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Preparation of Crackers by Mixing of Cassava, Carrot, and Protein Isolated from Waste of Ketchup Factory with $CaSO_4$ Ions

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Abstract. This research is one of the diversification efforts of food substances to create economically valuable nutritious food. It has been researched the use of isolation of protein from the waste of the Ketchup Industry as the mixture of crackers with various comparisons between isolating of the waste of protein from Ketchup Industry and cassava by adding an extract of carrot about its nutrient content also. The analyzing nutrient is protein content by using the Kjeldahl method and turning to dust β – carotene using the spectrophotometer and organoleptic test about the taste of crackers using a hedonic scale. The highest protein content and β – carotene is found in the crackers in comparison (1:6:3) namely 5,38 % and 53,59 ppm. Moreover, the lowest protein content and β – carotene is found in the crackers in comparison (1:0:0) namely 2.35 % and 27.49 ppm. The most delicious, crispy, and the most people like is the crackers with comparison (1:4:2).

Keywords: Crackers, Cassava, Protein, Waste, Ketchup Factory

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1 Introduction

Nuts are a source of vegetable protein. Every 100 grams of nuts contains about 25-35 grams of vegetable protein. In addition to protein, it also contains fat, carbohydrate, vitamin B, vitamin A, and minerals (such as calcium, phosphorus, and fiber, especially in the epidermis) (C. Soejoeti T, 1998). In Indonesia, most of the soy sauce industry uses soybean as the main ingredient. The exciting thing about making soy sauce is that the high protein content of the essential ingredients in soybeans can reach 37.2%, even in high-yielding varieties the protein content can reach 40-43%. But after becoming soy sauce only about 2-6% of the protein content is contained in it. Because these soy sauce dregs contain a fairly high protein content of + 20% which can be a source of protein (Muhammad Yuzar Fahrie, 2005).

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Protein is a polypeptide with a molecular weight that varies greatly, from 5000 to more than one million. In addition to different molecular weights, proteins have different properties (Anna Poedjiadi, 1994). MPF (Multi-Purpose Food) is an appropriate technology that aims to create new food that has good value, creates delicious food and has low economic value, and creates food that is ready to serve but has a quality to meet human needs in the food sector. Protein is a polypeptide with a molecular weight that varies greatly, from 5000 to more than one million. In addition to different molecular weights, proteins have different properties (Anna Poedjiadi, 1994). MPF (Multi-Purpose Food) is an appropriate technology that aims to create new food that has good value, creates delicious food and has low economic value, and creates food that is ready to serve but has the quality to meet human needs in the food sector.

According to the Ministry of Industry, there are four soy sauce factories in Medan City with a total waste of 250 tons per year or 85 tons/factory/year. This needs attention because the solid waste from the soy sauce factory is generally only piled up in rectangular tubs and is only used as animal feed, even though the vegetable protein content in the solid waste of the soy sauce factory is still very high. Therefore, in assisting government programs in environmental conservation, the authors are also interested in utilizing protein isolates from soy sauce factories in food diversification or MPF so that problems arise whether the low nutritional value of food becomes nutritious food.

This research aims to determine the protein isolates from the solid waste of the soy sauce factory and to determine the protein content contained in the protein isolate powder from the solid waste of the soy sauce factory. Furthermore, the protein isolate is used to enhance the nutrients from cassava, which cassava lacks nutritional value so the crackers could be nutritional food. Moreover, this study would provide the diversification of food.

The results of this study are expected to provide information about 1) the soy sauce factory entrepreneur stated that solid waste can still be used so that it can increase the income of the soy sauce factory; 2) to make food diversification for children's snacks that have nutritional value, especially for toddlers; 3) assist the government in tackling environmental pollution caused by solid waste from the soy sauce factory.

This research is a laboratory experiment. The steps taken are as follows: Sample preparation, namely the solid waste from the soy sauce factory, was washed first, then boiled and mashed and then filtered, plus tofu stones, then dried in the sun and mashed. Then determined protein content parameters. The crackers were prepared with a variation of the ratio between a mixture of cassava and protein isolate from the solid waste of the soy sauce factory, namely 1:0:0, 1:2:1, 1:4:2, and 1:6:3 with the addition of carrots. A qualitative test of protein content was carried out in a qualitative biuret manner. The parameters of protein content and β-carotene content were determined by the Kjeldahl method and Porim Test Method 1995, respectively. An organoleptic

test was performed with a hedonic scale. The data were statistically processed using the CCT (Chauvenet's Criterion Test) method.

2 Materials and Methods

2.1 Isolation of protein from soy sauce factory solid waste

Soy sauce factory solid waste was weighed at 3.2 Kg, washed, and re-weighed to 1.8 Kg. Boiled with water as much as 3 L until boiling. Filtered, mashed until it becomes mush with the addition of cooking water. Filtered again using gauze, then added tofu stone (CaSO4), (addition of tofu stone as much as 15 g). Leave it for a while, dried by the sun, then ground it into a powder.

2.2 Determination of protein content using the Kjeldahl method

2 g of the dry sample (powder and dry) was put into the Kjeldahl flask. Then it was added by 2 g selenium catalyst and 25 mL of sulfuric acid. The sample was crushed until the solution in the Kjeldahl flask became a clear or precise green solution (approximately 2 hours), the result is called desaturate. The desaturate was allowed to cool for 3 hours and then aqua dest was added. Then diluted with distilled water in a 100 mL volumetric flask. Pipette 25 mL plus 60 mL of 30% NaOH, then connected to a distillation apparatus until the distillate turns green. The distillate was added by 3% H_3BO_3, which had been mixed with three drops of Tashiro indicator. Further, It was titrated by 0.0968 N HCl until the solution turns purple and calculated % N and protein content.

$$\%N = \frac{fp\ x\ V_{HCl}\ x\ N_{HCl}\ x\ 0{,}014\ x\ f_k}{weight\ of\ sample}\ x\ 100\ \%$$

2.3 Manufacturing of cracker

Cassava was peeled, washed, and then grated and weighed as much as 50 g. Prepared mashed spices, namely 5 g of garlic and salt. After that, mix the spices with 50 g of protein isolate powder from the soy sauce factory solid waste while stirring slowly so that the spices are evenly mixed. Then, it was added 50 g of grated cassava and 100 g of grated carrots. The dough is shaped into thin rounds and covered with plastic and put in a pot. Next, it is steamed for 10-15 minutes. After cooking, the crackers were removed and dried in the sun to dry evenly. Analysis of protein and β-carotene content was carried out for the ratio of crackers 1:0:0, 1:2:1. 1:4:2, 1:6:3. An organoleptic test was performed for the ratio of crackers 1:0:0, 1:2:1. 1:4:2, 1:6:3.

2.4 The determination of protein content using the qualitative biuret method and the concentration of β – carotene sample (porim test method 1995)

The determination of protein content using the qualitative biuret method was carried out by putting 2 g of the sample into a test tube. Then, It was added with 2ml of 10% NaOH and

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$CuSO_4$ and dripped it until the color changed to purple. The determination of the concentration of β – carotene sample was carried out by dissolving 0.04g of the sample with n-hexane and putting it into a 25 ml volumetric flask. After that, it was diluted with n-hexane and then homogenized until the sample can dissolve completely. The absorbance was measured at a wavelength of 446 nm and calculated the content of β-carotene by following the equation below.

$$\beta - carotene\ content = \frac{2\ x\ Absorbance\ of\ sample\ x\ 383}{weight\ of\ sample\ x\ 100}$$

2.5 Organoleptic Test

Samples were prepared in the form of crackers made from various ratios of the mixture of cassava and protein isolate powder from the solid waste of the soy sauce factory and grated carrots with various ratios of 1:0:0, 1:1:2, 1:2:4, 1:3:6. The taste organoleptic test was carried out on 15 panelists by giving the following scores: 3 for very like; 2 for like; 1 for dislike.

3 RESULT AND DISCUSSION

3.1 The protein content

Determination of protein content based on the amount of N occurs in three stages, based on the following reaction:

1. Destruction

$$(C, H, O, N)n + H_2SO_{4(p)} \longrightarrow (NH_4)_2SO_4 + SO_2 \longrightarrow CO_{2(g)} + H_2O$$

2. Destilation

$$(NH_4)_2SO_4 + 2\ NaOH \xrightarrow{heated} Na_2SO_4 + 2\ NH_4OH$$

$$NH_4OH \xrightarrow{heated} NH_{3(g)} + H_2O$$

$$NH_{3(l)} + 4\ H_3BO_3 \xrightarrow{tashiro} (NH_4)_2B_4O_7 + 5\ H_2O$$

3. Titration

$$(NH_4)_2B_4O_7 + 2\ HCl \longrightarrow 2\ NH_4Cl + H_2B_4O_7 + 5\ H_2O$$

Based on the above reaction, the amount of boric acid that reacts with ammonia can be determined by titration using hydrochloric acid to obtain % N, then the protein content is calculated by multiplying a factor.

The Table 1 shows that the highest protein content is 5.38% for comparison (1:3:6), while the lowest protein content is 1.55% for comparison (1:0:0). This shows that with the addition of

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protein isolates from the Soy Sauce Factory Solid Waste, the protein content also increases. Table 1 shows that the protein content data is significant because htable > hcount i.e. 57.65 > 24.22 so the data is reliable.

Table 1. The Protein Content

No	Crackers	The volume of titration (mL)			Protein content (%)			$\sum X_t$ (%)	Average protein content
		I	II	III	I	II	III		
1.	A	1.25	1.15	1.15	1.36	1.66	1.64	4.66	1.55
2.	B	2.05	2.0	2.0	3.37	3.37	3.36	10.1	3.37
3.	C	2.6	2.55	2.6	4.38	4.30	4.36	13.04	4.35
4.	D	3.3	3.15	3.2	5.45	5.32	5.38	16.15	5.38
TOTAL								**43.95**	**14.65**

3.2 The β-carotene content

Table 2 shows that the highest content of β-Carotene was obtained at 53.39 ppm in crackers with a ratio (1:3:6), while the content of β-Carotene in crackers (1:0:0) or crackers without the addition of carrot extract contained the β-carotene was 0 or none contains β– Carotene at all. This shows that with the addition of carrot extract, the β-Carotene content also increases, and Table 2 shows that the β-Carotene calculation data is significant because h table > h count that is 4900 > 3333,3973 so the data is reliable.

Table 2. The β-carotene content

Crackers	Absorbance			β – Carotene content (ppm)			$\sum X_t$ (%)	Average of β – Carotene content (%)
	I	II	III	I	II	III		
A	0	0	0	0	0	0	0	0
B	0.0125	0.0124	0.0122	29.12	28.89	28.82	86.83	28.94
C	0.0135	0.0131	0.0132	33.75	32.75	33	99.5	33.17
D	0.0258	0.0254	0.0257	53.94	53.10	53.73	160.77	53.59
TOTAL							**347.10**	**115.70**

3.3 Organoleptic Test

From the results of the taste organoleptic test that was carried out on 15 panelists consisting of toddlers and children, it was found that the panelists preferred the crackers in the 1:2:4 variation with the highest score of 2.33 while the lowest value was 1.86 at variation (1:0:0), while the most exciting color is crackers in the ratio (1:3:6). This shows that the addition of grated carrots causes the color of the crackers to change to orange so that it becomes more attractive.

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4 Conclusion

The soy sauce factory solid waste, which in this case is in the form of soy sauce dregs, can be processed into protein isolate and the protein isolate contains protein after being tested by the qualitative biuret method so that it can be used as a mixture and source of protein in the manufacture of crackers that can add to the nutritional value of the crackers. From the MPF crackers produced, the highest protein content of 5.38% was obtained, namely in crackers with a ratio of 1:3:6 with the natural addition of carrots, and the highest -Carotene content was obtained at 53.59 ppm, namely in crackers with a ratio of 1: 3:6. Furthermore, the most delicious, savory, and fragrant crackers and the most preferred are crackers with a ratio of 1:2:4.

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