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The effect of temperature and drying time on rujak cingur spices powder properties and its change during storage

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ABSTRACT

Rujak cingur is an Indonesian traditional food that is very potential to be developed. The time required to serve one serving of Rujak cingur is from 10 to 15 minutes. Mostly used to make spices. Spices also cannot be stored for a relatively long period of time. So, it takes an alternative to shorten the presentation time and prolong the shelf life by making powder spice. This study aims to determine the best combination of treatment based on temperature and drying time so as to produce the best quality Rujak cingur spices powder and to know the change of the product's properties during storage at the best treatment. This study used Completely Randomized Design (RAL) with 2 factors, such as drying temperature (60 ˚C, 70 ˚C, and 80 ˚C) and drying time (10 hours, 12 hours, and 14 hours). The best results were stored for a month and analyzed the water content, a_w, peroxide number, and total mold every six days. The best treatment result based on physical, chemical parameters was obtained from Rujak cingur spices powder at 70 ˚C temperature with 14 hours drying time treatment, obtained value of yield 72.04 percent, moisture content 3.65 percent, ash content 4.76 percent, lipid content 15.15 percent, 75.44 percent solubility and 85.58 percent rehydration power. The result of storage was increase in moisture content 11.14 percent, increase of water activity equal to 1.78 percent, increase in peroxide number 8.94 percent, and total mold increased up to 40 colonies.g^{-1} on the 30th day.

Keywords: *Rujak cingur spices powder, Temperature, Drying time, Storage*

1. Introduction

One of the traditional dishes of the typical city of Surabaya is Rujak cingur. Many tourists from other regions spend time in Surabaya to enjoy the traditional foods. Therefore, these foods are very potential to be used as souvenirs from Surabaya. Rujak cingur condiment made from peanuts fried as the main ingredients along with shrimp paste, brown sugar, and some spices such as chilli, salt and thinly sliced banana. The time required to serve one serving of Rujak cingur is from 10 to 15 minutes, mostly use to make the spices. This spices also cannot store for a relatively long period of time. So that, it is necessary to make Rujak cingur spices serve easily and can be stored for a longer time. Studies on the making spices of Rujak cingur instant has been done by Sakinah, Yuwono [1], they determine the effect of pretreatment heating and temperature heating of the mixed spices pasta. Another method is making instant Rujak cingur spices into powder form. The instant a powdery spice will have longer lasting power because it has a low moisture content.

Generally, characteristic of instant products in the form of powder are easy to dissolve in the water, practically in the presentation and have the longer shelf life [2]. The products are a very small particle size, have a low moisture content and has a large surface area. Rujak cingur spices powder is the development of Rujak cingur spices pasta that is dried and processed into powder form. Drying will produce a

powder product with good quality and taste, also longer shelf life if it did in good processing and packaging. Temperature and drying time are the factors that mostly affected to the product characteristic because some of changes in physic and chemical of the product component are caused of this. The mechanism of drying process consists of the transport of (mass) moisture from the interior of the solid to the surface, the vaporization of liquid at the surface (diffusion) and the transport of the vapor into gas phase [3]. The drying operation reduces the moisture content of solids to a condition favorable for safe storage without deteriorations. The most significance reason for the popularity of dried products is that in dehydrated foods. Microorganisms practically do not grow due to the presence of a minimum amount of water and thus they are immune to enzymatic reactions that could provoke alterations or spoilage in the food.

The changes of product that occur at a particular time during storage is important to observe. These changes can indicate the presence of a decrease in the quality of a product during storage. Therefore, determining some of product attributes need to be done to determine the power of its shelf life. The variety of chemical reactions that occur in food products are accumulative and cannot be recovered back during storage. So, at certain times, the results of reactions in the quality of food is not acceptable back. Combination treatments with temperature and drying time on producing Rujak cingur spices powder is necessary to observe. Also, to get the best quality products with a minimum damage due to the effect of processing in nutritional composition and physical characteristics. In addition, it is also necessary to determine influence of changes during the storage. It can be supposed the shelf life of the product.

2. Materials and Methods

2.1 Raw Material Preparation

The main materials used in the making of the Rujak cingur spices powder are the shrimp paste, peanut, tamarind, sugar, salt, cayenne pepper, and banana. Supporting materials for analysis is aquadest, HCl, 25 percent, petroleum ether, chloroform, KI saturated, 0, 01N thiosulfate, alcohol 95 percent, PP 1 percent, 0.05 percent KOH, PDA, Chloramphenicol.

2.2 Processing of Rujak Cingur Spices Powder

The early stages of the research process start with the preparation of raw materials, selection of the materials used in the making of condiments Rujak cingur instant i.e. shrimp paste, peanuts, bananas, brown sugar, tamarind, salt and cayenne pepper. Weighing on each material with 33.5 percent for peanut, 30 percent of the shrimp paste, brown sugar 17 percent, banana 13.5 percent, and 2 percent for cayenne pepper, tamarind, and salt. After weighing, the peanut is fried without oil then banana and brown sugar are grated to easier in crushing and mixing process.

Further all spices material is crushed and mixed into homogeny dough. Then the spices dough is placed on a baking sheet, dried at a temperature of 60 ˚C, 70 ˚C 80 ˚C, and with drying time 10, 12, and 14 hours. After spices dough becomes dry mashed, blend using a dry blender speed one to be grains of powder and then sifted products using 60 mesh sieves. Next step, Rujak cingur spices powder is analyzed. After analyzed and obtained results from a combination of the best treatment then it is stored in a sealed jar container and observed every nine days for

one month. The tools used include baking dish, Erlenmeyer flask, weigh the bottle, beaker, drying cabinet, furnace, centrifuge, Soxhlet, burette, oven desiccator, 60 mesh-sieve, separating funnel, measure out the flask, glass funnels, measuring cup, pipette volume, balance analytical, blender, petri dish, test tubes, autoclave, incubators.

2.3 Product Analysis

The product was analyzed for parameters yield, moisture content, ash content, lipid content, solubility, and rehydration power. Then the best treatment was packed with PVC and stored for 30 days and analyzed every 6 days for parameters moisture content, water activity, peroxide number, and total mold.

2.4 Experimental Design

This study used a Randomized Complete Design (RAL) compiled with factorial pattern, consisting of two factors, where the factor A consists of three levels and factors B consists of three levels. Data obtained from the analysis results using Analysis of Variance (ANOVA) and advanced test using Duncan (α= 5 percent), so known existence of interaction and influence between each treatment.

3. Results and Discussions

3.1 Characteristic of Rujak Cingur Spices Powder

The result of physic-chemical analysis incudes yield, moisture content, ash content, lipid content, solubility and rehydration power are presented in Table 1.

Table 1. Average value of yield, moisture content, ash content, lipid content, solubility and rehydration power effect of temperature and drying time on Rujak cingur spices powder

Treatment		Yield (%)	Moisture Content (%)	Ash Content (%)	Lipid Content (%)	Solubility (%)	Rehydration Power (%)
Temp.	Drying Time (Hour)						
60	10	78.96	7.26	4.8	12.11	72.98	56.53
60	12	75.48	6.36	4.78	13.14	73.78	68.09
60	14	72.63	4.92	4.78	13.99	74.67	79.73
70	10	76.05	6.21	4.76	12.95	73.6	62.30
70	12	74.32	4.81	4.74	14.07	74.54	73.90
70	14	72.04	3.65	4.73	15.15	75.57	85.58
80	10	73.57	5.20	4.72	14.45	74.31	70.02
80	12	71.70	3.92	4.71	15.52	75.57	81.48
80	14	70.59	2.50	4.71	16.47	76.18	91.65

Table 1 showed that the higher the temperature and the longer drying time, then the yield will be progressively decreased. This is due to the higher temperature and longer drying time used causes the water in the product undergoes evaporation. So that, it will affect the amount of yield. According to Desrosier [4], due to the drying process causes the water in food components during processing is reduced, resulting in a decrease in the yield of a food. Fedha et al. [3], adding the smaller the produced water levels cause a decrease in weight of water materials, because water is the main component in the materials that affect the weight of the material.

The lowest water content showed in Table 1, obtained from the treatment of temperature 80 ˚C and 14 hours drying time. It is caused of the material's ability to release water from its surface will be even greater with increasing temperature of the dryer and the longer drying time are used, water migration from the product interior to the surface is mostly by molecular diffusion. If water removal is considerable, the products usually undergo shrinkage and deformation [5]. Air heating increases the drying force for heat transfer and accelerates drying. It also reduces air relative humidity, further increasing the driving force for drying. So, the moisture content is progressively lower.

Total ash content of Rujak cingur spices powder is presented on Table 1. There is no significant interaction were observed between temperature and drying time treatment on ash content. It is because temperature and drying time doesn't give influence on the levels of ash. The ash levels are generally expressed as the minerals contained in a material.

The ash content is a measure of the total amount of minerals present within a food, whereas the *mineral content* is a measure of the amount of specific inorganic components present within a food, such as Ca, Na, K, and Cl [6]. Although some food components damaged in the process of heating food products, the process does not affect the minerals contained in food products.

Table 1 showed that the higher the temperature and the longer of drying time the lipid content found getting higher. It is because the higher temperature and longer drying time then the moisture content of materials declining, thereby increasing the other ingredients including lipid. Accordance with the research of Sakinah et al. [1], stating that the increased lipid content with higher drying temperature can be caused by a decrease in moisture content so that the percentage of fat content increased. The value of lipid content ranges from 12.11 to 16.47 percent.

Table 1 showed that the higher the temperature and the longer the drying time, then the power of rehydration on Rujak cingur spices powder is getting higher. It is caused by the product is getting dry and porous because it has a low moisture content, so material able to absorb large amounts of water. Based on research of Gumus et al. [7], the higher the temperature tends to enhance rehydration, faster moisture transfer during drying causing lower water levels. Drying temperature also plays an important role against the characteristic of the porosity of the material which when drying temperature is not precise and quick in time then the porosity of the material will be reduced.

Table 1 showed that the higher the temperature and the longer the drying, then power the solubility is getting higher, caused materials have a lower water content and it easier when dissolved in water. According to Desrosier [4], the solubility of a material is related to moisture content. Low water levels caused the material dissolves easily in water. Powder products that have a low moisture content have easily soluble in water, and conversely the higher moisture content then the lower solubility [8]. Greensmith [5] explained, materials with high water levels have the surface moistened between the grains and be hard to spread out in the water.

Based on the results of physical and chemical testing, the best treatment was obtained on Rujak cingur spices powder with drying temperature 70 ˚C for 14 hours. In this case, it has low water content and good in solubility and rehydration

power properties. While in the drying temperature of 80 ˚C for 16 hours, although it has a lower water content and higher solubility and rehydration power but lower yields and higher fats that cause easily oxidized.

3.2 Chemical and Microbial Changes during Storage

In Figure 1, the value of moisture content increases upon storage from day 0 to 30, it was from 3.59 to 3.99 percent. Handoyo [9] suggested that increased levels of water in the product during storage is caused by the occurrence of the absorption of moisture from the environment in which such absorption due to the permeability of the packaging and the surface area of the product. The rate of absorption of water vapor in equilibrium with the products affected by the environmental conditions so that the water content increased during storage.

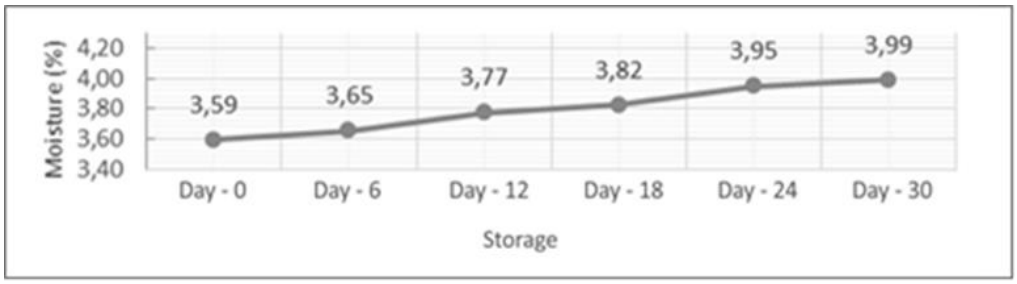

Figure 1. Value of moisture content increases upon storage from day 0 to 30

Figure 2 showed that the value of water activity (a_w) tends not to change until the 24th day of storage, this indicates that the storage for 30 days did not affect water activity (a_w). Purnomo [10] stated though the retention effect on water content but will not affect the value of a_w. Generally, the value of the minimum a_w allows the growth of microorganisms is started from the value 0.6 for molds, 0.8 for molds and yeasts, while Gram-positive bacteria grow at a_w 0.9 and grams negative grow at a_w 0.93 [11]. It means that the value for water activity (a_w) Rujak cingur spices powder under the minimum value of microorganism growth though it has been stored for 30 days.

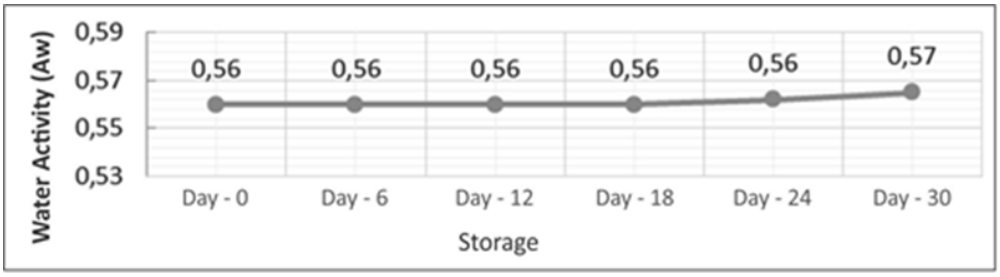

Figure 2. Value of water activity (a_w) content increases upon storage from day 0 to 30

Figure 3 showed that peroxide number has increased in the six days during storage. That is because at the moment there is a residue of oxygen trapped in the plastic container so that cause the increase of peroxide number of Rujak cingur spices powder in 30 days storage. Peroxide number value is range 4.72–5.12 meq.Kg^{-1}, whereas the terms specified by the SNI 3741 for quality edible oil maximum 10 meq.Kg^{-1}. This indicates that the product still appropriate standards set by SNI

despite having been stored for 30 days. The longer Rujak cingur spice pasta experience storage then the number of peroxides increasing allegedly due to buildup compounds peroxides during storage [1].

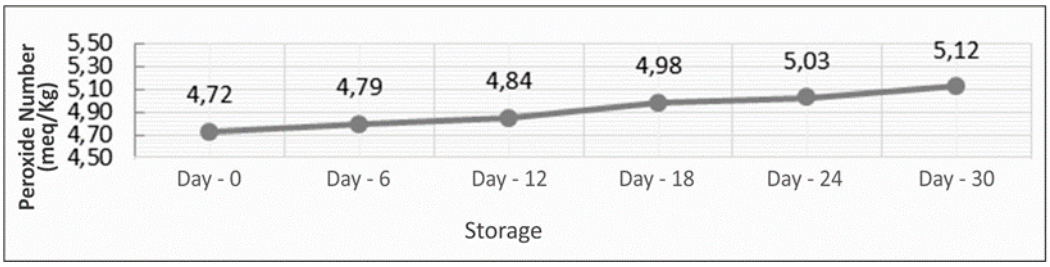

Figure 3. Value of peroxide number content increases upon storage from day 0 to 30

Figure 4 showed that total mold increase along the 30 days storage. The value of total mold range from 0 to 40 colonies.g^{-1}. The slightly increase of total mold is related to the increase of moisture content during storage, although the water activity is not increase significantly. Lower water activity (a_w) and moisture content, the slow growth of microorganisms to grow, so the deterioration process will take place more slowly [10]. Regulation of the head of BPOM HK. 00.06.1.52.4011 (2009) mentions that the maximum limit of total mold in condiments do not exceed 2×10^2 colonie.g^{-1} whereas Rujak cingur spices powder can be interpreted it remain safe for consumption until the 30th day of storage.

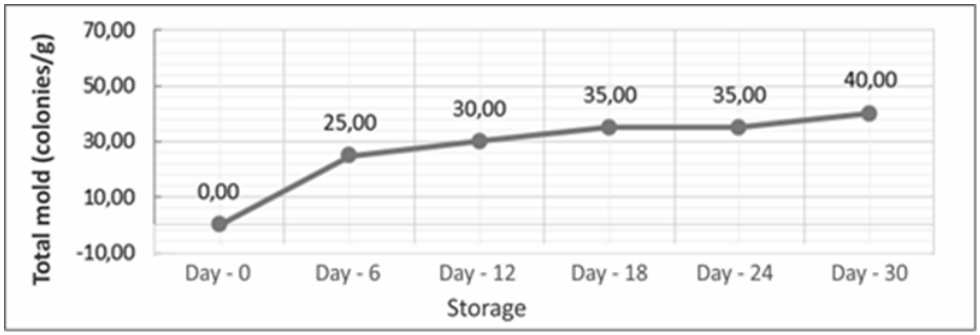

Figure 4. Value of total mold content increases upon storage from day 0 to 30

4. Conclusions

Rujak cingur spices powder with the treatment temperature 70 ˚C and drying time 14 hours is the best treatment with a value of 72.04 percent yield, 3.65 percent moisture content, 4.76 percent ash content, 15.15 percent lipid content, solubility 75.44 percent and rehydration power 85.58 percent. The increase in storage moisture content of 11.14 percent, increase on-water activity amounting to 1.78 percent, the increase in the number of peroxides 8.94 percent, and on the total mold increase to 40 colonies.g^{-1} on the 30th day of storage.

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