Effect of stabilizer type and concentration on the characteristics of black pepper sauce

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Abstract. Black pepper sauce is one type of sauce that widely used in a variety of modern dishes. The stabilizer is used to increase viscosity, forming the body and texture of sauce product. This study aimed to determine the effect of various types of stabilizers on the characteristics of black pepper sauce. There are four types of stabilizers used, namely Carboxy Methyl Cellulose (CMC), xanthan gum, alginate and maltose with concentrations of 0.5 and 1.0%. The variance analysis showed that the type and concentration of the stabilizer had significant effect on the viscosity, pH, and color of the black pepper sauce. The use of 1% CMC produces highest viscosity, 21,414 cP, while 0.5% maltose produces lowest viscosity, 371.05 cP. The use of stabilizer increases the pH value of black pepper sauce from 4.53 to around 4.61–4.75. Furthermore, the use of stabilizers also reduces the lightness and redness of black pepper sauce. The use of stabilizers affects the characteristics of black pepper sauce produced, especially value of viscosity and color of the product.

1. Introduction
Stabilizer is one type of additive that is widely used in the food industry to improve the texture quality of food products. Stabilizers are generally used in liquid and paste products to produce product with the desired texture. Black pepper sauce is a type of sauce that is widely used in various types of food products. Viscosity and texture are important quality parameters in sauce products.

Generally, stabilizers that widely use are from the hydrocolloid or starch groups. Starch and its derivatives often used as stabilizers in various food products. The gelatinization properties of starch produce a gel consistency that plays a role in stabilizing food products. Meanwhile, hydrocolloids have a very large water binding ability, so they are also widely used in the food industry to stabilize food and beverages product. Carboxy Methyl Cellulose (CMC), pectin, xanthan gum, alginate, agar, glucomannan are hydrocolloids that widely used. The characteristics of each type of stabilizer are different so that the type of stabilizer that is suitable for one food product is not necessarily suitable for the others [1–4].

The research regarding the use of stabilizers in sauces have been widely reported. The use of xanthan, k-carrageenan, pectin, sodium alginate and guar gum as stabilizers in manufacture cheese sauces had been conducted by Hassan et al [2]. The using of hydrocolloid on ketchup production also had been reported [5]. Potato starch and xanthan gum as thickening agent used as thickening agent reported by Cai et al [6]. Research on the use of stabilizers in black pepper sauce is still limited. This study aims to determine the effect of using stabilizer on the physical quality of black pepper sauce.
2. Methods
This research was conducted at the Product Development and Analytical Laboratory of Indonesian Center for Agricultural Postharvest Research and Development, Bogor in January-March 2020.

The materials that used were CMC, xanthan gum, alginate, maltose and commercial black pepper sauce, aquades. The equipment that used were measuring cup, Teflon, electrical heater, packaging bottle, stirrer, label, plastic, chromameter, viscometer, refractometer, pH meter.

There was the production process of black pepper sauce with addition of stabilizer: 100 ml black pepper sauce, added with the stabilizer with a concentration according to the treatment, added with 100 ml of water then stir until evenly distributed. The sauce was then heated and stirred at 100°C for 8 minutes and then put into bottle for further analysis. The analyzes carried out were color, viscosity, pH and Total Titratable Solid (TSS).

This study was designed with a completely randomized design. There are 4 types of stabilizer used, namely CMC, xanthan gum, alginate and maltose, at concentrations of 0.5 and 1% so that there are 8 treatments that compared to the control. The data that obtained then were analyzed using ANOVA with $\alpha = 0.05$ using SPSS 22.

3. Results and discussion

3.1. Viscosity

The viscosity of black pepper sauce with the addition of stabilizer ranged from 371.05-21.44.00 cP. The lowest viscosity was at 0.5% maltose treatment and the highest was at 1% CMC. The analysis of variance showed that the stabilizer treatment had a significant effect on the viscosity of black pepper sauce (Table 1).

| No | Treatments      | Viscosity (cP) |
|----|----------------|----------------|
| 1  | Maltose 0.5%    | 371.05$^{a}$   |
| 2  | Maltose 1%      | 1,464.75$^{d}$ |
| 3  | CMC 0.5%        | 1,184.80$^{c}$ |
| 4  | CMC 1%          | 21,414.00$^{b}$|
| 5  | Xg 0.5%         | 2,884.85$^{f}$ |
| 6  | Xg 1%           | 1,615.25$^{e}$ |
| 7  | Alginate 0.5%   | 778.75$^{b}$   |
| 8  | Alginate 1%     | 11,608.00$^{e}$|
| 9  | Control         | 344.70$^{a}$   |

Description: The same letter in the same column behind mean value showed no significant difference (P> 0.05)

The increase of sauce viscosity with the addition of 0.5% maltose was not significantly different from the control. Maltose is a disaccharide resulting from the breakdown of starch. Maltose is soluble in cold water. CMC is a derivative of cellulose; CMC has the ability to bind large quantity of water. CMC provides a high increase in viscosity and can be used as a thickener in sauces, fruit pie filling, and salad dressings production. Furthermore, it was reported that the type and concentration of thickener had an effect on the viscosity of the resulting fruit filling [2,7,8].

3.2. Color of raw and cooked patties burger

The lightness of the black pepper sauce ranges from 17.06–31.71. While the redness (a) ranges from 2.99–11.93 while the yellow color level of the sauce ranges from 12.35–14.61. The using of stabilizer had significantly affected of color parameter of black pepper sauce. The lightness level of black pepper sauce tends to decrease with the addition of a stabilizer, as well as the redness level parameter. When in yellowness, there was a decrease but not significant (Table 2). During the heating process, the hydrocolloids will bind water, thus reducing the lightness of the resulting sauce.
Table 2. Color parameter of black pepper sauce at various type and concentration of stabilizer

| No | Treatments   | L     | a     | b     |
|----|--------------|-------|-------|-------|
| 1  | Maltose 0.5% | 19.29 | 2.99  | 12.35 |
| 2  | Maltose 1%   | 20.53 | 4.11  | 12.51 |
| 3  | CMC 0.5%     | 17.06 | 3.86  | 13.51 |
| 4  | CMC 1%       | 18.07 | 3.53  | 12.60 |
| 5  | Xg 0.5%      | 19.39 | 2.95  | 13.87 |
| 6  | Xg 1%        | 20.77 | 3.27  | 13.94 |
| 7  | Alginate 0.5%| 17.86 | 3.93  | 14.61 |
| 8  | Alginate 1%  | 19.81 | 6.66  | 14.23 |
| 9  | Control      | 31.71 | 11.93 | 14.26 |

Description: The same letter in the same column behind mean value showed no significant difference (P> 0.05)

3.3. pH
The pH of black pepper sauce added with various types of stabilizers ranges from 4.53–4.75. The use of a stabilizer tends to increase the pH of the sauce that produced. The using of 1% alginate gave the highest pH. The results of the analysis of variance showed that the treatment had significantly affect the pH of sauce. The previous study on cheese sauce production reported that the use of hydrocolloid slightly increases pH value of the product.2

Table 3. pH and TSS of black pepper sauce at various type and concentration of stabilizer

| No | Treatments   | pH    | TSS   |
|----|--------------|-------|-------|
| 1  | Maltose 0.5% | 4.66  | 15.00 |
| 2  | Maltose 1%   | 4.67  | 15.40 |
| 3  | CMC 0.5%     | 4.67  | 15.00 |
| 4  | CMC 1%       | 4.75  | 16.00 |
| 5  | Xg 0.5%      | 4.61  | 16.20 |
| 6  | Xg 1%        | 4.62  | 15.20 |
| 7  | Alginate 0.5%| 4.65  | 17.00 |
| 8  | Alginate 1%  | 4.74  | 15.80 |
| 9  | Control      | 4.53  | 15.10 |

Description: The same letter in the same column behind mean value showed no significant difference (P> 0.05)

3.4. Total soluble solid
Total Soluble Solids (TSS) of black pepper sauce ranged from 15.00–17.00. The use of a stabilizer tends to increase the TSS of sauce that produced. The use of 0.5% alginate has the highest TSS. The ANOVA test showed that the treatment has significantly affect to TSS of the product. The addition of hydrocolloids will help the interaction between polymers, thereby increasing TSS [7].

4. Conclusion
The use of a stabilizer had significant effects on the viscosity, color, pH and total soluble solids of black pepper sauce that produced. 1% CMC had the highest increase in viscosity, while 0.5% maltose resulted in the lowest increase of viscosity. There was a decrease in the level of lightness, redness and yellowness of the black pepper sauce that was added with the stabilizer. The stabilizer that used were also increased pH and TSS of sauce that produced.

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