Effect of Desalting by Electrodialysis on the Cleaning Properties of Salted Duck Eggs

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Keywords: Duck Egg White, Desalination, Physical and Chemical Properties, Functional Properties

Abstract: Objective: in order to evaluate the effect of electrodialysis desalination on the functional and nutritional properties of duck egg white, the physical and chemical properties of duck egg white after electrodialysis desalination were investigated. Results: when the protein concentration of decolorized duck protein was low (5-8g / 100ml), there was no significant difference between decolorized duck protein and fresh duck protein. When the protein concentration was 3-9g / 100mL, compared with salted duck protein, the emulsifying activity and foaming ability were improved. Compared with duck 's egg protein, the emulsifying activity is the same, and the foaming property is better than duck' s egg protein. SDS-PAGE, DSC and amino acid analysis showed that there was no significant change in the relative molecular weight of salted duck egg protein before and after desalination. Conclusion: after electrodialysis and desalination, the physical and chemical properties of duck protein have little effect, so it can be used as a good raw material for food.

1. Introduction

Protein is mainly albumin, which has high biological value. At the same time, it also has many unique functions such as foaming, emulsification, gelation, water retention and so on [1]. The chemical composition and pattern of egg white protein are the same as that of egg white protein. All of these proteins contain eight essential amino acids, especially thioamino acids, which are high-quality full valence proteins. Duck eggs have a fishy smell, so 90% to 94% of eggs are used to treat eggs and yolks. It is predicted that billions of salted duck egg yolks will be used in traditional foods such as moon cakes and rice dumplings every year in China. At the same time, millions of tons of salty protein people leave every year. The salt content of salted eggshell is about 10%, and the salt content of salted eggshell powder is about 35%. High salt content in the food industry greatly limits the use of salted protein. At present, only a small amount of salted eggs are used in the treatment of feed, Frankfurter and noodles, which are almost rotten before use, polluting the environment and wasting resources. Therefore, the effective desalination of salted protein is the key to the comprehensive utilization of salted protein. At present, the common methods are: additional filtration, ion exchange chromatography, electrodialysis, etc. The principle of electrodialysis (ED) desalination is to use the electric potential difference as the driving force under the action of DC electric field. In order to achieve the purpose of deionization, the selective permeability of ion exchange membrane is used to separate electrolyte. Filtration and the same, the very significant problem on ED is membrane pollution. The effective solution of ED floating ring is to use electrodialysis inversion, that is, at a certain interval of switch, the movement direction of ED negative electrode ions changes. The original diluted leftovers become thick leftovers, and the original re diluted leftovers become thin leftovers. Therefore, any container will not be in a strong concentration polarization state, but will become weak [2]. It realizes the function of ED self filtration, excellent ed self washing and membrane fouling. At present, the ED desalination of salted

  DOI: 10.25236/wccbm.2020.035

duck egg protein has been studied systematically. The desalination rate was over 95%, and the recovery rate of protein was over 90%. According to the survey, the smell of salted duck eggs will decrease after desalination. In order to investigate whether the physical and chemical properties of duck eggshell protein before and after desalination were studied, the additional value of salted eggshell provided the basis. Please refer to the literature report.

2. Materials and Reagents

Duck eggs on the market; duck and egg shell (the concentration of protein content is about 105 g / L, and the mass concentration of normal saline is about 50g/L) Health Food Co., Ltd. sodium acetonitrile sulfate, acrylamide, methylpropionamide, ammonium persulfate, glycerin, glacial acetic acid, tetramethylethylenediamine and bromophenol blue [3]. Mercapto containing ethanol and glycine are all domestic analytical grade; natural gas chemical company of the United States; SDS-PAGE standard protein Shanghai China Institute of Biochemistry.

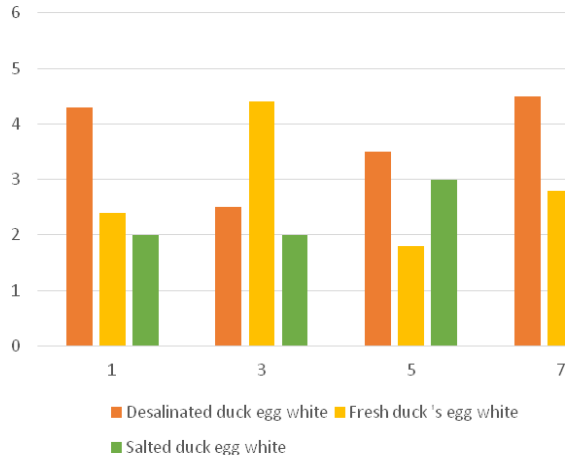

Figure 1 Comparison of emulsification stability of duck egg white with different protein concentration before and after desalination

2.1. Instruments and Equipment

Fe3El30 conductivity meter, Fe20El20 pH meter Mettler instrument, uv-2000 spectrophotometer unicodycz-24dn electrophoresis apparatus Beijing Liuyi Instrument Factory; alpha1-4ld vacuum freeze dryer German Marlin Christian company. British stable microsystem with physical property tester.

2.2. Desalination of Salted Duck Egg White by Electrodialysis

According to the electrodialysis method established in this study, duck protein was salted. The salt removal rate was 95.02%, and the protein recovery rate was 92.65% [4]. The desalinated duck protein is freeze-dried to obtain the desalinated duck protein powder it uses. Salted duck protein and fresh salted duck protein were freeze-dried as control oil.

2.3. Determination of Gel Properties

The gel properties of duck 's egg protein were measured by physical property analyzer. Duck 's egg white solution was prepared by adjusting the pH value to 7 mol/L NaOH, then poured the duck' s egg white liquid into the beaker of 10ml and put it into a glass vacuum dryer. 1 hour air, phase change film covering, rubber tape fixing, heating in a certain temperature water bath at 90℃ for 30 minutes, immediately stored in a 4℃ refrigerator, cool overnight[5]. After returning to room temperature, the gel is measured in the physical tester. Natural measurement condition: in order to measure the hardness of protein gel, please use TPA mode. The equipment condition is probe, pre straightening is 5mm/s, test speed is 2mm/s, test speed is 5mm/s, compression ratio is 40%. The time interval was 5s. three parallel experiments were carried out for each sample, and the average

value was taken.

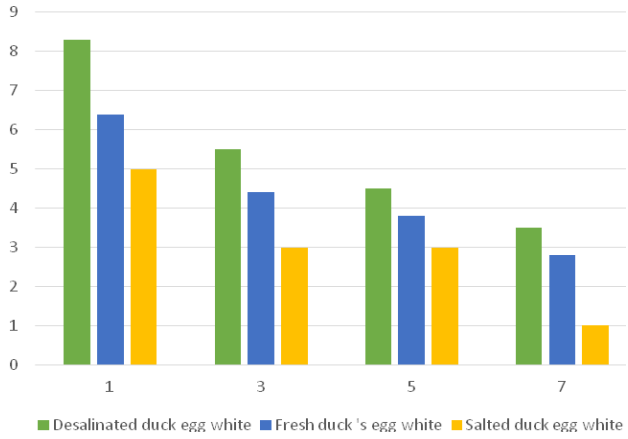

Figure 2 Comparison of emulsifying activity of duck egg white with different protein concentration before and after desalination

3. Analysis of Functional Properties of Duck Egg White before and after Desalination

The process of protein gel heating is the process of protein denaturation and aggregation, forming a three-dimensional network structure. The gel strength of three duck 's egg proteins increased with the increase of protein quality [6]. The mass concentration of protein was between 5 ~ 8g/100mL, and the gel strength did not change significantly. When the mass concentration of protein was greater than 8g / 100mL, the gel strength of the 3 duck 's egg proteins increased significantly. The protein gel network consists of a few non communal combinations of hydrophobic interaction, hydrogen bonding, electrostatic interaction, and two cyanamide binding. During gel formation, the exposure of hydrophobic groups promoted the Sultan like group. With the increase of protein concentration, the hydrophobic interaction between molecules increases, and the degree of intermolecular bridging increases, which contributes to the formation of gel network structure. In addition, salt hardness of salted duck protein is higher than that of bleached duck protein and duck protein. When the protein concentration was more than 6g/100mL, the difference was effective ($P < 0.01$). This is because salt ions in salted duck egg will affect the protein interactions in the formation of protein gels. Compared with fresh duck protein, when the protein concentration is less than 8g/100mL, the gel hardness of dropped duck protein will be reduced, but the difference is not important [7]. That was significantly higher than that of desalted duck egg white ($P < 0.01$). The duck 's egg protein was close to 8g / 100mL, suggesting that the shedding duck' s egg protein had a gel hardness similar to that of fresh duck protein.

Table 1 Chromaticity analysis of duck egg white powder before and after desalination

Types of protein powder	L	a	b
Salted duck egg white powder	96.09±0.27	0.40±0.10	4.40±0.20
Desalinated duck egg white powder	91.97±0.81	1.21±0.09	6.92±0.31
Fresh duck egg white powder	91.99±0.66	−1.52±0.07	6.50±0.23

4. DSC Analysis Results of Duck Egg White before and after Desalination

The heat denaturation temperature of duck eggshell, fresh duck eggshell and fresh duck eggshell were 76.0, 79.6 and 80.6℃, respectively. Duck 's egg shell and duck' s egg shell temperature were not changed much. But the duck egg shell ratio of salted duck 's egg shell was higher than that of the duck egg shell. Na + can protect the negative charge of proteins, reduce the electrostatic repulsion between proteins, reduce the water protein interaction, improve the protein protein interaction, and make proteins easy to agglomerate [8]. It is suggested that normal saline can induce protein denaturation. Using egg supermarket salted duck fluorescence microscopy, the

microstructure of salted duck egg was observed and gel formed. The larger the floc, on the contrary, the lower the content of normal saline, the more uniform the observed fluorescence structure. There is no normal saline, duck eggshell protein, and the protein is formed in smaller clusters, that is, the protein structure can destroy the order.

5. SDS-PAGE Analysis Results of Duck Egg White before and after Desalination

The SDS-PAGE images of duck protein and salted duck protein contain 7 bands, no matter the band position, width and color depth, there is no significant difference between them. This indicated that the protein composition and content of salted duck had no significant change before and after desalination. Compared with the fresh duck eggshell protein, there are two redundant bands around the 100 KD salted duck eggshell and salted duck eggshell respectively, but that is the possibility of breaking down and decomposing the molecular protein chain in the hardening of opal. The results of amino acid analysis of duck eggshell powder showed that there was no change in 17 amino acid composition of duck eggshell powder after desalination, and the total amino acid content was about 85%. After that, it was chicken desalination by electrodialysis, and there was no significant change in amino acid composition and content. The total amino acid content of salted duck protein is about 30% less than that of egg white [9]. This is because the salt content of salty protein powder is high, which is reported to be about 35% higher in literature.

6. Chroma Analysis Results of Duck Egg White before and after Desalination

Compared with the fresh duck protein powder, there was no significant difference in the L and b values of bleached duck protein powder. The L value of both was significantly lower than that of salted duck protein powder ($P < 0.01$). This is because the salted duck egg used in this experiment is a by-product of salted duck egg yolk. Compared with the fresh powder, the a value of the powder was higher ($P < 0.01$). Duck protein powder contains about 1/3 of normal salt water crystal. Therefore, the L value of salted duck protein powder is higher than that of desalinated salted duck protein powder and fresh salted duck protein powder [10]. Generally speaking, the pink difference between the chicken egg white powder and the fresh duck egg shell powder is Dirac $e < 1$. The naked eye cannot recognize the color difference. The color of the desalinated duck egg shell powder and the fresh duck egg shell powder is similar.

7. Conclusion

When the concentration of protein is 5-8g / 100mL, the gel hardness of duck protein after molting is different from that of fresh duck protein. When the concentration of protein is 3-9g / 100mL, the emulsifying activity of desalinated duck protein is increased. In addition, there was no significant difference between the fresh duck egg shell and the comparison of emulsifying activity, but the influence of foaming, protein structure, charge distribution, rheology and other properties on the normal saline caused no significant change in the relative molecular weight of the protein before and after desalination. The amino acid composition, thermal denaturation temperature and color of the desalinated duck protein are very close. It is suggested that electrodialysis desalination will not affect the physical and chemical properties of duck protein and can be used as a good food raw material.

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