PHYSICAL PROPERTIES OF LARD IN TUNA PROCESSED PRODUCTS IN ORDER TO INCREASE HALAL FOOD SAFETY

M Taufik[1,*], D Ardila[2], M Razali[3], A. Ghozali[2]
[1]Department of Chemistry, Universitas Sumatera Utara, Medan, Indonesia
[2]Department of agricultural technology, Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia
[3]Department of Pharmacy, Universitas Tjut Nyak Dhien, Medan, Indonesia
*E-mail: muhammad.taufik@usu.ac.id

ABSTRACT

Food safety in Indonesia was held to keep food safe, hygienic, quality, nutritious and halal. In increasing taste and economic reasons, processed food products are often found mixed with lard. This study aims to analyze the physical properties of lard in tuna processed products. Maceration method used n-heksan as a solven. Complete Randomized Design (CRD) factorial was carried out used 2 (two) replications. Factor 1 was chosen variation of solven concentration (K) consisting of 4 levels, namely K_1 = 20%, K_2 = 30%, K_3 = 40%, K_4 = 50%. Factor 2 was chosen maceration time (W) consisting of 4 levels, W_1 = 6 hours, W_2 = 12 hours W_3 = 18 hours, W_4 = 24 hours. The parameters was observed density, iodine numbers, acid numbers and total Microbes. The results showed that the solvent concentration had a highly significant effect ($p < 0.01$) on the analysis of acid and total microbial numbers. The concentration of n-hexane showed a very significant different effect ($p < 0.01$) on the analysis of density and total microbial but gave a significant effect ($p < 0.05$) on the analysis of acid numbers and the unreal effect on iodine numbers.

Keywords: tuna, lard, food, n-hexane, maceration.

A. INTRODUCTION

Changes in lifestyle make food products that was fast and practical choices including tuna processed products. World consumption of tuna processed product is very large. In 2017, the average of Indonesian consumption of tuna fish was 0.408 ounces per capita in one week. This number increased from 2016 which only ranged from 0.301 ounces per capita [1]. Generally, the composition of tuna l is water (71%), protein (21.6%), fat (1.3%), minerals (1.2%), ash (1.45%), vitamin A (0.5 %) and vitamin D (1.0%). Various types of dishes and application of tuna processed products increase in several years. Therefore, maintaining the freshness of fish and quality was very much considered. The thickness of the layer of fat under the skin changes according to age and season. Determination of food halal was very complex. Currently, food processing technology, preservation technology, packaging technology, food genetic engineering and the use of chemicals in food products have experienced development. Processed food products usually use additional ingredients to improve taste. The use of lard is possible so that it will harm consumers[2].

Adulteration was a mixture or counterfeiting of a product that did not meet standards [3][4][5]. The addition of lard in food to improve flavor and sharpen the aroma so that consumers were increasingly interested in the product. Sometimes to attract consumers, the existing halal signs are often misused by business people. One of them is by putting a halal sign, even though it has never been examined by a competent institution. Food labeling regulations in many countries require that meat species used in processed meat products must be listed for consumers because of ethics in religion, medical goals, and personal food preferences [6]. Problems related to the presence of lard in food had occurred in Indonesia. For example, the product of Monosodium Glutamate (MSG) which in its production process uses a catalyst from Bactosoytone which contains pig enzymes. Pig enzymes were not detected in MSG final products, but due to the use of illicit substances in the production process, the products were finally declared unlawful.

The challenge in determining the authenticity of food was indeed increasing for food analysts because the practice of counterfeiting becomes more subtle and complicated, so to detect it becomes very difficult [7]. The effort to identify had been done by various methods. The method that had been developed was the detection method with Fourier Transform Infra Red (FTIR) to detect lard so that its application to detect lard which is mostly protein requires sample preparation which is not easy [8][4]. Other identification with PCR-RFLP method of cytocrome b gene and primary PCR specific amilogenin gene [9]. The disadvantage in the PCR-RFLP method is that it takes a long time because it passes through two important stages of analysis, namely the PCR itself and the cutting of DNA from PCR results with restriction enzymes. Therefore, efforts to find practical methods are still being carried out. One easier and simpler method is to use a separation or extraction method using maceration techniques with solvents so that later the desired fat is obtained. The extraction results were tested for chemical physical properties and total microbial tests which were then compared between original products and products mixed with lard. This method is simpler and more efficient because it does not require complicated instruments in its implementation. This maceration method is classified as simple and fast but has been able to extract the simplicia active substance to the maximum [10]. This research was conducted in order to developed methods to identify differences in physical properties of pure tuna fish products with products adapted to lard. In this case we will study the physical properties of lard in processed tuna products.

B. MATERIALS and METHOD

The ingredients used in this study were canned tuna products and lard. The chemicals used in this study were n-hexane, nutrient agar, sodium thiosulfate, chloroform[11], alcohol 96%, KOH, Na_2SO_4, HCl, indicators of PP, Aquades, iodine-bromide, starch indicators, indicator PP, CH_3COOH, saturated KI solutions , 0.5% H_2SO_4.

Design of research

This study uses a factorial completely randomized design consisting of two factors [4][3]: Factor I: Solvent Concentration (K) consists of 4 levels, namely: K_1 = 20%, K_3 = 40%, K_2 = 30%, K_4 = 50%. Factor II: Maseration Time (W) consists of 4 levels, namely: W_1 = 06 Hours, W_2 = 12 Hours, W_3 = 18 Hours, W_4 = 24 Hours.

Preparation and extraction

Preparation and extraction was carried out at the Agricultural Technology Laboratory UMSU Medan. Sample was used lard and tuna processed products. Tuna samples were weighed 5 grams, mashed, added 5 grams of lard, macerated[12], filtered, and then added anhydrous Na_2SO_4. Physical testing process was carried out, including density, iodine number, acid number, and total microbes.

C. RESULT and DISCUSSION

The effect of n-hexane concentration and maceration time on each parameter showed in **Tab 1**.Density, iodine number, acid number and total microbes increased as the concentration increased. The effect of maceration time on parameters showed in **Tab. 2**. The longer of the maceration time, density, acid number and total microbes was be increased. However, iodine numbers showed a decrease with increasing maceration time.

Table 1. Effect of n-hexane concentration on parameters of lard in tuna processed products

concentration	density (g/ml)	iodin number (gIod/100g)	acid number (mgKOH/g)	total microbe (log CFU/ml)
K1 = 20%	0,890	73,851	2,323	4,216
K2 = 30%	0,895	74,233	2,380	4,279
K3 = 40%	0,899	74,264	2,461	4,315
K4 = 50%	0,905	75,438	2,558	4,337

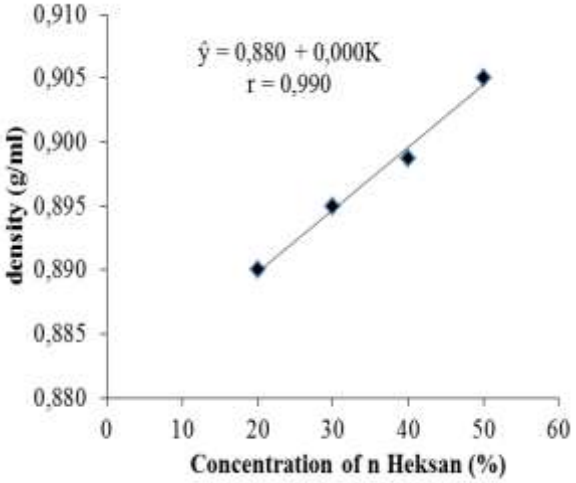
Table 2. Effect of Maseration Time on Parameters of lard in tuna processed products

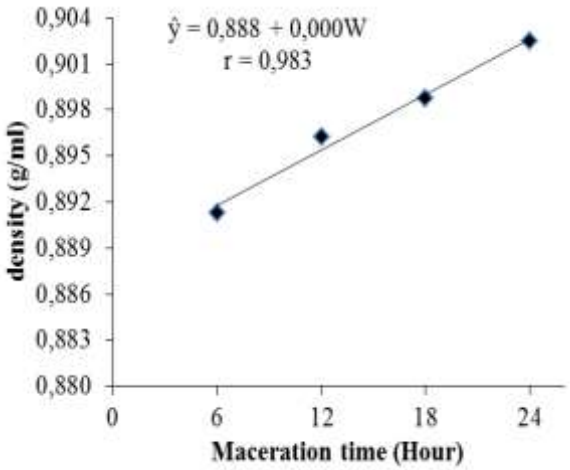
concentration	density (g/ml)	iodin number (gIod/100g)	acid number (mgKOH/g)	total microbe (log CFU/ml)
K_1 = 20%	0,891	75,629	2,350	4,173
K_2 = 30%	0,896	74,643	2,405	4,206
K_3 = 40%	0,899	73,885	2,435	4,359
K_4 = 50%	0,903	73,629	2,531	4,410

Density

The concentration of n-hexane had a significantly different effect ($p < 0.05$) on the parameters of the density obtained. The treatment of K_1 gives a different effect that is not significant with K_2 and K_3 treatment, but differs very significantly from K_4 treatment. The treatment of K_2 is not significantly different from the treatment of K_3 and K_4. K_3 treatment was not significantly different from K_4 treatment. The highest density value was in the K_4 treatment = 0.905 g / ml, while the lowest value was in K_1 treatment = 0.890 g / ml (**Fig.1**).

The maceration time had a significantly different effect ($p < 0.05$) on density parameters. The treatment of W_1 showed a very different effect with the treatment of W_2, W_3 and W_4. W_2 treatment is not significantly different from W_3 and W_4. W_3 treatment was not significantly different from W_4. The lowest density in the treatment of maceration time was in W_1 = 0.891 g / ml and the highest value in W_4 = 0.903 g / ml (**Fig. 2)** .





Iodine Numbers

N-hexane concentration had no significant effect (p> 0.05) on the iodine number parameter. In the treatment of solvent concentration the number of iodine produced from the solvent treatment 20% to 50% treatment had increased. Iodine number at 20% was at the lowest point (73.851 g Iod / 100 g). Then there was an increase to the highest point, which was 50% to 75.438 g Iod / 100g. The value of iodine number obtained between all treatments ranged from 73.851 gIod / 100 g to 75.438 gIod / 100 g. The maceration time had a significantly different effect (p <0.05) on the parameters of iodine number. The treatment of W_1 gave a different effect which was not significant with W_2 treatment and was significantly different from the treatment of W_3 and W_4. W_2 treatment is not significantly different from W_3 and W_4. The treatment of W_3 gave a different effect which was not significant with W_4. The lowest iodine number between the treatment of maceration time was at W_4 treatment, that is 73,629 g Iod / 100 g and the highest value on W_1 treatment was 75,629 g Iod / 100 g.

Fig. 3 shows the treatment of 6 hours to 24 hours had decreased. At 6 hours, the iodine number = 75,629 gIod / 100g. Its continued to decrease until the 24-hour treatment became 73,629 gIod / 100g. Iodine number obtained between from 73.692 to 75.692 gIod / 100g and the averaged = 74.446 gIod / 100g. The interaction of n-hexane concentration and maceration time had a very significant different effect (p <0.01) on iodine numbers. N-hexane concentration of 50% and maceration time of 6 hours (K_4W_1) obtained the highest iodine number = 79.435 g Iod / 100g. While the lowest value was in n-hexane concentration = 20% and maceration time = 12 hours (K_1W_2) and the result = 72,200 gIod / 100g.

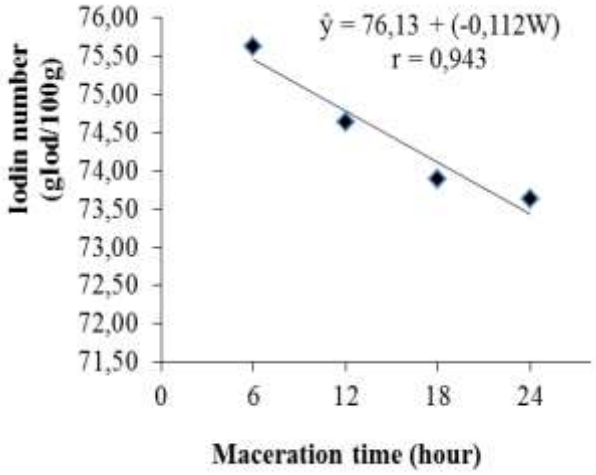


Figure 3. Maseration Time vs Iodine Numbers

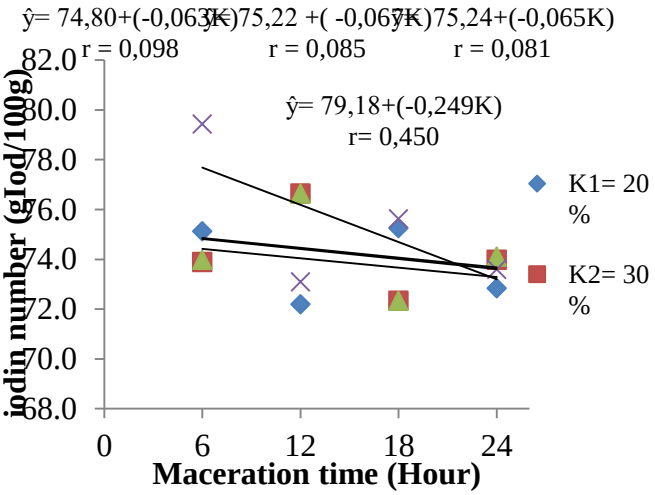


Figure 4. Relationship of Interaction n-Hexane and maseration time on Iodine Numbers

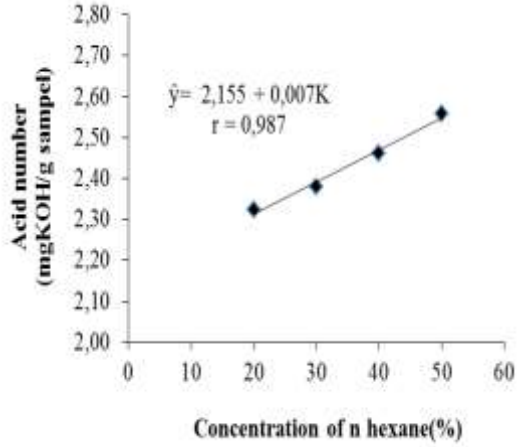


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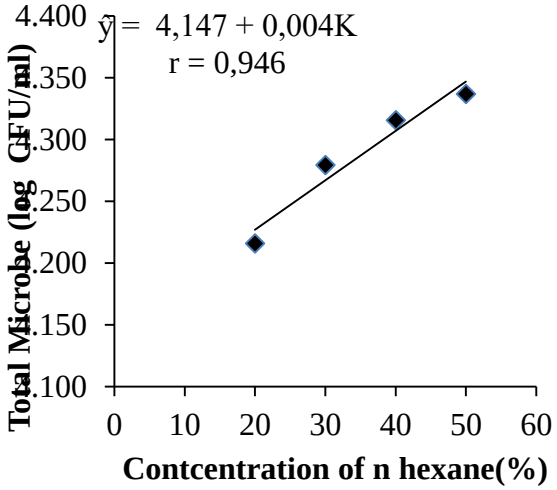
Fig. 4 shows the iodine numbers obtained would be fluctuate. Iodine number (K_1W_1) was obtained 75,120gIod / 100g, K_2W_1 was decreased = 73,980 gIod / 100g and K_4W_1 = 79,435 gIod / 100g was increased. However, if the entire treatment of W_1 to W_4 is averaged, the iodine number will decrease as the maceration time increases. Whereas in the n-hexane solvent concentration treatment, the amount of concentration will produce fluctuating iodine numbers, but if it was averaged the value will increase along with the increase of n-hexane solvent concentration. This means that along with increasing concentration and maceration time the iodine number produced will fluctuate between each treatment. However, the lard content which has fewer chain saturated fatty acids (PUFA). Unsaturated fatty acid content in lard is 6-11%[6].

Acid Numbers

The concentration of n-hexane has a significantly different effect (p <005) on the resulting acid number parameters. Acid numbers had increased with increasing n-hexane concentration. **Tab. 2** showed that K_1 had a very different effect with K_2 and K_3, but it is not significantly different from K_4. K_2 was not significantly different from of K_1 and K_4. However, K_3 differs not significantly from K_4. The lowest result of K_1 = 2.323 mgKOH / g sample and the highest value in K_4 = 2.558 mgKOH / g sample (**Fig. 5**). **Fig. 5** showed acid number produced from 20 to 50% treatment has increased. Lard has an acid number of 1,300 mgKOH / g of sample. Whereas from the results, the average value of the acid number = 3.405 mgKOH / g sample. These results indicated that the free fatty acids contained are less. Acid numbers was an indicator of the free fatty acids contained in oi[11]l. Maceration time has an unreal effect (p> 0.05) on acid number parameters.

Total Microbes

N-hexane concentration had a highly significant effect (p <0.01) on the total parameters of microbes. The total number of bacteria increases with the amount of solvent concentration. K_1 had a very different effect with the treatment of K_2, K_3 and K_4. K_2 was not significantly different from K_3, but it was significantly different from K_4. The lowest total microbial was in K_1 = 4.216 log CFU / ml (1.7x104 CFU / ml) and the highest value = K_4 (4.337 log CFU / ml (2.2x104 CFU / ml)) (**Fig. 6 and 7)**.



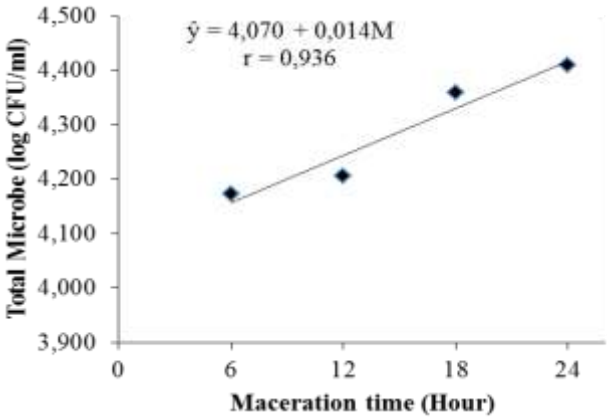


Figure 6. N-hexane concentration vs total microbes **Figure 7**. Maseration time vs total microbes

The total microbes produced from 20 to 50% was to increased. Many factors influence the growth of microbes such as the nutrient content of the substrate, water content, temperature, humidity and acidity[13]. an increase in the total number of microbes in products mixed with lard due to the increasing nutritional content of the substrate. When the solvent concentration was increased, the solvent will reach in the saturation point longer so that the more substrate content is extracted in the oil. Tuna fish has a fat content of 4-5% which is dominated by unsaturated fats. Pigs had a lard of 20.24%. Lipolytic bacteria would be increase in number due to substrates that were very suitable for development and growth.

The maceration time has a very significant different effect ($p < 0.01$) on the total microbial parameters. **Fig.1 and 2** shows that W_1 had a different effect which did not significant with W_2 and differs very significantly from W_3 and W_4. The treatment of W_2 differs very significantly from the treatment of W_3 and W_4. W_3 treatment was not significantly different from W_4. **Fig 5** showed the effect of maceration on acid numbers, there is a linier of the increase in acid numbers and the activity of microorganisms. Acid numbers would be increase with the duration of maceration. This increase in acid numbers can occur due to the activity of lipase enzymes from microbes which break down triglyceride compounds into glycerol and free fatty acids. Therefore, the high total microbes obtained was directly proportional to the increase in acid numbers in the oil. Both of there were related to the length of maceration time. The presence of lipolytic activity due to microbes produces lipase enzymes which are used to hydrolyze triglycerides in oil to glycerol and fatty acids[5][14].

D. CONCLUSION

1. The maceration time had a very significant effect ($p < 0.01$) on the analysis of acid numbers, iodine numbers, total microbes and had a significantly different effect ($p < 0.05$) on the results of the analysis of specific gravity on pure tuna products.
2. The concentration of solvents gave a very significant different effect ($p < 0.01$) on the analysis of specific gravity and total microbes but had a significant effect ($p < 0.05$) on the analysis of acid numbers and the unreal effect on iodine number on the product tuna mixed with lard.

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