



APPLICATION OF THE TAGUCHI METHOD IN AN EFFORT TO OPTIMIZE THE SHRIMP HEAD POWDER BROTH PRODUCTION PROCESS

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ABSTRACT

Indonesia is a maritime country with abundant marine resources. Currently, Indonesia is a country that exports marine products, one of which is shrimp. The shrimp exported are headless shrimp. One of the shrimp exporting cities is Sorong City, Southwest Papua Province. One shrimp export company is capable of producing and exporting 1,800 – 2,000 tons of shrimp per year. Therefore, this research focuses on good production processes to produce good products. This research applies the Taguchi method in the sample making process, and then carries out proximate analysis as product testing. The results of this research show that an experiment with a temperature of 200 and a time of 80 minutes is the best level which produces a product with the lowest air content and a protein content of 43.90%, fat 2.58% and carbohydrates 9.80%. This value is the best value of all levels .

Keywords: Shrimp, Taguchi, Proksimat

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1. INTRODUCTION

Natural wealth is one of the factors for the defense and economic development of a country nationally (Nikawati., 2021). Apart from being on a national scale, the use of local resources can improve the economy of small and medium-sized communities (Ridzal & Hasan., 2019). Indonesia is a maritime country, where the results of marine wealth are very abundant (Sukamto.,2017). Currently, Indonesia is a marine product exporting country. One of the marine products exported is shrimp (Pudyastiti et al.,2018). Data from the Central Statistics Agency show that the number of shrimp exports was 861,336 kg in 2019 (Badan Pusat Statistik., 2017). In the process, each shrimp exporter has waste in the form of shrimp heads. Shrimp head contains high enough protein (Prihatini, E.S., 2010), so it can be used as an additional ingredient for making crackers to add protein to cracker products (Adawiyah et al., 2017). In addition to high protein content, shrimp heads also contain astaxanthin which functions as an antioxidant (Mauludia., 2021).

West Papua is one of the contributors to abundant marine products with export quality (Sienatra et al., 2021). Until now there has been no handling of export waste in the West Papua region, especially in Sorong Raya. Based on interviews conducted with one of the shrimp exporting companies in the city of Sorong, namely PT. Irian Marine Product Development, they stated that each year they are able to export 1,800 – 2,000 tons of shrimp/year. As explained above, there is no handling of shrimp export waste. This is because public understanding is still limited.

The results of research conducted by Siti et al (2023) stated that a good shrimp head waste production process is the roasting process. However, this research only produces information related to the production process that produces the shrimp head powder broth product that respondents like most. However, the nutritional value of this product is not yet known. Therefore, this research will be carried out in more depth by carrying out proximate tests to determine the nutritional content of the

samples. The results obtained will later show what processes and factors are influential. The formulation of the problem in this research is: (1) What factors influence the quality of powdered broth made from shrimp head waste? (2) Which process produces shrimp head powder broth that has high nutritional value? . This research will apply a method for determining the number of samples using the Taguchi method and laboratory tests. because the Taguchi method is a very good method in terms of experimental research (Cudney et al., 2011).

2. METHODS

This research was carried out using two methods, namely the Taguchi method and laboratory tests. In this research, the Taguchi method is used as a tool to determine the number and combination of experiments (Wahjudi et al., 2001), This taguchi method also functions as a tool in efforts to improve product quality (Muid et al., 2021). Samples from the experimental results will be tested in the laboratory for analysis quality of product (Isnaeni et al., 2014). The process of this research is to process shrimp heads using predetermined factors. In previous research, temperature and time factors influenced the results of the shrimp head powder broth production process. Therefore, researchers used these two factors, namely temperature,time, and additional spices as control factors. The equipment used in this research process is a drying machine and a grinding machine. After the samples are made in different quantities and levels, they are then carried out proximately in the food laboratory. The proximate test is carried out to determine the percentage of nutritional content, in this case, protein, fat, watter content and carbohydrates in the product. From the results of the proximate test, it will be known which level the sample has the highest nutritional value. The number of levels and samples is determined using the Taguchi method (Kamaruddin et al., 2010), in this case, created in an orthogonal matrix:

$$VA = (\text{sum of factor A levels}) - 1 = kA-1 \quad (1)$$

$$VB = (\text{sum of factor B levels}) - 1 = kB-1 \quad (2)$$

For interactions, for example the interaction of A and B

$$VA \times B = (kA.1) (kB.1) \text{ total degrees of freedom} = (kA.1) + (kB.1) + (kA.1) (kB.1)$$

3. FINDINGS AND DISCUSSION

3.1. Findings

A good process for processing shrimp heads into powdered stock is to dry them using a drying machine (Siti et al., 2023). To determine the number of samples in applying the Taguchi method is to determine the control factors and arrange them in a matrix (Sawitri et al., 2021). The control factors in this research are temperature, and time. The following is a matrix that shows the number of experiments that must be carried out in this research:

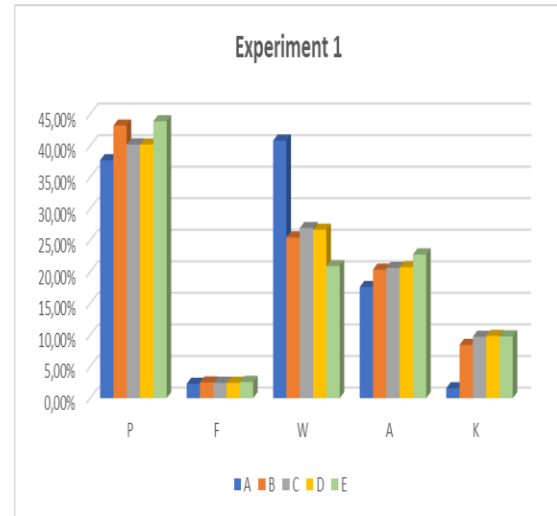
$$\begin{aligned} F (\text{Number of Factors}) &= 2 \\ \text{Runs} &= 10 \\ \text{Signal/Replay} &= 2 \\ \text{Columns of L4} &(23) \\ \text{Db (Level)} &= 3-1=2 \\ \text{Db (OAW)} &= F \times \text{db (level)} \\ &= 2 \times 2 = 4n = \text{db (AO)} + 1 = 5 \end{aligned}$$

Table 1. Experiment 1

Lav el	Factors		Experiment 1				
	Te mp	Time (Men ute)	P	F	W	A	K
A	150	40	37,7 1%	2,27 %	40,8 3%	17,6 1%	1,58 %
B	200	60	43,2 0%	2,50 %	25,4 8%	20,3 8%	8,44 %
C	250	80	40,2 2%	2,44 %	26,9 6%	20,6 4%	9,74 %
D	150	60	40,2 1%	2,44 %	26,7 1%	20,7 6%	9,88 %
E	200	80	43,9 0%	2,58 %	20,9 4%	22,7 8%	9,80 %

information :

P: Proteins, F: Fat, W: Water, A : Ash, K: Carbohydrates



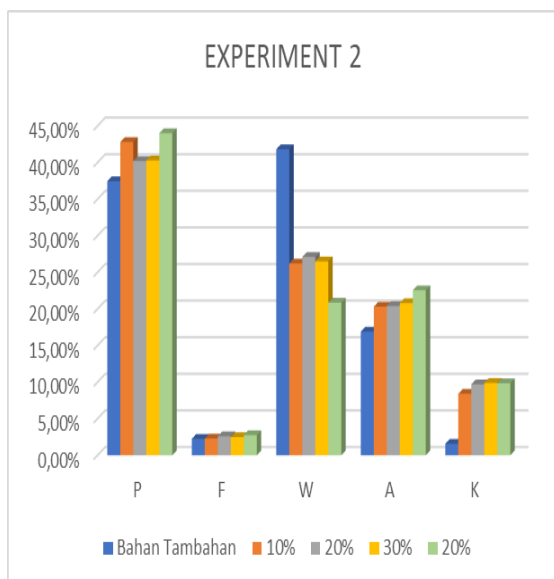
Picture 1. Grafik Of Experiment 1

Table 2. Experiment 2

Lav el	Faktor Kendali		EXPERIMENT 2				
	Te mp	Time (Men ute)	P	F	W	A	K
A	150	40	37,4 5%	2,25 %	41,8 2%	16,9 0%	1,58 %
B	200	60	42,8 0%	2,30 %	26,2 0%	20,3 0%	8,40 %
C	250	80	40,2 0%	2,60 %	27,1 0%	20,4 0%	9,70 %
D	150	60	40,3 0%	2,50 %	26,5 0%	20,8 0%	9,90 %
E	200	80	44,0 0%	2,75 %	20,8 5%	22,5 5%	9,85 %

information ;

P: Proteins, F: Fat, W: Water, A : Ash, K: Carbohydrates.



Picture 2. Grafik Of Experiment 2

3.2. Discussion

This research uses 2 control factors, namely temperature and time, and 3 levels, in this case, temperature 150,200, and 250, and time 40 minutes, 60 minutes, and 80 minutes. The experiment was carried out with two repetitions. Therefore, the number of experiments was 10 times. Experiment 1 showed that samples with level 1 had a high water content, namely 40.83%, protein 37.71%, and very low carbohydrate content, namely 1.58%. Meanwhile, at level E, the percentage of water content is very low, namely 20.94%, the amount of carbohydrates is 9.80% and protein is 43.90%. This is because the temperature and time factors of the drying process greatly influence the quality of the product (Wiranata et al., 2016). Apart from that, this research shows that the amount of water content has a big influence on the amount of protein and carbohydrates in the sample. The total percentage of protein, fat, water, ash and carbohydrates in experiment 2 has values that tend to be the same as experiment 1. Low water content without damaging the product and producing products of good quality must use the right temperature and process time (Maulina et al., 2017).

4.CONCLUSION AND SUGGESTION

Based on this research, it can be concluded from experiments 1 and 2 that the level E sample is the

best sample. This is because the lowest water content produces products with higher protein and fat content compared to samples from levels A-D. In addition, samples from level E showed the same or greater amount of carbohydrates than samples from other levels. After knowing the results of the shrimp head powder broth using this experiment, further research can be carried out to find out whether there are dangerous substances and the shelf life of the product.

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