

GELATIN PRODUCTION FROM SKIN OF CHICKEN LEG USING A VARIETY OF NAOH CONCENTRATION

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Diterima 4 Oktober 2018; diterima pasca revisi 31 Oktober 2018
Layak diterbitkan 31 Oktober 2018

ABSTRACT

*Gelatin is a type of protein that is extracted from collagen of skin, bone, or ligament (animal connective tissue) tissue. Cow bone, cowhide and pig skin are the materials commonly used to obtain gelatin. The purpose of this research was to determine the difference of NaOH concentration as soaking agent on gelatin making from skin of chicken leg (*Gallus gallus domesticus*) for 72 hours of soaking. Fresh skin of chicken leg weighing 250 g were immersed in NaOH solution with concentrations of 1%, 1.5%, and 3% for 72 hours, then extracted using n-hexane solution: alcohols in a ratio of 1: 3 and dried to obtain gelatin. The resulting gelatin is then analyzed for physicochemical characteristics such as sensory, yield, pH test, and water content test. The results of this study, mentioned that the concentration of 1% NaOH solution produces gelatin under average of yield of 6 g, neutral pH and water content of 11%. The concentration of 1.5% NaOH solution produces gelatin under average of yield 8 g, pH 7 and water content of 13%. The concentration of 3%NaOH solution produces gelatin under average of yield 4.144 g, pH 7 and water content of 7.11%. Based on the result, it can be concluded that a good solution of NaOH to get high yield under a concentration of 1.5% solution. The gelatin obtained under 1.5% solution in accordance with the standard gelatin. The characteristics of standard gelatin are colorless to yellow, odorless, tasteless, pH 7 (neutral), and moisture content below 16%.*

Key words : *Gelatin; gallus gallus domesticus; soaking agent; physicochemical properties*

ABSTRAK

Gelatin merupakan jenis dari protein yang diekstrak dari kolagen jaringan kulit, tulang atau jaringan ligamen (jaringan konektif ternak). Kulit tulang sapi, kulit sapi dan babi adalah bahan yang biasa digunakan untuk mendapatkan gelatin. Tujuan penelitian ini adalah untuk mengetahui perbedaan konsentrasi NaOH sebagai perendaman pada pembuatan gelatin dari kulit kaki ayam (*Gallus gallus domesticus*) yang direndam selama 72 jam. Kulit kaki ayam seberat 250 g direndam dalam larutan NaOH dengan konsentrasi 1%, 1,5%, dan 3% selama 72 jam, kemudian diekstraksi menggunakan larutan n-heksana: alkohol dengan perbandingan 1: 3, kemudian dikeringkan hingga menghasilkan gelatin. Gelatin yang dihasilkan kemudian dianalisis untuk karakteristik fisikokimia seperti uji organoleptik, uji pH, dan uji kadar air. Hasil penelitian ini menunjukkan bahwa konsentrasi larutan NaOH 1% menghasilkan gelatin di bawah rata-rata hasil 6 g, pH netral dan kadar air 11%. Konsentrasi larutan NaOH 1,5% menghasilkan gelatin di bawah rata-rata hasil 8 g, pH 7 dan kadar air 13%. Konsentrasi larutan NaOH 3% menghasilkan gelatin di bawah rata-rata hasil 4,144 g, pH 7 dan kadar air 7,11%. Dapat disimpulkan bahwa larutan NaOH yang baik untuk mendapatkan hasil yang tinggi di bawah konsentrasi larutan 1,5% karena sesuai dengan gelatin standar. Karakteristik gelatin standar tidak berwarna hingga kuning, tidak berbau, tidak berasa, pH 7 (netral), dan kadar air di bawah 16%.

Kata kunci : Gelatin; *gallus gallus domesticus*; larutan perendaman; sifat fisikokimia

INTRODUCTION

Gelatin is a natural product obtained through partial hydrolysis of collagen from animal skin and bones (Duconseille et al., 2015; Etxabide et al., 2015). Utilization of gelatin is very widely. It is estimated that around 59% of gelatin produced worldwide is used for the food industry, 31% for the pharmaceutical industry, 2% for the photography industry, and around 8% for other industries (Mohebi and Shahbazi, 2017). So far, Indonesia's gelatin needs have been imported from several countries such as France, Japan, India, Brazil, Germany, China, Argentina and Australia (BPS, 2015). Gelatin imports in 2014 reached 255,822 kg with a value of US \$ 2,059,329 (BPS, 2015).

One important aspect that needs to be considered is the halalness for Muslims. Kuan et al. (2016) states that 98.5% of gelatin in the world is produced from meat,

bone and pork skin, therefore it is necessary to develop gelatin production from other animal sources. Previous research has produced gelatin production technology from bovine bones (Yuniarifin et al., 2006), fish bones (Marzuki et al., 2011), fish skin (Shyni et al., 2014), chicken skin (Sarbon et al., 2013), sheepskin (Hasdar and Rahmawati, 2017), chicken feet (Rafieian et al., 2015), and duck legs (Kuan et al., 2016).

Another example of this research is Haryati (2011) which is making gelatin from skin of chicken leg which is applied as a gelling agent in making multivitamin jelly candy. Chicken leg, is one of the results found in the Chicken Slaughterhouse. Its potential is abundant along with the high number of chicken cuts.

The number of broiler cuts in Indonesia in 2011 was 1.3 million tons (1.3 million x 103 kg). Due to the large number of chicken leg produced, it is quite

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How to cite :

Setyawaty, R., & Triliandari, M. (2018). Gelatin Production from Skin of Chicken Leg using A Variety of Naoh Concentration. *Jurnal Ilmu dan Teknologi Hasil Ternak*, 13 (2), 126-132

potential as a raw material in the manufacture of processed products that have a selling value.

One of the products that use raw material skin of chicken leg is gelatin. Chicken leg skin has collagen, which results in hydrolysis of the collagen will produce gelatin.

This study was conducted to determine the yield under NaOH concentration of 1%, 1.5% and 3% as a soaking media in making gelatin from skin of chicken leg (*Gallus gallus domesticus*) by using soaking time for 72 hours in term of physicochemical.

MATERIALS AND METHODS

Sample selection procedures

Skin of chicken leg (*Gallus gallus domesticus*) was obtained from one traditional market in Purwokerto.

Materials

The materials are skin of chicken leg from broiler variety, technical NaOH 1 M with concentrations of 1%, 1.5% and 3%, then extracted using technical n-hexane, and 96% of ethanol.

Procedure

1. Collection of chicken leg skin from broiler chicken variety

Skin of chicken leg used in this study was obtained from the Chicken Slaughterhouse in a Purwokerto traditional market.

2. Separation of skin from chicken leg

The leg of broiler chicken as much as 9 kg is skinned in the right way. The plug from fresh broiler chicken is washed with cold water until clean, then proceed with cutting the finger on the base except the middle finger. Furthermore, the skin is sliced straight on the back of the leg from the base of the foot to the tip of the finger, the skin is peeled with a knife, and the carried meat is cleaned with a knife. Then the skin is washed

with water until it is clean and weighed to find out the yield obtained (Purnomo, 1992).

3. Soaking in bases

2 g of NaOH Preparation of 1% NaOH solution by 2 g NaOH was dissolved in 200 mL of aquadest. Preparation of 1.5% NaOH solution by 3 g of NaOH dissolved in 200 mL of aquadest. Preparation of 3% NaOH solution by 6 g NaOH was dissolved in 200 mL of aquadest. Skin of chicken leg as much as 250 g for each NaOH concentration soaked for 72 hours while occasionally stirring.

4. Neutralization

Skin of chicken leg is obtained from soaking in NaOH under different of concentration, then separated from NaOH solution by washing using flowing water.

5. Extraction and heating

Skin of chicken leg was soaked in technical chemical n-hexane : ethanol under ratio 1 : 3 for an hour. Furthermore, it is heated in a waterbath under temperature 70 – 90 oC for one hour. The results of heating process are then filtered and the filtrate is taken.

6. Gelatin molding

Gelatin solution was poured in a mold. Then storage in the room temperature. After that, storage in for one day at 50 oC in oven.

7. Drying of gelatin

The cooled and hardened gelatin was removed from the mold and then dried in a drying cabinet at 50 oC until the moisture content is less than 16% for 48 hours.

8. Gelatin powder

Gelatin was blender until it becomes powder.

9. Packaging

Powder gelatin is stored in a plastic.

Physico-chemical analysis

Analysis of gelatin produced from the skin of chicken leg, such as sensory test, yield, pH and moisture content.

Statistical analysis

Data obtained from the results of subsequent studies analyzed by one-way analysis of variance (ANOVA) and if there is any significant difference then continued by test using Duncan's Multiple Range Test (DMRT) at the 5% significance level ($\alpha = 0.05$) with SPSS for Windows version 16.

RESULTS AND DISCUSSION

Sensory test of gelatin

Sensory tests include form, taste, color, and smell. The resulting gelatin has a

powder form, the taste of chicken feet is not strong, pale yellow to colorless, and non-stinging smell, both fishy smell from chicken feet or odor from solvents. The test results obtained were compared with the existing gelatin standard in Indonesian Pharmacopoeia and SNI (Indonesian National Standard). In Indonesian Pharmacopoeia, the description of gelatin is in the form of sheets, chips, powders or granules, colorless or pale yellow, smell and weak taste (MOH, 1979). In SNI -01-3735-1995 it is stated that the quality requirements for gelatin are colorless to pale yellowish, normal odor and taste. Based on the Indonesian Pharmacopoeia and SNI standards it can be concluded that the gelatin produced meets the requirements, in accordance with the Pharmacopoeia and SNI -01-3735-1995. Organoleptic test results can be seen in Table 1.

Table 1. Sensory test of gelatin

NaOH concentration (%)	Soaking time (hour)	Sample	Results		
			Color intensity	Taste	Odor
1 %	72 hours	1	Yellow	Neutral	Fishy
		2	Yellow	Neutral	Fishy
		3	Yellow	Neutral	Fishy
1.5 %		1	Dark Yellow	Neutral	Fishy
		2	Dark Yellow	Neutral	Fishy
		3	Dark Yellow	Neutral	Fishy
3%		1	Pale Yellow	Neutral	Fishy
		2	Pale Yellow	Neutral	Fishy
		3	Pale Yellow	Neutral	Fishy

NaOH solution obtained from the rest of soaking of the chicken feet skin has a cloudy color. This shows the occurrence of deproteinization process on the skin of chicken feet. Deproteinase or non-collagen protein removal in chicken feet skin is caused by NaOH solution which is able to break down most of the collagen molecular telopeptides in the pre treatment process so that swelling occurs on the skin of chicken

feet (Jaswir et al, 2011). In the treatment using 1% NaOH solution, light yellow color was obtained. This is because the 1% NaOH solution dissolves non-collagen protein, while collagen protein remains stuck in the skin so that the resulting color intensity looks faded. In the treatment using 3% NaOH solution significantly dissolves collagen and non collagen proteins so that the color becomes pale due to the large

amount of collagen protein dissolved in NaOH solution. Whereas in the treatment using NaOH solution with a concentration of 1.5% there was a perfect deproteinization process so that the resulting color became more concentrated.

Yield

The yield is one of the important parameters in making gelatine. Efficient

and effective extraction process of raw materials for making gelatine can be seen from the yield value produced. The greater the yield is produced, the more efficient the treatment is given (Said et al, 2011). The yield was calculated based on the comparison of the gelatine powder produced with the fresh chicken leg skin used. The yield can be seen in Table 2 and Table 3.

Table 2. Yield of gelatine (%)

NaOH concentration	Soaking time (hour)	Yield (%)		
		1	2	3
1%	72 hours	5.88	5.80	5.86
1.5%		7.97	8.00	7.96
3%		4.14	4.14	4.15

Table 3. Yield of gelatin (g)

NaOH concentration	Soaking time (hour)	Yield (g)		
		1	2	3
1%	72 hours	14.70	14.52	14.66
1.5%		19.92	20.01	19.90
3%		10.35	10.36	10.39

The yield of gelatin with 1% NaOH concentration can dissolve non-collagen protein without causing collagen loss in the skin, so the yield obtained is less than that of gelatin soaked in NaOH solution with a concentration of 1.5%. Whereas, the use of 3% NaOH solution is significantly caused collagen loss in the skin during the pre-treatment process, resulting in lower yield rates. The treatment of NaOH with a concentration of 1.5% allows collagen to

have completely dissolved to obtain a higher yield (Liu et al, 2015).

pH

pH value is one important parameter of gelatin quality. The pH value will affect other gelatin properties such as viscosity, gel strength, and melting point. Gelatin with neutral pH, its use will be wider because it is more stable (Astawan, 2002). The pH of gelatin can be seen in Table 4.

Table 4. The pH value of gelatin

NaOH concentration	Soaking time (hour)	pH value		
		1	2	3
1%	72 hours	7	7	7
1.5%		7	7	7
3%		7	7	7

The pH of the gelatin obtained is neutral, which means that the gelatin produced has met the requirements. The pH value of gelatin is very dependent on the stage of the washing process. Optimal

washing can remove the soaking solution (NaOH). This is necessary because alkaline solutions can cause further hydrolysis and reduced quality of gelatin.

Moisture content

Water is an important ingredient in food. The role of water in foodstuffs is influencing in metabolic processes such as enzyme activity, microbial activity, chemical activity, namely the occurrence of rancidity and non-enzymatic reactions that cause changes in organoleptic properties and nutritional value (Astawan, 2002).

Determination of water content is to determine the water content contained in gelatin. The water content in gelatin will

greatly affect the storage power due to its relation to metabolic reactions that occur during the gelatin stored (Setiawati, 2009).

Based on the requirements according to the Indonesian National Standard or SNI, the maximum gelatin moisture content is 16%. While the gelatin requirements according to FAO, gelatin water content is not more than 18%. The results of the water content analysis of gelatin from chicken feet skin extract can be seen in Table 5.

Table 5. Water content of gelatin

NaOH concentration	Soaking time (hour)	Water content (%)		
		1	2	3
1%	72 hours	8.5	12.2	12.2
1.5%		13	14.5	11.3
3%		8.3	7.03	6.03

The range of moisture content of chicken feet skin extract gelatin from 3 types of NaOH concentration as a soaking liquid is 6.03% -14.53%. This value is still in the range of water content permitted by the Indonesian National Standard (SNI, 1995) for gelatine which is a maximum of 16% and FAO requirements (JECFA, 2003) may not exceed 18%.

CONCLUSION

The test results of physical and chemical characteristics of gelatin of chicken feet skin extract stated that a good soaking solution was a NaOH solution with a concentration of 1.5%. This is because the NaOH with a concentration of 1.5% allows collagen to dissolve completely to obtain a higher yield. In addition, the value of acidity (pH), water content and sensory test of gelatin extract of chicken skin with 1.5% NaOH solution has been in accordance with the requirements stipulated in the SNI and FAO even though the value of the obtained water content is quite high.

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