

PHYSICOCHEMICAL CHARACTERISTICS OF EXTRACTED GELATIN FROM CHICKEN FEET AT DIFFERENT TEMPERATURES

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Abstract – The aim of this study was to investigate the effect of extraction temperature on physicochemical characteristics of gelatin from chicken feet. Chicken feet were soaked in acidic solution (0.1 N HCl) for 24 h and washed using water until the pH was 5.5. The neutralized chicken feet were heated at 65, 75, 85, and 95°C for 2 h, respectively. The extracted gelatin was freeze-dried and made 4% gel (w/v) using distilled water. For physicochemical properties, extraction yield, gel strength, and melting point were analyzed. The extracted gelatin at 95°C showed the lowest and highest values in extraction yield and gel strength ($P<0.05$), respectively. A significantly higher melting point was observed in extracted chicken feet gelatin at 65 and 75°C compared with extracted ones at 85 and 95°C. In conclusion, different extraction temperature led to difference in physicochemical properties of chicken feet gelatin. Therefore, the chicken feet gelatin could be utilized as extracting the gelatin with different physicochemical properties by controlling temperature depending on the purpose of the application.

Key Words – collagen hydrolysate derived from poultry by-product, extracting condition, utilization of animal by-product

I. INTRODUCTION

Over the past few decades, consumption of chicken meat has continued to rise in the world due to its health benefit including well-balanced amino acids, low-fat, and low calorie [1]. This phenomenon has been also led to an increase in chicken by-product such as feet, bone, heart, liver, etc. However, application of the by-products from chicken was limited as human food source. Gelatin which has unique functional and technological properties is widely used in food, pharmaceutical, and cosmetic applications [2]. However, frequent outbreaks of bovine spongiform encephalopathy (BSE) and foot/mouth diseases have been a barrier to be used, and thus trial to use new gelatin sources such as poultry skin, feet, and bone has been gradually increased to replace mammalian resources [3]. Therefore, the objective of this study was to determine physicochemical properties including extraction yield, gel strength, and melting point of extracted gelatin from chicken feet at different temperatures and the applicability of chicken feet as gelatin source.

II. MATERIALS AND METHODS

Preparation of chicken feet gelatin

Chicken feet (broiler) with skin were washed using tap water and soaked in acidic solution (0.1 N HCl) for 24 h and washed using water until the pH was 5.5. To extract gelatin, the neutralized chicken feet was heated at 65, 75, 85, and 95°C for 2 h, respectively.

Physicochemical characteristics

The extracted gelatin was frozen at $-70 \pm 1^\circ\text{C}$ and dried at -40°C under 80×10^{-3} torr pressure using a freeze-dryer (PVTFD20R, Ilshinlab, Korea). The 4% (w/v) gel sample was made with extracted gelatin and distilled water and cooled at 10°C . Extraction yield was determined by calculating the weight differences of sample before and after extraction. Gel strength and melting point were measured using Texture Analyzer (TA.XT2, Stable Microsystems LTD, UK) at 8°C and melting point analyzer (ATM-01, AS ONE, Japan), respectively.

Statistical analysis

Data was analyzed using General Linear Model (GLM) procedure with the fixed effect (extraction temperature) and the random effect (chicken feet and manufacturing day). Mean values with standard deviation of means were reported and the Duncan's multiple range test ($P<0.05$) was used to determine differences between treatment means.

III. RESULTS AND DISCUSSION

Physicochemical characteristics of chicken feet gelatin

Extraction yield was significantly increased with increasing extraction temperature (Table 1). This result might explain that higher amounts of hydrolysis were occurred from cross-linkages of collagen and other proteins at higher temperature [4]. In general, higher gel strength ($P<0.05$) was observed as decreasing extraction temperature because it contained higher amounts of proline and hydroxyproline compared to extracted gelatin at higher temperature. Furthermore, the extracted chicken feet gelatin at 65 and 75°C had the highest melting point compared to extracted one at 85 and 95°C ($P<0.05$).

Table 1. Physicochemical properties of extracted gelatin from chicken feet at different temperatures

Traits	Extraction temperature (°C)			
	65	75	85	95
Extraction yield (%)	64.1 ± 0.87 ^c	83.0 ± 0.82 ^b	82.1 ± 0.84 ^b	89.2 ± 0.93 ^a
Gel strength (g)	410.4 ± 29.53 ^a	305.3 ± 21.89 ^b	293.0 ± 27.24 ^b	225.4 ± 19.97 ^c
Melting point (°C)	38.5 ± 0.41 ^a	37.88 ± 0.63 ^a	36.50 ± 0.41 ^b	36.38 ± 0.48 ^b

All values are mean ± standard deviation.

^{a-c} Means within a row with different letters are significantly different ($P<0.05$).

IV. CONCLUSION

The results of this study suggested that extracted chicken feet gelatin at different temperatures could be used for their purpose in various areas due to its different physicochemical properties depending on extraction temperature. Thus, in this study, the applicability of extracted chicken feet gelatin by controlling temperature was presented as alternative to mammalian resources.

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