The Quality of Low Fat Mayonnaise Using Banana Peel Flour as Stabilizer

H Evanuarini¹ and A Susilo¹

¹ Animal Product Technology Department, Faculty of Animal Science, University of Brawijaya, Jl. Veteran, Malang 65145, Indonesia

herlyfptub@ub.ac.id

Abstract. Low fat mayonnaise has disadvantage of having low stability, this is due to decreased dispersed phase and increased aqueous phase. The use of a stabilizer is needed to improve the quality of low fat mayonnaise. The use of banana peel flour is to add the value of low fat mayonnaise. The objective of this research was to observe the quality of low fat mayonnaise by using banana peel flour as a stabilizer. The research method used an experiment using a completely randomized design. The research treatment were use of various percentage of banana peel flour (1%, 3%, 5%) which will be compared with a control (without banana peel flour) with 4 replications. The data obtained were analyzed using analysis of variance (ANOVA) and followed by Duncan’s multiple range test. The results showed that the use of banana peel flour gave a significant difference in pH and acidity, highly significant difference with moisture content and gave no difference to the sensory evaluation of low fat mayonnaise. The use of banana peel flour can increase the stability of the emulsion and can be acceptable. The conclusion of the study using 1% banana peel flour produced good quality of mayonnaise.

1. Introduction

Mayonnaise is an emulsion that has several types, such as full fat, light, reduced and low fat mayonnaise. The industry responds to consumer demand to produce low-fat mayonnaise, therefore commercial mayonnaise is full fat. Low fat mayonnaise is mayonnaise made from 30-40% oil. Low fat mayonnaise has disadvantage of low emulsion stability because decreasing dispersed phase and increase aqueous phase in its production. One factor influence of mayonnaise is ratio between the oil phase and aqueous phase with additives such as emulsifier, thickener and stabilizer. By adding stabilizer, the stability of low fat mayonnaise emulsion can increase. Stabilizers that can be added to mayonnaise include polysaccharides, gums, starches, pectin, and carrageenan. Banana peel is one of the local ingredient that can be used as a stabilizer and has function to increase viscosity. Banana peels are local raw materials which are abundant and are one of the agricultural waste, but have not been widely used by the community. Banana peels contain 3.63% crude protein, 2.52% crude fat, 18.71% crude fiber, 7.18% calcium and 2.06% phosphorus. The weight of a banana peel varies, around 25-40% is determined from the level of maturity of the banana. Banana peels contain pectin in them which can reduce cholesterol levels in the blood [1]. Banana peels are produced into flour by drying, crushing and sifting. Banana peel flour was expected to add value. The purpose of this study was to determine the quality of low-fat mayonnaise with the addition of a banana peel flour based on
physical, chemical quality, sensory evaluation, and the stability of emulsion so that it can serve as a low fat functional food.

2. Materials and methods

2.1. Materials
The materials were used in mayonnaise production: soybean oil, egg yolks, vinegar, sugar, salt, white pepper powder and mustard. Banana peel flour was depend to the treatment.

2.2. Methods
The research method was using experiment with completely randomized design 4 treatments and 4 replications. The treatments were mayonnaise without the addition of banana peel flour as a control, mayonnaise with the addition of banana peel flour depend to the treatment (1%, 3%, and 5%) with the use of 30% oil. The data obtained were analyzed using analysis of variance (ANOVA) and standard deviation, and if there are differences in influence will be continued with Duncan's multiple range test.

3. Result and discussion

3.1. Moisture content
The results of the analysis of variance showed that the addition of banana peel flour with different percentages showed highly significant effect (P <0.01) on the moisture content of mayonnaise. The average value of mayonnaise moisture content shown in Table 1.

| Treatments | Moisture Content (%) |
|------------|----------------------|
| T0         | 22.62 ± 0.97 d       |
| T1         | 20.41 ± 0.45 c       |
| T2         | 18.03 ± 0.78 b       |
| T3         | 14.16 ± 0.80 a       |

Different superscript in the same column indicate highly significant difference (P<0.01)

Increasing the addition of banana peel flour will reduce the moisture content of low fat mayonnaise. This is due to the banana peel flour containing starch type consist of amylopectin and amylose. Starch will absorb water so more addition level of banana peel will be absorbed the water phase in mayonnaise and the moisture content will be decreased [2]. Pectin in carbohydrates functions as a stabilizer, binds water and could form a gel [3]. The control treatment (T0) had high moisture content, this was due to the high oil content which is 70% oil content and without the addition of banana peel flour. The use of banana peel flour will increase the thickness of low fat mayonnaise.

3.2. Total acidity and pH value
Analysis of variance results showed that the addition of banana peel flour with different percentages showed significant effect (P <0.05) on the total acidity and pH value of mayonnaise. The average total acidity and pH value of mayonnaise with the addition of banana peel flour shown in Table 2.
Table 2. Average value of total acid and pH value of mayonnaise

| Treatments | Total Acid(%) | pH Value |
|------------|---------------|----------|
| T0         | 0.90 ± 0.06   | 4.43 ± 0.11 a |
| T1         | 0.87 ± 0.06 ab| 4.65 ± 0.18 ab |
| T2         | 0.81 ± 0.03 ab| 4.67 ± 0.04 b  |
| T3         | 0.79 ± 0.09 a | 4.78 ± 0.11 b  |

Note: Different superscript in the same column indicate significant difference (P<0.05)

The total acidity and pH value have a value with an inverse ratio. If the total acidity is high, the pH value is low and if the total acidity is low, the pH value is high. The more addition of banana peel flour, it will reduce the total acidity and will increase the pH value of mayonnaise. Increasing the pH value and decreasing the total acidity value can be affected by the capacity of water to bind banana peel flour. The decrease in pH value is caused by the bonding of biopolymers with biopolymers which is contained by proteins, so that the pH of proteins will neutralize acids with the formation of new aggregates [4]. The addition of ingredients will affect the pH value. The addition of ingredients such as salt and sugar can decrease the pH of the mayonnaise, but mustard oil and pepper will increase the pH of the mayonnaise [5]. The total acidity of the mayonnaise can be measured. Higher volume NaOH, so total acidity will be increased. This applies to mayonnaise with the addition of banana peel flour. The higher level banana peel flour was added, the lower the total acidity. This is presumably because the banana peel flour is alkaline, so that when the acid titration is carried out, it will reduce acidity.

3.3. Emulsion stability
The addition of banana peel flour will increase the viscosity of low fat mayonnaise so it would form a stable emulsion. Treatments T1 to T3 have good emulsion stability and did not undergo separation and had good consistency as control, there were amylose and amylopectin in the banana peel flour which would absorb water and bind it which would increase viscosity.

3.4. Sensory evaluation
The score value of texture, aroma, color, taste and overall acceptance mayonnaise shown in Table 3.

Table 3. Score value of mayonnaise sensory evaluation

| Treatments | Texture | Aroma | Color | Taste | Overall Acceptance |
|------------|---------|-------|-------|-------|-------------------|
| T0         | 4.40 ± 0.50 | 3.30 ± 0.80 | 4.50 ± 0.51 | 3.90 ± 0.31 | 4.10 ± 0.31 |
| T1         | 4.60 ± 0.50 | 4.60 ± 0.60 | 4.35 ± 0.49 | 4.75 ± 0.44 | 4.65 ± 0.49 |
| T2         | 4.20 ± 0.41 | 4.35 ± 0.67 | 3.80 ± 0.41 | 4.45 ± 0.51 | 4.55 ± 0.51 |
| T3         | 3.25 ± 0.44 | 3.50 ± 0.76 | 3.35 ± 0.49 | 4.40 ± 0.50 | 4.30 ± 0.57 |

3.4.1. Texture
The panelists gave the highest mayonnaise score with the addition of 1% banana peel flour. This was because banana peel flour has high fiber content. The biggest component in banana peel flour was cellulose [6]. Cellulose is a fiber that did not dissolve in water. The treatment with the addition of 5% banana peel flour has the highest texture and was disliked by panelists because the texture was too thick. When compared with the treatment of adding banana peel flour, the more it is added to the mayonnaise, the texture is getting thicker, rough because there were coarse grains that were difficult to unite with other ingredients, because banana peel flour grains were too large, large crystals with non-uniform size and the air cells were getting bigger [7]. Starch on banana flour had function as a stabilizer, so higher addition of banana peel flour, mayonnaise will be more stable and thicker.
Treatment 1 (T1) had similar consistency to control treatment. So that the addition of 1% banana peel flour could replace oil and mayonnaise stabilizers such as full fat mayonnaise.

3.4.2. Aroma
The panelists gave the highest score for T1 treatment, this was due to the acid aroma from vinegar absorbed by the banana peel flour. Banana peel flour had a normal odor (typical of a banana). Banana peel stored the aroma obtained by banana fruit, if the banana peel flour was made into flour then the aroma was still appeared in the banana peel flour [3]. The higher the addition level of banana peel flour, the banana aroma and sour aroma of mayonnaise would be balanced. Panelists preferred mayonnaise with the treatment of adding 1% banana peel flour when compared to the control treatment (T0), because the aroma was not overly acidic and gave a slight banana aroma.

3.4.3. Color
The higher the addition level of banana peel flour, resulted in a darker color. This was resulted from the browning reaction. Browning reaction was obtained by oxidation, between carbohydrates (phenol compounds) and oxygen which would cause browning that affected by enzymes. The color of banana peel flour was resulted by the enzyme phenoloxidase or polyphenol oxidase. This enzyme would catalyze phenol compounds into quinones and polymerized them into the brown melanoidin pigment [8]. The color of banana peel flour was strongly influenced by the activity of the polyphenol oxidase enzyme [9]. If the polyphenol oxidase enzyme activity was not controlled, the brownish color would appear [6]. The brown color appeared because of the sugar content found in banana peel flour. Panelists preferred mayonnaise that is neither overly brown nor overly white. The selection of mayonnaise with a color indicator that was acceptable and preferred by panelists was by Treatment 1 (T1), namely by adding 1% banana peel flour. T1 had a slightly yellow mayonnaise color and less brown color when compared to other treatments.

3.4.4. Taste
Banana peel flour has a bitter taste. The higher the addition level of banana peel flour in mayonnaise, therefore the bitterness of the taste would increase. The taste was influenced by several factors namely chemical compounds, temperature, concentration and interactions with other primary substance components that can cause an increase or decrease in flavor intensity [10]. Treatment 0 (T0) had the most acidic taste compared to other treatments. The bitter taste of banana peel flour resulted from the saponin content in it [11].

3.4.5. Overall acceptability
The assessment of overall acceptability of mayonnaise was based on texture, aroma, taste and color. Increasing the level of banana peel flour addition in mayonnaise, resulted in less of panelists overall acceptability. The treatment preferred by panelists was the addition of 1% of banana peel flour. This was because the addition of banana peel flour could form a texture similar to control treatment, the texture was smoother and the thickness of the consistency was decreased and less presence of the coarse grains, the color was slightly brownish-yellow and could still be accepted by panelists, the typical sour taste was still there and there was a slight taste banana, and the aroma was balanced between the sour aroma and the aroma of banana.

4. Conclusion
It could be concluded that addition of 1% of banana peel flour in mayonnaise was increased the quality of low fat mayonnaise and acceptable by panelists.

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