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THE CHARACTERISTICS OF COWSKIN GELATIN PRODUCED FROM CURING ACETIC ACID CONCENTRATION

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Abstract

Gelatin is a denaturalized protein that is derived from collagen by acidic or alkaline hydrolysis and is an important functional biopolymer that has a very broad application in many industrial fields. This research was aimed to determine the effect of acetic acid concentration on characteristics of cowskin gelatin. The experiment used Completely Randomized Design (CRD) with two factors and three replicates of treatment. The first factor was concentration of acetic acid solution, consisted of (2.5, 5 and 7.5%. The second factor was soaking time in acetic acid (12, 24 and 36 hours). The result showed that concentration acetic acid solution had no significant effect (P>0.05) on the viscosity value but had significant effect (P<0.01) on the gel strength, yield, protein content and sensory test of cowskin gelatin. The soaking time had no significant effect (P>0.05) on the yields, gel strength, viscosity and protein content of gelatin. It was concluded that the best characteristics of cowskin gelatin was produced from curing 5% acetic acid concentration with soaking time 36 hours due the gel strength value, viscosity, yield and protein content of gelatin which are optimal and sensory test acceptable by panelists.

Key words*: acetic acid, cowskin, gelatin,*

INTRODUCTION

Gelatin is a denaturalized protein that is derived from collagen and is an important functional biopolymer that has a very broad application in many industrial fields. Gelatin is a protein of animal origin, that can be obtained from collagen by acidic or alkaline hydrolysis. Its functional properties depend on processing conditions as well as the raw material (Liu & Guo, 2008, Sompie et al., 2018, Sompie et al., 2019).

Animal age also influences the protein content of skin collagen, which increases with animal age, protein collagen and fibrous collagen growing stronger (Ockerman & Hansen, 2000). Gelatin production require a curing step to improve its quality. Curing materials from the group of acids have been widely applied in gelatin production (Pranoto et al., 2006; Said et al., 2012).

The use of cowhide as raw material for extraction gelatin (Sugihartono, 2014) and gelatin from Bali cowskin by using lime solution immersion (Mokoolang et al., 2019) has been studied but the effect of acetic acid concentration and curing time to produce gelatin from cowskin was limited information. Thus, this research was conducted to study the effect of combination between different concentration acetic acid solution and soaking time on characteristics of cowskin gelatin.

MATERIALS AND METHODS

Gelatine was prepared by the acid extraction method (Ockerman & Hansen, 2000). Acetic acid (CH_3COOH 0.5M) concentrations of 2.5%, 5% and 7.5% (v/v) were used for hydrolysis. First, the clean cowskin was cut into small pieces and then soaked in a lime solution of $Ca(OH)_2$ for 48 hours, after that, it was washed with running water until clean, then soaked in several concentrations of acetic acid solution, 2.5%, 5% and 7.5% as a treatment. The raw material was soaked at different time immersion of acetic acid solution 12 hours, 24 hours and 36 hours. After soaking samples were neutralized to pH 6, weighed and extracted. The extraction process was performed on three steps (each step for 3 hours), the first step at 50^0C, second step at 55^0C and then at 60^0C. Solubilized gelatin was separated from residual skin fragments by filtration through a nylon filter. The extracted gelatin was concentrated at 70^0C for 5 hours and it was stored in the refrigerator 5-10^0C for 30

minutes, then dried at 60^0C for 24-36 hours until the gelatin sheet solid. Gelatin sheets were milled and packaged in vacuum plastic and stored in a desiccator for subsequent process.

Method of analysis

Gel strength was determined with a Universal Testing Machine (Zwick/Z.0,5). Gelatin solution 6,67% w/v (6,67 grams to 100 ml distilled water) was heated at 60^0C to dissolve the particles. Solution in the container Ø5 cm and height 6 cm was stored at 5^0C for 16-18 hours. Gelatin was placed at the bottom of the plunger (Ø=13mm). Measurement was conducted at the temperature of 10^0C and the speed 10 mm/min as deep as 4 mm was used as plunger. The value of gel strength (g Bloom) uses the formula = 20 + 2,86 x 10^{-3}D, where D = F/G x 980; F = height chart before fracture; G = constant (0,07)

Viscosity was measured by gelatin powder dissolved in distilled water at a temperature of 40°C with a solution concentration of 6.67%. The values were measured by Stromer Viscosimeter Behlin CSR-10. The results obtained were expressed in centipoise according to the method Gomez

The yield is obtained from the comparison between the weight of dry gelatin produced with fresh skin weight.

Yield = weight of gelatin / weight of fresh skin x 100%

Protein content FOSS Kjeltec 2200 was used to determine protein content. A total of 0,5 g of sample + ¼ bussino tablet + 12 ml H_2SO_4 was concentrated in the destruction of the tube FOSS at ± 410^0C for 1 hour. The result of destruction was distilled with thio-NaOH 40% + H_3BO_4 4% + BCGMR indicators. A total of 150 ml was distilled in Erlenmeyer glass and titrated with 0,099 N HCl until the colour changed from blue to pink. Five points fifty-five was used as the conversion factor of gelatin protein. The protein content (%) was calculated using the formula (ml HCL–ml Blanko) x N HCL x 14,0008 x 100 x 5,55)/g sample x 1000.

RESULTS AND DISCUSSIONS

Gel Strength

Gel strength of gelatin is very important on physical properties of gelatin. The average gel strength of cowskin gelatin is displayed in Table 1. Statistical analysis indicated that the soaking time in acetic acid gave highly significant effect ($P<0.01$) while the level concentration of acetic acid and their interaction had no significant effect ($P>0,05$) on cowskin gelatin. The value of gel strength tended to decrease with increasing level of acetic acid concentration. Gel strength values from cowskin gelatin was ranged 73.31 - 78.30 g Bloom, that in line with the criteria of ISO 75-300 g Bloom (Said et al, 2011). The presence of hydroxyproline caused the stability of the hydrogen bonds between water molecules and free hydroxyl groups of amino acids in gelatin, it is very important for gel strength. The gel formation of a stable condition that ability of a free chain to form a lot of crosslinking (Sompie et al., 2019).

Viscosity

The average viscosity of cowskin gelatin is displayed in Table 1. Statistical analysis indicated that the interaction between concentration of acetic acid and soaking time had no significant effect ($P>0,05$) on cowskin gelatin. The value of viscosity tended to decrease with the increasing of acetic acid concentration. This is because the viscosity of gelatin is directly proportional to the gel strength that was not significantly different between treatments (Said et al., 2001). Sompie et al. (2020) explained that viscosity is affected by molecular weight and amino acid chain length. Increased concentrations of acetic acid in the gelatin production process can reduce the viscosity. The curing material has been breaking the peptide bonds of amino acids into short-chain molecule so that its viscosity decrease. Viscosity values from cowskin gelatin was ranged 6.03 to 7.27 cP. It values is included in the ISO range 2.0 to 7.5 cP (Said et al., 2011).

Protein Content

Gelatin is a collagen protein, a group derived from the structural proteins and extracellular matrix and produced in large quantities (Said et al, 2011; Sompie et al., 2015**).** Statistical analysis indicated that the soaking time of acetic acid had highly significant effect ($P<0.01$) on protein content of cowskin gelatin, while the concentration of acetic acid and the interaction between these two different factors had not significant effect ($P> 0.05$) on levels of protein gelatin. Duncan test results showed that protein

content of gelatin from cowskin had a tended to increase with age increasing. According to Swatland (1984), age at slaughtering influences the content of collagen in the skin, increasing age increased the level of collagen protein. Protein content from cowskin gelatin ranged 86.14 to 89.04 %. That it was not different with protein content from chicken leg skin ranged 83-90 % and commercial gelatin, 91, 63% (Hasdar, 2012; Said et al., 2011).

Yield

Results shows that the acetic acid concentration in cowskin gelatin had no significant effect ($P< 0.05$) to the yield value. This means that the yield of cowskin gelatin was the same for all three concentrations of acetic acid. There was no effect of acetic acid concentration on gelatin yield because of the concentration range used in this study was only 2.5 percent different, so although there was an increase in yield for each treatment, the increase was very small. The yield value is influenced by the concentration of the acetic acid solution. The increasing yield is related to a large amount of collagen converted and transformed to gelatin (Kolodziejska et al., 2008). Total yield value is affected by the concentration of the acetic acid solution used in immersion. The increase in yield is related to amount of collagen converted to gelatin (Sompie et al., 2019).

Table 1. The Characteristics of cowskin gelatin

Parameters	Acetic acid (%)	Soaking time (hours) + Sd			Average
		12	24	36	
Gel strength (g Bloom)	2.5	78.30±0.02	75.10±0.02	73.31±0.03	75.57±0.13
	5	75.08±0.40	74.18±0.10	75.04±0.21	74.76±0.02
	7.5	76.20±0.12	74.02±0.02	74.04±0.12	74.75±0.03
	Average	76.52±0.02^{c}	74.43±0.01^{d}	74.13±0.02^{d}	
Viscosity (cP)	2.5	7.21±0.01	7.24±0.01	7.27±0.01	7.24±0.32^{a}
	5	6.16±0.06	7.17±0.04	7.18±0.06	6.83±0.22^{b}
	7.5	6,03±0.07	6.06±0.07	6,86±0.07	6.32±0.14^{a}
	Average	6.47±0.05^{c}	6.82±0.53^{c}	7.10±0.34^{d}	
Yield (%)	2.5	12.22±0.21	13.04±0.20	11.25±0.11	12.17±0.21
	5	12.16±0.03	12.36±0.33	12.06±0.23	12.16±0.13
	7.5	12.03±0.07	12.01±0.12	13.03±0.02	12.19±0.04
	Average	12.13±0.05	12.47±0.21	12.11±0.25	
Protein content (%)	2.5	88.04±0.57	89.04±0.57	89.04±0.57	88.70±0.12^{b}
	5	88.50±0.07	88.30±0.07	88.50±0.07	88.62±0.31^{ab}
	7.5	88.14±0.23	87.14±0.23	86.14±0.23	87.13±0.02^{a}
	Average	88.23±0.12^{c}	88.16±2.27^{c}	87.89±3.02^{d}	

Different letters in the same row same row and column indicated the significant differences ($P<0.05$)
Sd = standard deviation

Figure 1. Comparison of physical appearance of cowskin gelatin using acetic acid 2.5, 5% and 7.5%

Sensory Test

The sensory test is one of the assessment factors besides the physical and chemical properties of a product and have a high relevance to the quality of the product because it is directly related to consumer tastes. Based on the results of the researcher's subjective identification of the physical appearance of the product.

The figure 1 above showed that physically the main difference of gelatin produced using acid curing material with base differs in colour and texture of granule while the shape and odour are relatively the same. Comparison of visual appearance of cowskin gelatin products produced by using acetic acid curing concentration (2.5, 5 and 7.5%). Sensory test has high relevance to product quality because it is directly related to consumer tastes (Said, 2011). Humans are panelists who can sometimes be affected by physical and mental conditions, so panelists become bored and degrade their sensitivity. Gelatin is uncolored to yellowish or light brown and have no odour and tastes. Gelatin produced either by acid or base process is not much different from the quality standard required by SNI, shaped sheets, pieces, have a coarse or fine powder texture

CONCLUSIONS

It was concluded that the best characteristics of cowskin gelatin was for that produced from curing with 5% acetic acid concentration for 36 hours soaking time; this is due to its better gel strength value, better viscosity, yield and protein content of gelatin which are optimal and sensory test acceptable by panelists.

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REFERENCES

Hasdar, M. (2012). Karakterisasi *edible film* yang diproduksi dari kombinasi gelatin kulit kaki ayam dan soy protein isolate. Tesis. Fakultas Peternakan Universitas Gadjah Mada Yogyakarta

Kołodziejska, I., Skierka, E., Sadowska, M., Kołodziejski, W., & Niecikowska, C. (2008). Effect of extracting time andtemperature on yield of gelatin fromdifferent fishoffal. *J. Food Chem*., 107, 700-706.

Liu, H.Y., Han J., & Guo, S.D. (2008). Characteristics of the gelatin extracted from channel catfish (*Ictalurus punctatus*) head bones. *Food Sci and Tech*, 43 (2), 313-317.

Mokoolang, S., Sompie M., & Wahyuni, I. (2019). Pengaruh konsentrasi Larutan kalsium hidroksida ($Ca(OH)_2$ gelatin kulit sapi terhadap karakteristik fisik dan kimia. *J. Agri SosioEkonomi*, 15 (3), 217-224.

Muyonga, J. H., Cole., C.G.B, & Duodu, K.G. (2004). Extration and physic-chemical characterization of Nile perch (*Lates niloticus*) skin and bone gelatin. *Food Hydrocolloids*, 18, 581.

Ockerman, H.W., & Hansen, C.L. (2000). *Animal by product processing and utilization*. Boca Raton, USA: CRC Press Publishing House.

Pranoto, Y., Chong, M.L., & Park, H.J. (2006). Characterizations of fish gelatin films added with gellan and x-carrageenan. *J. Food. Sci and Tech*., 40, 766-774.

Said, M.I., Triatmojo, S., Erwanto Y., & Fudholi, A. (2011). Gelatin properties of goat skin produced by calcium hydroxide as curing material. *Media Peternakan*, 34(3), 184-189.

Sompie, M., Triatmojo, S., Pertiwiningrum A., & Pratono, Y. (2012). The effect of animal age and acetic concentration on pigskin gelatin characteristic. *J. of Indonesia Tropical Animal Agriculture*, 37 (3), 176-182.

Sompie, M., Surtijono, S.E., Pontoh, J.W., Lontaan, N. (2015). Effect of Acetic Acid concentration and temperature extraction on physical and chemical properties of pigskin gelatin. *Procedia Food Science, 3* (1), 383-388

Sompie, M., Siswosubroto, S.E., & Pontoh, J.H.W. (2015). Effect of acetic acid concentration and curing time on the characteristics of native chicken legs skin gelatin. *Proceedings The 6th ISTAP,* 2, 714-718.

Sompie, M. & Triasih, A. (2018). Effect of extraction temperature on characteristics of chicken legskin gelatin. *IOP Conference Series: Earth and Environmental Science,* 102(1), doi: 10.1088/1755-1315/102/1/012089

Sompie, M., Siswosubroto, S.E., Rembet, G.D., & Ponto, J.W. (2019). Effect of different types of acid solvent on functional and microbiological properties of chicken leg skin gelatin. *IOP Conference Series: Earth and Environmental Science,* 387(1), doi: 10.1088/1755-1315/387/1/012128.

Sugihartono (2014). Kajian Gelatin dari kulit sapi limbah sebagai renewable flocculants untuk proses pengolahan air. *J. Industri Res*., 8, 179-190.

Swatland, H.J. (1984). *Structure and development of meat animals*. New Jersey, USA: Prentice-Hall Inc, Englewood Cliffs.

Wang, L., Auty, M.A.E., Rau, A., Kerry, J.F., & Kerry, J.P. (2008). Effect of pH and addition of corn oil on the properties of gelatin based biopolymer film. *J. of Food Engineering*, 90 (1), 11-19.

Wulandari, A., Supriadi, & Purwanto, B. (2013). Pengaruh defating dan suhu ekstraksi terhadap karakteristik fisik gelatin tulang ikan babus. *Jurnal Fishtech*, 2(1), 38-45.