Application of Carrageenan on Quail Nugget without Seasoning Stored At Room Temperature

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ABSTRACT

The instability of dough emulsion system has been a problem that often occurred in meat processing. Preventative measures for the emulsion system to be non-breakable and durable were the addition of stabilizers or binders. One of the natural binding agents and also having antibacterial activity that can be used in nugget processing is carrageenan. The purpose of this study was to determine the effect of carrageenan in processing quail nugget stored at room temperature to the early detection of rottenness. The experiment was conducted using Orthogonal Polynomial Test with five treatments of the addition of carrageenan on quail nuggets: (P1 = 0% carrageenan); (P3 = 1% carrageenan), (P4 = 1.5% carrageenan), (P5 = 2% carrageenan) with four replications. Parameters in this study were total bacterial, initial rottenness, and pH. The results showed that P4 yielded the best quail nugget with total bacteria $40x10^5$ CFU/gr, initial time of decay 251,25 minutes, with pH 6,42.

Keywords: Carrageenan, Quail nugget, Bacteria, Initial rottenness, pH

INTRODUCTION

The problem that often occurs during meat processing is the instability of the dough emulsion system. The attempt to maintain the emulsion system to be non-breakable and durable is to add emulsifier as a binder. Meat processing can be performed at room temperature however it is ideal condition for bacteria grow which cause damage to processed foods such as nuggets. Thus utilization of preservative that has antibacterial activity and serves as a natural binder such as carrageenan is needed. Carrageenan is a polysaccharide extracted from red edible seaweed type *Eucheuma cottonii*. It has commonly used as a binder, filler, gelling agent and emulsifier for the food industry. Carrageenan has antibacterial and other biological activity (Ermak, 2006; Andriani, 2015). Flavonoids are antibacterial compounds contained in carrageenan, with a mechanism that can denature bacterial cells and damage cell membranes. Carrageenan is used in food processing to form gel, thicken and produce emulsions (Van de Velde *et al*., 2002). The use of carrageenan in food products

ranges from 0.005% to 2% of the product weight. Generally carrageenan is used in processed meats, food formulations, and the food industry. In the field of Biotechnology, carrageenan is used as a gel material for immobilization (Necas and Bartosikova, 2013)

The purpose of this research was to investigate to what extent carrageenan can increase durability and shelf life of quail nugget without seasoning stored at room temperature.

MATERIALS AND METHODS

The main ingredients used were quail meat and carrageenan. Five kilograms of male quail meat age of 42 to 45 days, with meat weights 45 to 55 grams. Refined carrageenan derived from red seaweed (*Rhodophyceae*) as much as 250 grams, obtained from Pectin Store Yogyakarta. Additional ingredients used were bread flour as a coating, and cooking oil.

The research was conducted using experimental methods with completely randomized design with orthogonal polynomial test on five treatments on the level of carrageenan usage: without carrageenan (P-1), 0,5% (P-2), 1,0% (P-3), 1,5% (P-4) and 2,0% (P-5). Each treatment was repeated four times. The parameters measured were as follows:

1. Detection on time of rottenness
2. Inspection on pH
3. Total bacteria, calculated by the number of colonies/g = the number of colonies per plates x dilution factor

RESULTS AND DISCUSSION

The treatment of Carrageenan on quail nugget had significant effect on time of rottenness, pH and total bacteria. Table 1 below showed the effect of various concentration of Carrageenan (0%, 0.5%, 1.0%, 1.5% and 2.0%) on detection of rottenness, pH and total bacteria.

Based on analysis of variance, the addition of Carrageenan significantly increased the time of rottenness of quail nugget ($P<0.05$). The orthogonal polynomial test results were performed to find out the best response between treatments on the initial time of decay, showing the results significantly affect the cubic regression with the equation $y = 244.05-99.488x+48.054x^2-5.7083x^3$ with the determination level R2 = 99.6%. Figure 1 below illustrated the application of various % Carrageenan on time of rottenness.

Table 1. The Effect of Various Carrageenan Treatment on the Average of Rottenness, pH and Total Bacteria in Quail Nugget

Parameters	Treatments				
	P1	P2	P3	P4	P5
Detection of Rottenness (Hour)	186.5 ± 1.732	193.25 ± 2.362	221.5 ± 4.041	251.25 ± 4.787	234 ± 4.618
pH	6.38 ± 0.006	6.42 ± 0.029	6.42 ± 0.012	6.46 ± 0.021	6.44 ± 0.013
Total Bacteria (x 10^4 cfu/g)	109.5 ± 3.862	95.13 ± 3.038	60.5 ± 4.203	53.37 ± 2.136	57.13 ± 5.359

Notes: all treatment showed
P1 = 0% Carrageenan
P2 = 0.5% Carrageenan
P3 = 1.0% Carrageenan
P4 = 1.5% Carrageenan
P5 = 2.0% Carrageenan

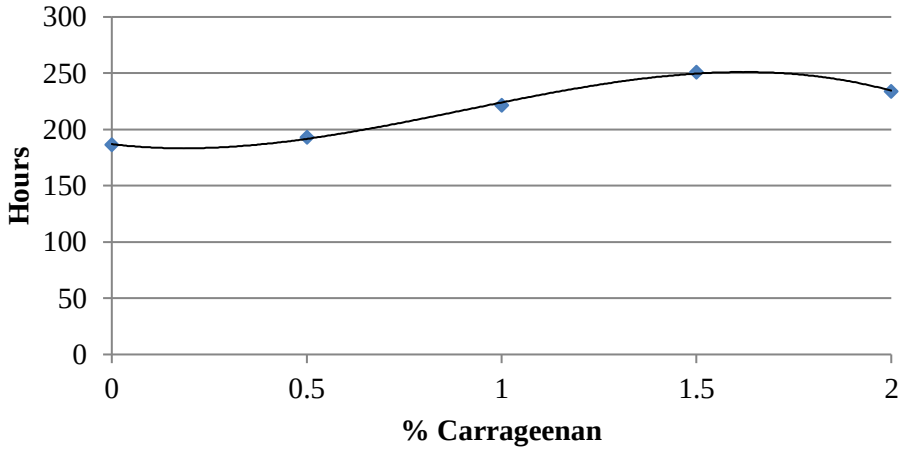

Figure 1. Time of rottenness of quail nugget on various Carrageenan concentrations

Figure 1 above showed the use of Carrageenan as emulsifier on quail nugget tended to slower the rottenness process. Flavonoid compounds in Carragenan are able to slow the activity of microbes to break down proteins. In accordance with the opinion of Dave and Ghaly (2011), microbial activity during meat storage can lead to protein breakdown. Proteins will be degraded into simpler compounds, if this process continues, H_2S compounds will produce. H_2S compounds are formed by several types of microorganism through the breakdown of amino acids containing sulfuric elements such as lysine and methionine. H_2S may also be produced by reduction of inorganic sulfur compounds, such as thiosulfite, sulfite, or sulfate.

The addition of carrageenan had a significant effect on pH of quail nugget (P<0.05). The orthogonal polynomial test showed significant effect on quadratic regression with regression model $y = 6.33+0.0539x-0.0061x^2$ at high coefficient of determination (R^2) = 81,3% indicated carrageenan usage was align with pH by 81,3%. Pearson and Dutson (1994) and Hedrick (1994) suggested that the addition of salt and protein ions gives the effect of pH change, so the more carrageenan added will increase the salt content, resulting in increased pH due to protein denaturation.

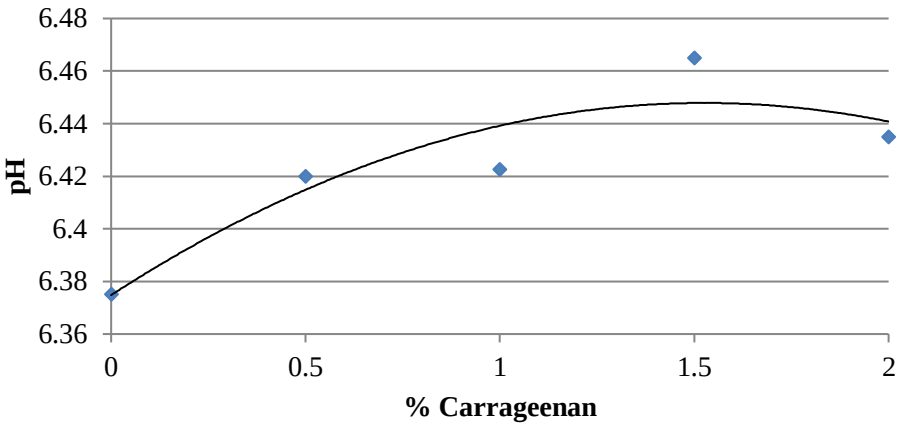

Figure 2. pH of quail nugget on various Carrageenan concentrations

Based on analysis of variance, the addition of carrageenan significantly decreased the total bacteria in the quail nugget (P<0.05). The result of orthogonal polynomial test showed a significant effect on cubic regression pattern with regression model $y =106.72-9.9554x-53.679x^2+23.25x^3$ with coefficient of determination (R^2) = 97,17%. Figure 3 below illustrated effect of application of carrageenan on total bacteria.

The addition of carrageenan to the quail nugget can decrease the amount of bacteria in the quail nugget. In accordance with the opinion of Zulli Andriani (2015) antimicrobials in Carragenan can inhibit Gram positive and Gram negative bacteria.

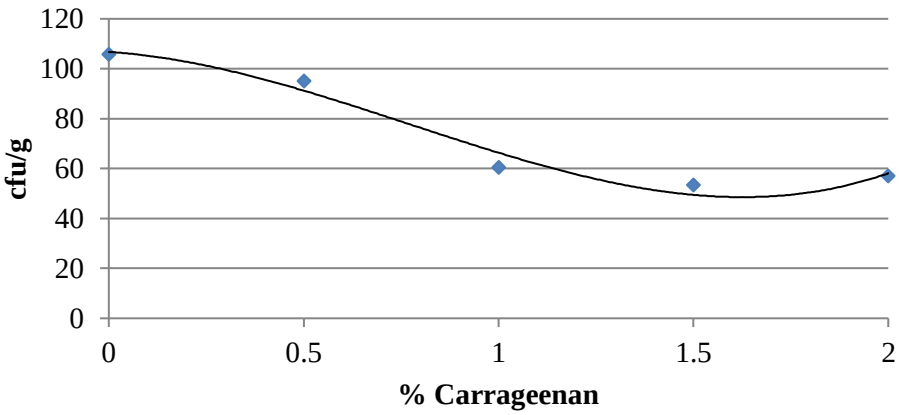

Figure 3. Total bacteria of quail nugget on various Carrageenan concentrations

CONCLUSION

The addition of 1.5% Carrageenan on the quail nugget without seasoning showed the best result based on time of rottenness, pH and total bacteria.

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