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# Physical and Chemical Characteristic of Halal Gelatin Extracted from Buffalo Hide with Addition of Pineapple Rind at Different Ratio

## ABSTRACT

The production of halal gelatin from buffalo hide waste which is animal be slaughtered according to Islamic law and using pineapple rind as an extraction agent was an alternative to produce halal gelatin. The availability of buffalo hide in Riau Province was stable and its hide had high protein content. This research was conducted to produced and determine the characteristics of halal gelatin from buffalo hide using solution of pineapple skin in terms of their physical and chemical properties. The Completely Randomized Design (CRD) was experimental design used with consist of 3 treatments and 4 replications. The treatment was ratio hide : pineapple rind solution, namely 3:1, 3:2, 3:3 w/v. The parameters observed were yield, viscosity, color, pH, ash content and moisture content. The results showed that immersion of buffalo hide in the solution of pineapple rind at different ratio gave highly significant increased the viscosity and ash content of gelatin but not significant effect to yield percentage, color, pH and moisture of gelatin. The yield percentage ranging from 5.99-7.33%, pH 4.83-4.85, viscosity was 1.95-2.20 cP, color 0.54-0.71 absorbance unit, ash 0.25-, 0.32% and moisture 9.97-9.99%. It can be concluded that the best treatment was ratio 3:2 and 3 : 3 according to had viscosity, pH, color, ash and moisture in line with the standard of gelatin by Gelatin Manufacture Institute of America (GMIA).

**Keywords:** buffalo hide, chemical properties, halal gelatin, pineapple rind, waste

## 1. Introduction

Indonesia is one of the importing gelatin countries. The problem that arises was not of all imported gelatin was produced by halal procedure due to origin of hide material and the animal slaughtering techniques that were not accordance with Islamic law. The production of halal gelatin from buffalo hide waste which is animal be slaughtered according to Islamic law and using pineapple rind as an extraction agent was an alternative to produce halal gelatin.

The availability of buffalo hide was high in Riau Province because there were three regencies which had the highest number of registered slaughtered cattle, i.e. buffalo, namely : Kampar Regency, Kuantan Singingi Regency and Pekanbaru city. According to Badan Pusat Statistik Riau Province 2017, number of slaughtered of buffalo in 2015 at Kampar Regency was 7,797 heads, Kuantan Singingi Regency there were 782 heads and Pekanbaru City was 731 heads. According to Badan Pusat Statistik Riau Province 2017, number of slaughtered of buffalo in 2015 at Kampar Regency was 7,797 heads, Kuantan Singingi Regency there were 782 heads and Pekanbaru City was 731 heads. Consequence, hide was available which was the by-product from slaughtering of buffalo. Processing buffalo hide into gelatin is one way to increase the added value of hide. Raw hide is divided into two groups, namely group of hide derived from large animals such as cattle, buffaloes, horse, known as hide, and group of skin derived small animals such as goats, rabbits, and reptiles, known as skin. The hide from large animal

had more protein content than the skin of small animals (Rafika *et al.*, 2016).

Gelatin is a product derived from extraction of collagen, bone and other tissues by using acids, bases or enzymatic process (GMIA, 2012). According to Remawati (2016), the gelatin derived bovine hide that extracted by acetic acid 0.2 M had value of viscosity 30 cP, yield was 6.29 %, pH value was 5.6, water content 63.51 %, and ash content was 0.3%. Mulyani *et al.*, (2017), had studied on gelatin producing from buffalo hide by using different acid solution ( hydrochloric acid, citric acid and acetic acid at various concentration, had produced yield percentage were 6.22%, 6.52% and 6.79%, respectively. The research on gelatin producing from buffalo hide by using waste of pineapple rind extract has not been reported, so this research is urgent to do.

According to Kumaunang (2011), the pineapple rind contains bromelain enzymes amount as 0.07 Unit/ml. Bromelain is protease enzyme which have the properties of hydrolyzing proteins (Dubey *et al.*, 2012). Protease enzymes will break up of peptide bonds of collagen proteins (Suhermiyati and Setyawati, 2008).

The production of pineapple in Riau Province in 2015 was 74.389 ton (BPS Riau Province, 2017). The high production of pineapple in Riau Province also produces high pineapple waste, that can be used as a source of crude bromelain. This pineapple rind could use to extract gelatin from buffalo hide. This research was conducted to produced and determine the

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characteristics of halal gelatin from buffalo hide using solution of pineapple skin in terms of their physical and chemical properties.

## 2. Materials and methods

The material used in this research were 7 kg buffalo hide from the traditional slaughterhouse in Bangkinang. Slaughtering method according to Islamic law. The waste of pineapple rind from traders in Jalan Rimbo Panjang, Kampar and distilled water.

The research method was experiment with Completely Randomized Design (CRD) as experimental design with consist of 3 treatments and 4 replications. The treatment was the ratio hide : pineapple rind solution, namely 3:1, 3 : 2 and 3 : 3 g/v. The parameters observed were yield, viscosity, color, pH, ash content and moisture content.

### 2.1. Preparation of hide

The preparation of buffalo hide were conducted as follow : The buffalo hide was cleaned by using the water and then continued to remove the hair by burn with smal fire on the surface of hide. This process aimed to removed the lipid in the hide. Then, the hide was cut in to small cubes (size of 2-4 cm) and finally, the small cubes were rinsed by the water repeatedly until clean.

### 2.2. Preparation of pineapple rind extract

The preparation of pineapple rind extract was carried out as follows: the waste of pineapple rind was cleaned from dirt by using water. Then, the pineapple rinds were cut into small pieces. The pieces of rind and distilled water were put into a blender with a ratio of 1:1 and followed by grinding in 5 minutes. Furthermore, the pineapple rind juice was filtered by gauze to get the filtrate of pineapple rind. Then, this filtrate was dissolved in distilled water according to the ratio in the treatment.

### 2.3. Process of gelatin extraction

Procedure of gelatin extraction from buffalo hide were carried out as follow : an amount of 300 g of the cleaned hide was soaked in the pineapple rind extract according the research treatment (ratio of buffalo hide : solution of pineapple rind extract, namely P1 300 : 100, P2 300 : 200 and P 3 300 : 300 w/v). Amount of distilled water were added in P1 and P2 were 200 ml and 100 ml, respectively. Percentage of pineapple rind extract were added in the treatment respectively about 33.33% (P1), 66.67% (P2) and 100% (P3). The soaking process was held at room temperature, 20 hours. Then, hide was rinsed by distilled water. The extraction process was began by placing the hide in a

glass jar and adding 1000 ml of distilled water, then heating it in a shaker waterbath at 70 °C for 2 hours, from this heating process will produce a gelatin solution. Gelatin solution then filtered to separate the gelatin solution and buffalo hide. The next process was placed the gelatin solution in the refrigerator until gelatin became hardening. Then, the hard gelatin was dried using an oven at 105°C for 24 hours. Then the dried gelatin was ground using a blender and was sieved until becomes as a flour.

### 2.4. The parameter observed

The parameter observed in this research were physical and chemical properties of gelatin. The physical properties were analysis of yield percentage (GMIA, 2013), viscosity (GMIA, 2013), color (Schrieber dan Gareis, 2007). The chemical properties were pH value (GMIA, 2013), moisture (AOAC, 2005), and ash content (AOAC, 2005).

### 2.5. Data Analysis

Data statistically analyzed by analysis of variance to know the effect of the treatment towards the parameter observed. If the treatment showed significant effect, continued to post hoc analysis Duncan Multiple Range Test (DMRT) at  $\alpha$  0.05.

## 3. Result and discussion

The pineapple rind extract contain proteolytic enzyme, known as bromelain. The activity of crude enzyme in the pineapple rind extract in this research was 0.071-0.076 unit/ml. This enzyme activity was similar with research of Kumaunang *et al* (2011), the enzyme activity in pineapple rind solution was 0.071 unit/ml.

### 3.1. Physical properties (Yield percentage, viscosity, color)

Data on yield percentage, viscosity and color of gelatin from buffalo hide that was soaked in pineapple rind extract at different ratios were shown in Table 1. The analysis of variance showed that the treatment of buffalo hide and pineapple rind extracts at different ratio had significant effect on increasing the viscosity of gelatin but did not significantly effect to the yield percentage and the color of gelatin. DMRT analysis showed that gelatin were made with buffalo hide and pineapple rind extract at ratio 3:2 and 3:3 had significantly higher viscosity than gelatin made from buffalo hide and pineapple rind extract at ratio 3:1. This means that the increase of concentration pineapple rind extract from 33.33% to 66.67%-100% can increase the viscosity of gelatin. The increasing of viscosity related to increasing of gelatin concentration at ratio 3:2 and 3:3 of buffalo hide and pineapple rind extract as an effect from proteolytic activity of bromelain enzyme in the

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pineapple rind extract. But, both of ratios could not give the increasing of yield percentage of gelatin significantly. This indicated that the concentration of pineapple rind extract should be greater and ratio of hide and pineapple rind extract should be varied in order to improve the yield percentage of gelatin.

Table 1. Physical properties of gelatin halal from different ratio of Buffalo hide and pineapple rind extract

Experiment	Value (unit)
<b>Yield Percentage</b>	
3:1	5.99±2.02% <sup>ns</sup>
3:2	8.69±1.57% <sup>ns</sup>
3:3	7.33±1.36% <sup>ns</sup>
<b>Viscosity</b>	
3:1	1.95±0.02 cP <sup>a</sup>
3:2	2.14±0.11 cP <sup>b</sup>
3:3	2.20±0.14 cP <sup>b</sup>
<b>Color</b>	
3:1	0.54±0.01 au <sup>ns</sup>
3:2	0.65±0.05 au <sup>ns</sup>
3:3	0.71±0.02 au <sup>ns</sup>

Note : different superscript in the same column showed significant effect (a 0.05), ns showed not significant effect. Data was shown as mean ± deviation standard.

The yield percentage of gelatin in this research was similar with the yield percentage of gelatin from buffalo hide which was soaked in pineapple fruit solution for 12-96 hours, result the yield percentage about 5.29-6.20% (Gozali, 2018).

This research emphasized that soaking time for 20 hours could produce the yield percentage of gelatin similar with soaking time 96 hours, and both of fruit and rind of pineapple extract showed similar enzymatic activity in hydrolysis of buffalo hide.

The similar phenomenon also reported by Mulyani *et al.*, (2017), that the yield percentage of gelatin did not significant increased when buffalo hide was soaked in a different acid (hydrochloric, citric, and acetic acids at concentrations of 0.3, 0.6, 0.9, 1.2, and 1.5 M, respectively). The yield percentage ranged from 6.30-29.27%. Another research Kurmia (2015) reported that the soaking of bone of bovine head in 5% hydrochloric acid solution for 10, 15 and 20 days did not significant effect to increase yield percentage, and gave the percentage 6.22%, 6.52% and 6.79%, respectively.

Viscosity was a measure of the physical properties of gelatin which is strongly related to gel strength. Viscosity analysis was done to determine the level of viscosity of gelatin as a solution at certain concentrations and temperatures (GMIA, 2013). The viscosity of gelatin in this research was higher from viscosity of gelatin from beef hide that was soaked in hydrogen chloride acid at 3% and 5%, showed the

maximum viscosity was 1.79 cP (Rapika *et al.* 2016). The value of the viscosity of this research met the gelatin standards by Gelatin Manufacturers Institute of America, GMIA (2012) which are 1.5-7.5 cP.

Color of gelatin in this research was measured by using spectrophotometer and was reported in absorbance unit. The color of gelatin ranging from 0.54, 0.65, 0.71 absorbance unit. The color of gelatin produced was yellowish. According to GMIA (2012), the color of gelatin depends on two factors, first, the nature of the raw material used and source of the gelatin represents a color (skin, or bone), second extraction process of gelatin. Gelatin from pork skin have less color than those made from bone or hide of cattle (beef, buffalo, horse). Furthermore, color does not influence the properties of gelatin or reduce its usefulness. The standard of color of gelatin was less color – yellow. The color of gelatin from buffalo hide in this research was yellowish and match with GMIA (2012).

### 3.2. Chemical properties

Data on pH value, moisture and ash content of gelatin from buffalo hide that was soaked in pineapple rind extract at different ratios were shown in Table 2. The analysis of variance showed that the treatment of buffalo hide and pineapple rind extracts at different ratio had non significant effect on the pH value and moisture of gelatin but had significant effect to increasing ash content of gelatin. DMRT analysis showed that gelatin were made with buffalo hide and pineapple rind extract at ratio 3:2 and 3:3 had significantly higher ash content than gelatin made from buffalo hide and pineapple rind extract at ratio 3:1. This means that the increase of concentration pineapple rind extract can increase the ash content of gelatin. The ash content of gelatin was influenced by material processing (GMIA, 2012). At higher concentrations of pineapple rind, the mineral of pineapple rind diffuse to buffalo hide during soaking at beginning of gelatin processing. The mineral content of pineapple rind also contribute in ash content of gelatin. According to Romelle *et al.* (2016), the pineapple rind had ash content about 4.39 %, calcium 8.30 mg/100 g, zinc 6.46 mg/100 g, iron 25.52 mg/100 g and manganese 5.32 mg/100 g.

Table 2. Chemical properties of gelatin halal from different ratio of Buffalo hide and pineapple rind extract

Experiment	Value (unit)
<b>pH</b>	
3:1	4.83±0.05 <sup>ns</sup>
3:2	4.83±0.10 <sup>ns</sup>
3:3	4.85±0.17 <sup>ns</sup>
<b>Moisture</b>	
3:1	9.97±0.11% <sup>ns</sup>

3:2	9.96±0.15% <sup>ns</sup>
3:3	9.99±0.18% <sup>ns</sup>
<b>Ash</b>	
3:1	0.25±0.04% <sup>a</sup>
3:2	0.30±0.01% <sup>b</sup>
3:3	0.32±0.02% <sup>b</sup>

Note : different superscript in the same column showed significant effect ( $\alpha$  0.05), ns showed not significant effect. Data was shown as mean  $\pm$  deviation standard.

According to GMIA (2012), the ash content of gelatin varies with the type of raw material and the method of processing. Pork skin gelatins contain small amounts of chlorides or sulfates. The other hand, gelatin from bone and hide of cattle contain primarily calcium salts of those acids which are used in the neutralization after liming.

The ash content of gelatin in this research was lower than those from Mulyani *et al.*, (2017). The ash content of gelatin from buffalo hide was soaked in a different acid (hydrochloric, citric, and acetic acids at concentrations of 0.9, 0.5, and 1.5 M,) showed value 0.56%, 0.62% and 2.67%, respectively.

The pH value of gelatin in this study did not effected by concentrations of pineapple rind extract. However, the pH value of gelatin met GMIA standards for type A gelatin, ranged from 3.8-5.5 (GMIA, 2012) and in line to the Indonesian National Standard.

The moisture of gelatin in this research met the moisture standard in GMIA, ranged from 8-13%. The moisture of gelatin in this research was differ than those from Mulyani *et al.*, (2017). The moisture of gelatin from buffalo hide was soaked in a different acid (hydrochloric, citric, and acetic at concentrations of 0.9, 0.5, and 1.5 M,) showed value 7.08%, 4.41% and 11.09%, respectively.

#### 4. Conclusion

The pineapple rind extract had good potency as agent hydrolysis of buffalo hide at ratio buffalo hide and the pineapple extract 3:2 and 3:3 due to could produce halal gelatin with viscosity, color, pH value, moisture and ash content met with gelatin standard, GMIA. This research recommended the next research to increase concentration of pineapple rind and improve ratio of buffalo hide and pineapple rind extract variety in order to increase the yield percentage of gelatin produced.

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