ISSN (Print) : 0974-6846
ISSN (Online) : 0974-5645
Indian Journal of Science and Technology, *Vol 12(2), DOI: 10.17485/ijst/2019/v12i2/138333, January 2019*

Investigation of Lard on Pork Nuggets using UV Spectrophotometry

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Abstract

Objective: To make quantitative analysis of lard using UV Spectrophotometry. **Method:** UV Spectrophotometry techniques were carried out in order to determine the level of lard in pork nuggets. The extraction process was observed using n-hexane solvent and at temperature 55°C. **Findings:** The optimum wavelength was found to be at 270 nm. The lard concentration of five samples of pork nuggets was 24.9123%, 26.2719%, 26.8421%, 24.9123 and 24.5614% respectively. **Novelty/Improvement:** This work provides a simple method of investigating lard in pork nuggets.

Keywords: Extraction, Lard, n-Hexane, Nuggets, Pork, UV Spectrophotometry

1. Introduction

UV radiation at short wavelengths <150 nm (> 8.3 eV) caused the breakdown of the strongest bonds in organic molecules[1,2]. Spectrophotometric analysis is precise, fast and very suitable that can be used at a small laboratory. The compounds analyzed must be have a chromophore group that can be compared before and after partition[3]. The spectrum is often shown on special fatty acids of lard[4]. Investigation of lard on pork nuggets has been done a lot because it is very important to prove whether the food sold contains lard or not. Lard is one of the pig derivatives made in two ways: wet and dry rendering. In wet rendering, lard is boiled in water or steam at high temperatures and lard which is insoluble in water, filtered from the surface of the mixture, separated by centrifugation. In dry rendering, fat is given high heat in a pan or oven without water[5–7]. Lard taken from the wall of the pork belly is of the highest quality. The part has a soft, white taste and has an acid value of no more than 0.8. Lard has less triglycerol content than triglycerol in cow fat. Therefore, lard fats at lower temperatures[8]. Table 1 shows the composition of fatty acid in lard. The composition of lard stearin and lard olein was determined used Differential Scanning Calorimeter (DSC) instrument[9].

Identification of lard in processed meat products can only be detected based on DNA data. This is very expensive. Research on forgery of pork into processed meat products, especially meatballs, has been studied using SDS-PAGE. The results obtained are the detection of protein fractions with certain molecular weights on these products[10]. The characterization of myofibril protein as an alternative for identification of pork in sausages has also been studied[10,11].

This work used pork nugget as a sample analysis. One obstacle that is often faced in examining lard is the absence of a truly valid method for analyzing non-halal substances in food[11]. One of the compounds that

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are often used is fat or oil. The difference between one fat to another is in the constituent fatty acid components, the order of fatty acids and the saturation level of fatty acids[7]. The physical properties of lard had also been studied and the results obtained had a marked difference from other animal fats (tuna fish, chicken and cow)[6,12].

Several methods of analysis on lard were e-nose GCMS, spectrophotometry FTIR, PCR-electrophoresis, TaqMan probe RT-PCR, Molecular beacon RT-PCR, SYBR green RT-PCR and gold nanoparticle. Some of these methods require a lot of time and cost, so a fast and reliable analysis technique needs to be developed for analyzing pork in food products. There was a significant difference in fatty acid composition among the three animal fat samples based on GCMS analysis where Saturated Fatty Acid (SFA) content in lard was much greater (68%) compared to chicken fat (33%) and pork (21%), while the Polyunsaturated Fatty Acid Content (PUFA) in lard is relatively larger (25%) than chicken fat (18%) and pork (1.2%)[5,8,13]. Whereas in cooked beef sausages, the protein can be detected and yield at BM 36.31 KD. The Fourier Transform Infrared (FTIR) spectroscopic method was used to observe lard in the mixture of olive oil using Principal Component Analysis (PCA) and quantifiedy with the help of Partial Least Square (PLS) with a detection limit at 11.92%[7,14]. However, examination using UV Spectroscopy is still little, so this study was undertaken.

Table 1. The composition of fatty acids in lard[7,8]

Fatty acid	Amount	Ref
Myristic acid (C14:0)	1,30 ± 0,03	1,0 – 2,5
Palmitic acid (C16:0)	20,66 ± 0,24	20 – 30
Palmitolic acid (C16:1)	1,98 ± 0,01	2,0 – 4,0
Heptadocanioc acid (C17:0)	0,48 ± 0,01	< 1,0
Stearic acid (C18:0)	10,91 ± 0,12	-
Oleac acid (C18:1)	39,13 ± 0,09	35 – 55
Linoleic acid (C18:2)	19,56 ± 0,04	4 – 12
Linoleic acid (C18:3)	1,21 ± 0,06	< 1,5
Arachidic acid (C20:0)	0,91 ± 0,01	< 1,0
Heneicosanic acid (C21:0)	0,50 ± 0,05	-
Behenic acid (C22:1)	0,26 ± 0,02	-
Eicasaenoic acid (C20:1)	0,96 ± 0,04	<1,5
Eicosapentaenoic acid (C20:5n3)	0,12 ± 0,00	-
Eicasohexaenoic acid (C20:6n3)	0,14 ± 0,01	-
Docosahexaenoic acid (C22:6n3)	0,20 ± 0,00	-

2. Materials and Method

The ingredients used in this study were pork nuggets and lard. The solven at maceration process was used n-hexane at temperature 55°C.

2.1 Design of Research

This study uses a factorial completely randomized design consisting of two factors: Factor I: Solvent Concentration (K) consists of 5 levels, namely: K_1 = 20%, K_2 = 30%, K_3 = 40%, K_4 = 50%, dan K_5 = 60%. Factor II: Maseration Time (W) consists of 5 levels, namely: W_1 = 06 Hours, W_2 = 12 Hours, W_3 = 18 Hours, W_4 = 24 Hours and W_5 = 30 Hours.

2.2 Preparation and Extraction

Preparation and extraction was carried out at the Agricultural Technology Laboratory UMSU Medan. Lard samples were weighed 5 grams, macerated, filtered and then added anhydrous Na_2SO_4. Spectroscopy analysis was carried out used Genesys 10S UV-vis Spectrophotometer.

3. Result and Discussion

In this study, maceration was carried out on a laboratory scale and n-hexane solvents were chosen because they have the ability to dissolve the lard to the maximum lard are generally insoluble in water but are soluble in organic solvents. The choice of the most suitable solvent for lipid extraction is to determine the degree of polarity[15,16]. N-hexane solvents were chosen because they have more ability to extract fatty acids found in lard. This condition is very possible to obtain an abundance of high amounts of fatty acids found with the addition of weight and maceration time. However, Extraction process is the separation process of the component from a mixture based on the distribution process of two types of solvents that do not mix together. Solvent extraction is generally used to separate the desired number of groups and may be a confounding group in the overall analysis[15].

In this study, temperature had been optimized and optimal process was obtained at 55°C. UV-vis spectrophotometry analysis measures the transmission or absorbent of a sample as a function of a wavelength. This instrument empoyed UV electromagnetic radiation at 190-380 nm and visible light at 380-780 nm. This spectroscopy is often used as a quantitative analysis when compared to qualitative[6,15]. A spectrophotometer is used to measure energy relatively if the energy is transmitted, reflected or emitted as a function of the wavelength[3]. Figure 1 shows the pat-

tern of spectra of lard in n-hexane solvents. A single peak at 270 nm wavelength with an absorbance value of 0.777 was identified. Determination of the optimum wavelength is done using a standard solution concentration of 10%. The resulting pattern is as follows: Linear regression was developed using standard solutions 5, 10, 15, 20 and 25% lard. The regression equation can be seen in Figure 2.

The value of R^2 = 0.958 has shown that the linear regression obtained in this study can be trusted for its accuracy and can be continued with sample measurements. Five (5) samples had been analyzed with variations in the concentration of n-hexane (K) consisting of 5 levels, namely: K_1 = 20%, K_2 = 30%, K_3 = 40%, K_4 = 50%, K_5 = 60%. Factor II: Maseration Time (W) consists of 5 levels: W_1 = 06 Hours, W_2 = 12 Hours, W_3 = 18 Hours, W_4 = 24, and W_5 = 30 Hours. Measurement data was carried out based on factorial namely variations of K_1W_1 (sample 1), K_2W_2 (sample 2), K_3W_3 (sample 3), and K_4W_4 (sample 4), and K_5W_5 (sample 5). The results of UV spectroscopic analysis can be seen in the Figure 3 which reveals the concentration of lard by the addition of n-hexane concentration and maceration time. However, the n-hexane concentration of 40% and the maceration time of 18 hours gave the best results with the highest amount of lard extracted. Thus the spectroscopic technique using a UV-vis spectrophotometer is an easy laboratory work that can be applied as simple tests in the field also. This investigation of lard on pork nuggets is very helpful in forensic analysis of counterfeiting of food ingredients. However, initial investigations of this sort have been carried out and will contribute to further research.

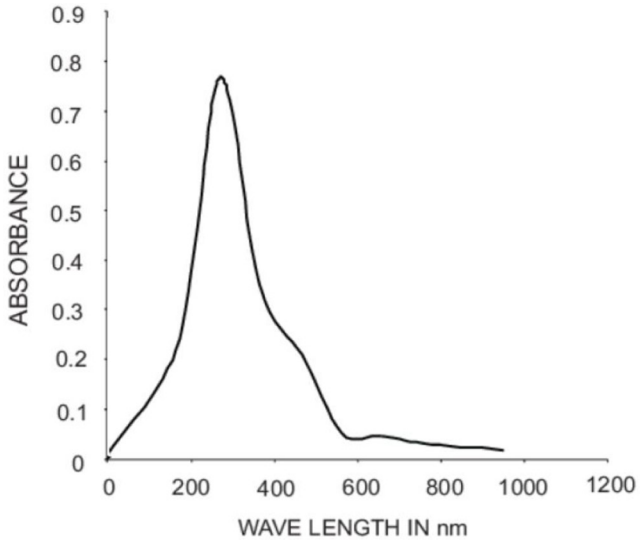

Figure 1. UV-vis spectra spectra of lard.

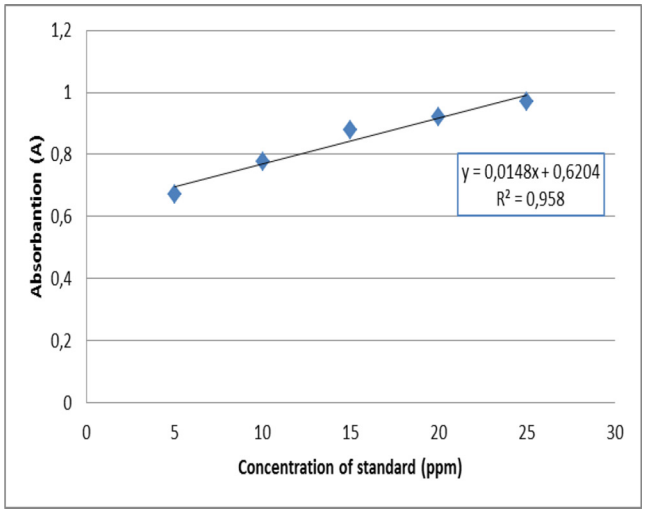

Figure 2. Linear regression.

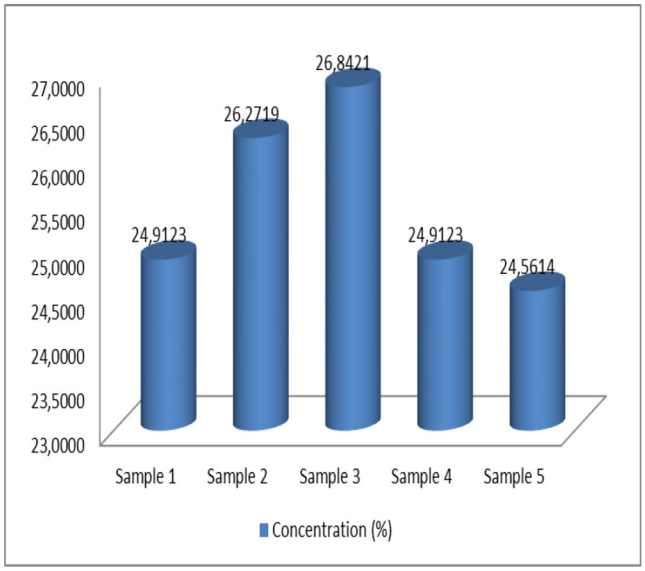

Figure 3. Quantitative analysis of lard using UV Spectrophotometry.

4. Conclusion

- An investigation of lard using UV Spectrophotometry has been done.
- The optimum amount of test material (lard in the pork nugget) for a quantity of n-hexane solvent and temperature (55°C) was investigated. The optimum wavelength for detection was found to be at 270 nm. The lard concentration of five samples of pork nuggets was 24.9123%, 26.2719%, 26.8421%, 24.9123 and 24.5614% respectively.

5. Acknowledgement

Authors would like to thank to Ministry of Research and Higher Education of Indonesia for research funding support via DRPM 2018 funding scheme.

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