16) = 2.119 or by comparing significance value which is bigger than error level (0.05) it was concluded that there was tensile strength difference between vegetable skins and chrome skins, and there was elongation difference between vegetable skin and chrome skins.

Keywords: Puffer Fish, tanning material, Physical Test.

INTRODUCTION

The implementation of the ASEAN Economic (AEC) in 2015 and the Asia-Pacific free trade, make every country prepares to face the free trade market, including Indonesia. Human Resources (HR) of Indonesia is still left behind to face the free market; it is because Indonesia has not prepared it maximally. Natural Resources (SDA) in Indonesia is very abundant, but has not been utilized effectively. One of the big challenges is to embed the collective awareness as a Nation which has to work hard to reach its advancement, to catch up with other countries in many aspects. It needs an effective strategy to improve the performances of national industries as well as to protect the domestic industries in facing the goods and services flows from the ASEAN countries. Therefore, Indonesia will emphasize its industries on the benefits of natural resources and the workers. One of the problems which is always be faced by this industry is the limitedness of its raw material which is the fresh leather.

The numbers of tanning industry which utilizes the fish leather as its raw material is still low. The alternative which can be taken by utilizing the fish leather as the raw material of tannery. Tanned fish leather is very potential to be developed but it has a very slow progress. The tanned fish leather business is not only giving an additional value for the leather wastes but also as an alternative in sufficing the leather materials for tanning industry in Indonesia which had been applied in producing the leather material products such as, bags, shoes, and sandals.

In utilizing the fishery products as one of the supplies to tanning industry is still facing some constraints and problems. First, the fishery products are the quickly-rot commodity, including the fish leather. Both the chemical composition and physical structure of the fish leather are different from the terrestrial animal leather. The fish leather is more easily decayed. The consequence to get the fish leather which is able to be tanned, it should be from the superfine-fresh fish. Therefore, the fish should be treated well. Similarly, the tanned leather needs a well treatment and is should be

processed as soon as possible. The scarcity of fish leather supply in tanning industry is primarily on the difficulties to get the high-quality fresh fish leather for the tannery. Besides, it should consider the impact to the environment, so that the chemical substances used should be environmentally friendly.

The purpose of this research is to find out the differences of the physical strength of puffer fish leather which had been used for vegetable tanning (environmentally friendly tanning) and chrome tanning. Besides, it should consider that the characteristic of puffer fish leather histology as an alternative of raw materials of tannery industry.

MATERIALS AND METHODS

Research Method

The materials used in this research were 36 sheets of puffer fish leather obtained from Rembang. 18 sheets were for the vegetable tanning and 18 others were for chrome tanning. Then, from the crust leather results, there were observed histologically. In the making of this histology preparation, the tissue of fish leather which would be observed was pickled by using formalin, then it was sliced thin (with a thickness of few micron), stuck up to the glass object, colored, and then covered by the glass cover (Suntoro, 1983). For the assessment of tensile strength was conducted based on the Indonesian standard of SNI 06-1795 -1990.

RESULTS AND DISCUSSION

Physical Quality

Leather has the physical properties and chemical composition that is different (Kanagy, 1977). Physical strength according to Roddy, (1978) is the power to influence the environment, among others, the effect of storage power, physical strength can be measured quantitatively, e.g. tensile strength, elongation, temperature wrinkles and rigidity. The physical strength according to Tuck (1981) correlated with tissue structure and the levels of chemicals on the leather, so that the amount of physical strength of the leather can be expected from the tissue structure and the levels of chemicals leather.

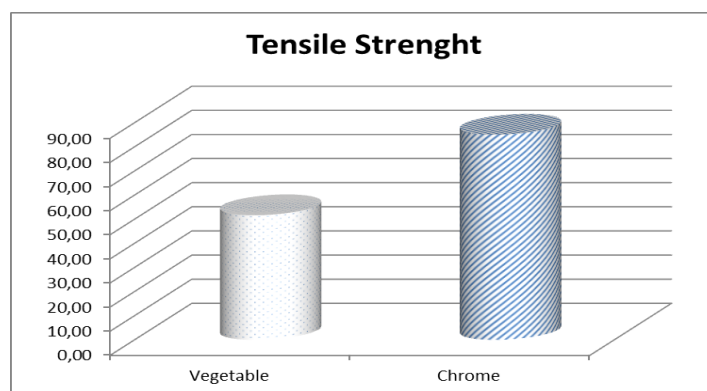


Figure 1. The testing result of the tensile strength of the vegetable and chrome leather.

Figure 1 shows the results of tensile strength testing of the puffer fish leather tanned with chrome tanning materials where the value indicates a higher value than the tanned using vegetable materials. The tensile strength of the chrome tanned leather is 85.04 N/cm² while the puffer

fish leather vegetable is 51.65 N/cm² this is due to the nature of the tanned leather using the chrome tanning materials will produce more supple skin/soft, and more resistant against the high heat, higher tensile strength. Leather tanned with chrome tanning materials also have a high wrinkle temperature thereby the leather will produce high tensile strength values as well. Besides, the leather which is tanned with chrome tanning has a high wrinkle temperature as described by Covington (2009), that the chrome tanning gives a high hydrothermal stability, so that the chrome tanned leather will reach a wrinkle temperature to 110 °C. Wrinkle temperature is the temperature at which the structure of collagen in the leather experiencing shrinkage. Shrinkage occurs due to rupture woven collagen fibers due to extreme conditions such as heating at a high temperature (Astrida *et al.*, 2008).

According to Purnomo (1985), chrome tanning materials are most important minerals tanner materials. This is caused by special-quality related to the molecular structure of chromium which allows trivalent chromium salts to form materials that have a strong appeal for complex leather material. Chrome has a high tannic power shown through its binding to the carboxyl group of leather so the leather structure becomes more compact and strong and it can be seen in Figure 2.

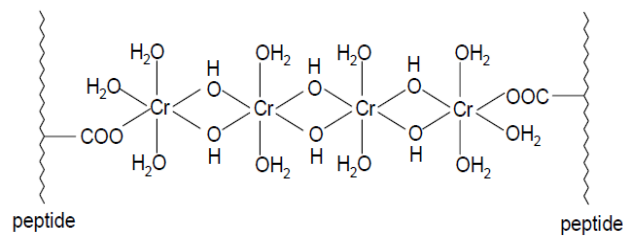


Figure 2. The reaction between chromium and carboxylic acid in the leather collagen (Covington, 2009)

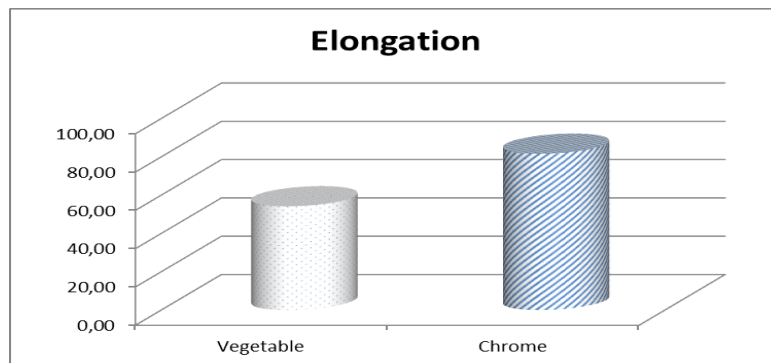


Figure 3. The elongation of Vegetable and chrome tanned of Puffer Fish Leather

In Figure 3, the results of the tensile strength testing in puffer fish leather tanned with vegetable tanning materials indicates that the test value is lower than the puffer fish leather which is tanned with chrome tanning materials. The lower tensile strength values can be caused by the bonding that occurs in the vegetable tanned leather is in the form of hydrogen bonding so that the leather tanned with vegetable tanning materials has lower wrinkle temperature than the chrome tanned.

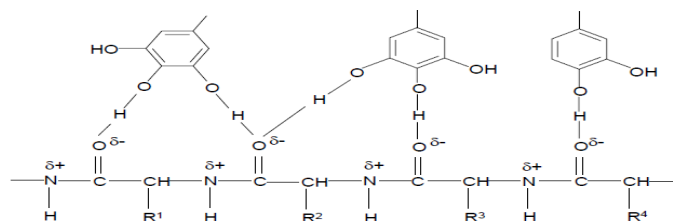


Figure 4. The reaction between polyphenols and carboxylic acid in the leather collagen (Covington, 2009)

To determine whether there is a difference in tensile strength and elongation between vegetable and chrome leather, the independent t test is carried out. The results of the test showed that there is a difference in strength attraction between vegetable and chrome leather ($P > 0.05$), as well as there is an elongation difference between vegetable and chrome leather.

Histological Structure

Long, *et al* (1996) states that the natural arrangement of the leather dermis can make the fish leather in the tensile strength testing is quite high because its arrangement is trans parallel. The dermis is composed and organized as parallel fiber layers which is oriented forming an angle (oriented helically) in the opposite direction. Fish does not have scales mucus which is produced more than fish that have scales. The slime function on the fish is to reduce the friction between the body and water that makes the fish can swim faster (Omar, 1987). While the dermis, the leather layer will be thicker than the outer leather layer. The dermis contains blood vessels, nerves and connective tissue. This layer also plays a role in the process of formation of the scales on a fish with scales.

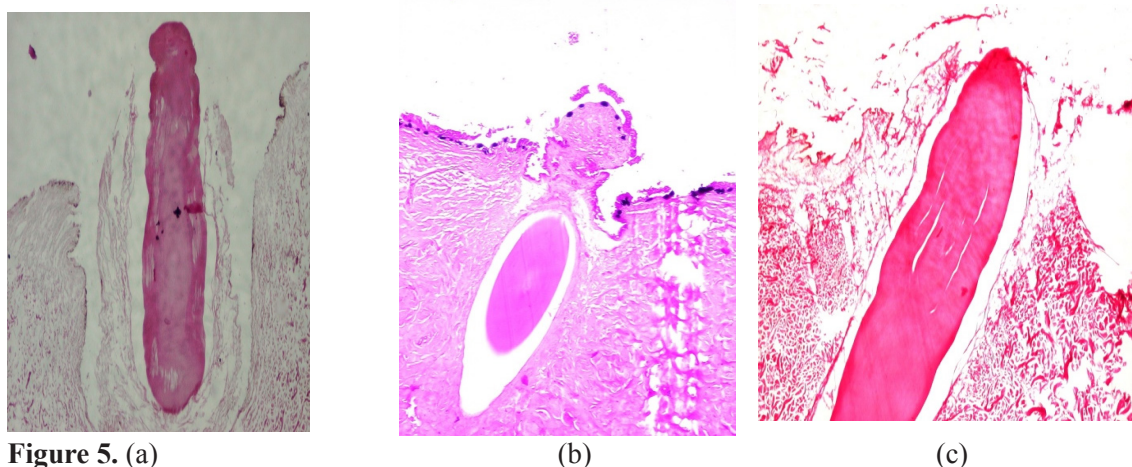


Figure 5. (a) Microstructure of the puffer fish skin thickness with complete epidermis and dermis (b) Microstructure of the Vegetable tanned puffer fish Leather that fish which do not have sharp spines with soft shapes (c) Microstructure of the Chrome tanned puffer fish leather with the straight and sharp thorns.

Based on the figure 5, it is explained that the vegetable tanning leather affects the spines on its surface that is not as sharp as on the basis of chrome tanning. Although it is stated that the chrome tanning has good softness properties but it has no effect on the prickly softness, it is proved from the handle after the chrome tanned leather is still sharp prickly than vegetable tanned puffer fish leather.

CONCLUSION

1. The tensile strength and the elongation of the puffer fish leather which is tanned by chrome has the higher value than the puffer fish leather which is tanned by the vegetable.
2. It is seen from the histological, the vegetable tanning affect the softness spines of puffer fish

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