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Characteristic of Low Fat Mayonnaise Containing Porang Flour as Stabilizer

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Abstract: Mayonnaise is oil in water (o/w) emulsion which contain vegetable oil, pasteurized egg yolk, acidulants and other substances. The aim of this study was to characterize of low fat mayonnaise stabilized by porang flour. The addition of hydrocolloids such as porang flour was used to develop low fat mayonnaise as substitute stabilizer alternative to oil. Emulsion of low fat mayonnaise were prepared using Rice Bran Oil, egg yolk, porang flour (0.1, 0.2 and 0.3%), water, vinegar, salt, sugar, white pepper and mustard. Physicochemical characteristics and droplet emulsion of mayonnaise was evaluated. The result showed that the addition of porang flour affects the characteristic and emulsion of low fat mayonnaise. These results have important information for production of reduced fat food emulsion.

Key words: Low fat mayonnaise, rice bran oil, porang flour

INTRODUCTION

Mayonnaise is a semi-solid oil in water emulsion, made from vegetable oil which is combined with vinegar or cuka, pasteurized egg yolk as emulsifier and other flavoring ingredients such as salt, sugar, mustard and pepper. In Indonesia mayonnaise is widely used in various dishes of salad and sandwich. Characteristics of mayonnaise are quality and stability from its self which are physical properties, chemical, sensory and reology. As a product which is obtained from livestock, mayonnaise is included in high fat food because the main ingredient material are oil and egg yolk which are consumed in limited amounts.

Some industry respond consumer demand to produce healthy and nutritious food product. Consumption of low fat food product become new trend in society. Commonly amount and type fat that are consumed can trigger kind of chronic disease such as obesity, cancer, cardiovascular and atherosclerosis (Mc. Clements, 1999). Various research are conducted to decrease fat content in mayonnaise.

The main roles in mayonnaise production is composition ratio of oil phase and the addition of various emulsifier, stabilizer and thickener. Quality of mayonnaise emulsion depend on stability and viscosity of emulsion since homogenization process. Mayonnaise which is made traditionally is oil in water emulsion that content 70-80% oil (Depree and Savage, 2001). Subtitution of fat in mayonnaise is conducted to create low fat mayonnaise. Some thickener material commonly able to increase texture of mayonnaise. The function of oil in mayonnaise is as dispersed phase of oil emulsion in water and also as main ingredient of mayonnaise. Texture of mayonnaise depend on oil, the more oil is used then the better texture is resulted. Oil has important function in characteristic of reology. Low fat mayonnaise can be produced by decreasing dispersed phase and increase aqueous phase. Using fat replacer is recommended to decrease fat content.

Porang flour is pure fiber soluble in water and low calories. Porang flour is recognized by its characteristic easy to form a gel (gelling agent). This characteristic is used to produce many kinds of food such as noodles, bread, cake, edible film, sausage and meat ball. Reversible gel is used to produce jelly, jams, yogurt, pudding and ice cream. Porang flour has high viscosity level naturally with has shiny appearance outside. Porang flour content glukomanan which is food fiber soluble in water with character strong hydrocolloid and low calories widely used in food industry well as functional food and food additives (Thomas, 1997). Porang flour can act as fat replacer and decrease oil use in mayonnaise production because when this flour is applied in food, it has function as thickener and increase viscosity that gives stability. The objective of this research was to determine the characteristic of low fat mayonnaise stabilized by using porang flour.

MATERIALS AND METHODS

Materials: The materials were used to mayonnaise production: vegetable oil (Rice Bran Oil), pasteurized egg yolk, porang flour, sugar, salt, vinegar, mustard,

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distilled water. Rice Bran Oil obtained from local market. Porang flour were purchased from porang producer Nganjuk, East Java Province. Different spices were purchased from local market. Fresh hen egg yolk were obtained from local producer Malang, East Java Province, Indonesia.

Preparation samples of mayonnaise: Full fat mayonnaise and low fat mayonnaise samples were prepared using the formula according to Mun *et al.* (2009). Formulation of mayonnaise samples were presented in Table 1. A full fat mayonnaise without porang flour formulation was used as a control. The low fat mayonnaise are using Rice Bran oil content 30, 40 and 50% (w/w) and 0.1, 0.2 and 0.3% porang flour (previously dissolved in 40°C water). The sugar, salt, white pepper and mustard were first mixed with pasteurized egg yolk and vinegar for 1 min. The oil was slowly added to the system until the emulsion formed.

Methods: The research methods was using experimental design. The parameter observed were pH measured by using pH meter and viscosity using viscometer Brookfield according to the method by AOAC (2000), fat content were determined according to the Babcock methods and droplet emulsion were measured by using optical microscope according AOAC (2000) official methods. The data obtained were analyzed using one-way analysis of Variance (ANOVA) and if were significant differences the analysis was continued using Duncan Multiple Range Test. Data were presented as means±standard deviation and each analysis were replicated three times.

RESULTS AND DISCUSSION

Physicochemical properties and stability of mayonnaise using porang flour were presented in Table 2.

Physicochemical analysis: The physicochemicals properties of mayonnaise samples are shown in Table 2. There were significant differences ($p<0.05$) on pH, viscosity and fat content. Result showed low fat sample using 0.3% porang flour has the highest pH compare with all other treatments. The mayonnaise samples had pH values ranging from 4.02-4.28. These pH values were close to the pH value obtained by Radford and Board (1995), which were 4.1. The pH value increased by increasing levels of porang flour, this is due more addition level of porang flour that is used will weak concentration of vinegar which is ingredient of mayonnaise. Porang flour is hydrocolloid that very easy soluble in water. Mayonnaise is one of acidic food material because one of its ingredients in liquid phase is vinegar. Addition of vinegar maintains the acidic pH, thereby retarding the bacterial degradation.

Table 1: Formulation of mayonnaise samples

		LF		
Ingredients	FF	P1	P2	P3
Rice bran oil	70	30	40	50
Porang flour	-	0.1	0.2	0.3
Egg yolk	15	15	15	15
Vinegar	5	5	5	5
Salt	1.5	1.5	1.5	1.5
Sugar	2	2	2	2
White pepper	0.5	0.5	0.5	0.5
Mustard	1.5	1.5	1.5	1.5
Water	4.5	44.9	34.8	24.7

FF: Full fat mayonnaise, LF: Low fat mayonnaise

Table 2: Physicochemical properties and stability of mayonnaise using porang flour

Treatment	pH	Viscosity	Fat content	Emulsion stability
P_0 FF	4.12±0.02^b	3342±3.46^d	76.22±0.58^d	NSO
P_1 LF	4.02±0.02^a	1686±5.29^a	37.68±0.58^a	NSO
P_2 LF	4.15±0.03^b	2345±5.00^b	43.69±0.87^b	NSO
P_3 LF	4.28±0.02^c	3153±15.53^c	56.19±2.47^c	NSO

Result are Means±SD, means with different superscript in the same column differ significantly ($p<0.05$). NSO: No Separated Oil

Result of viscosity in mayonnaise showed significant difference among all of treatments ($p<0.05$). More porang flour addition, then viscosity of mayonnaise became higher. Decreasing oil and increasing water will be affected viscosity of mayonnaise. Porang flour which was added in low fat mayonnaise caused it more viscous because porang flour has capability as thickener or gelling agent. Porang flour has function to stabilize low fat mayonnaise by increasing viscosity. Paraskevopoulou *et al.* (2005) stated that polysaccharides are usually added to o/w emulsion to enhance viscosity of the aqueous phase, thus preserving desirable textural characteristics and stabilizing oil droplet. In full fat mayonnaise, droplet is arranged more tight and viscous that can not move. In low fat mayonnaise product by using porang flour, droplet will be more stable because it is arranged by porang that will fill and arranged more tight.

Increasing viscosity in aqueous phase by adding porang flour will show emulsion stability and droplet will move slowly.

Based on Table 2, there is significant difference ($p<0.05$) for fat content among all of treatments. Decreasing oil in low fat mayonnaise production and increasing water will cause decreasing of fat content. More water addition in treatment, fat content which is resulted become lower. In P1 treatment, fat content that was resulted lowest than all of other treatment. Decreasing oil amount will cause decreasing viscosity and stability of mayonnaise which is resulted, however by adding porang flour that has function as fat replacer that make final product of mayonnaise almost equal with full fat. Ford *et al.* (2004) reported that fat content of emulsified product could be reduced by replacing the fat droplets with biopolymers

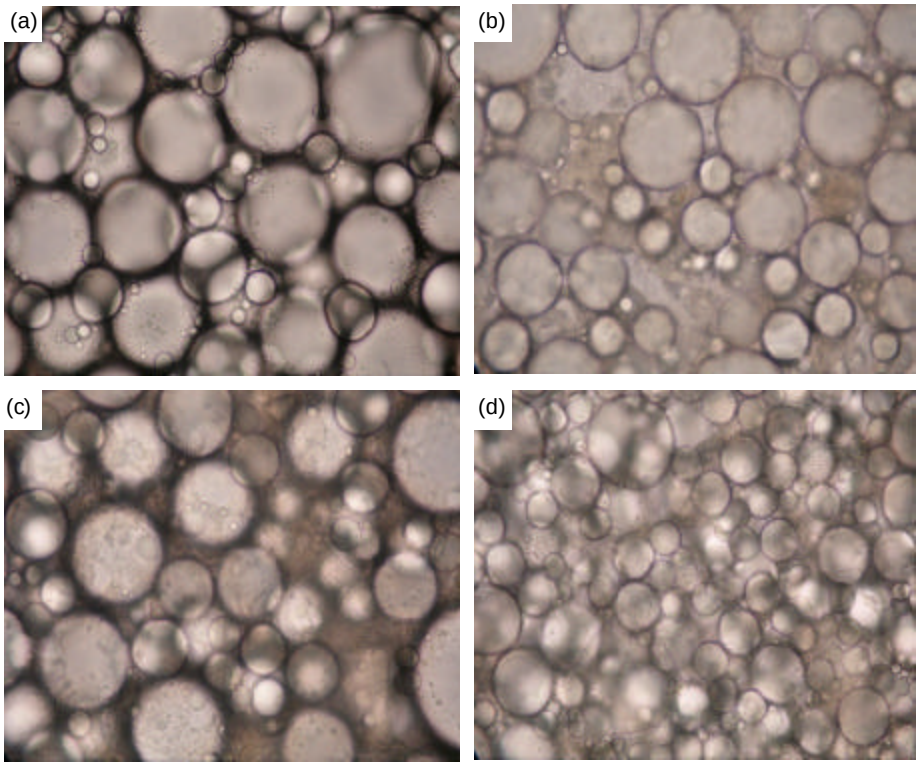

Fig. 1: Photo micrograph droplet of mayonnaise samples. Magnification is 400X. A: Control mayonnaise, B: RBO 30 and 0.1% porang flour, C: RBO 40 and 0.2% porang flour and D: RBO 50%, 0.3 porang flour

such as gums and starch. Porang flour is polysaccharide that content very low calories that is very good as dietary fiber source. Applications of using porang flour in food production are widely used because give some advantages. Low fat mayonnaise production able to help consumer in term of healthy because it can avoid some chronic disease.

The droplet emulsion samples are shown in Fig. 1. The interspace voids represent the oil droplets. Droplets distribution is very important factor for the quality of emulsion. The quality of emulsion is often checked by measuring the droplet size besides others properties. Mayonnaise A (without porang flour) showed the most densely packed structure. This is due to the fact that full fat have high stability.

Mayonnaise B, C showed a packed structure. Mayonnaise D using high level of porang flour have good structure and small uniform droplet. The process is the same for samples A, B, C and D. The differences between them are only due to the thickener agent use. An ideal emulsion consist of spherical droplets packed together within the continuous phase. In mayonnaise, however, the high oil content and the close packing of the droplets may affect the oil droplet (Depree and Savage, 2001).

The smaller the droplet size of the disperse phase the more stable is the emulsion. Liu *et al*. (2007) stated a decrease of oil droplet diameter leads to a greater contact surface area between droplets and therefore to an increased viscosity. The physical stability of an emulsion can be improve by increasing the viscosity of the continuous phase by adding stabilizer or reducing and maintaining the droplet size. Porang flour as thickening agent are dissolved in the continuous phase and increase its viscosity.

Composition of mayonnaise had a significant effect on stability against flocculation and coalescence. At concentration ranging from 0.1 to 0.3, 0.3 provided the most viscous emulsion, followed by those with 0.2 and 0.1

Porang flour is one of local product hydrocolloids used food and beverages. It's glucomannan component is responsible as thickener agent, including the ability to form stable emulsion. Glucomannan have limited surface activity and are more effective as stabilizer. Using porang flour improve the stability of the emulsion mayonnaise.

Conclusion: The result showed that the addition of porang flour affects the characteristic and emulsion of

low fat mayonnaise. This research finding suggested that porang flour can be used as an stabilizer for mayonnaise production. Advantage of porang flour was that it was a hydrocolloids containing dietary fiber which would be good for human health. In the future, it may be developed and applied porang flour as fat replacer for food emulsion product else.

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