Development of Maceration Methods in the Investigation and Analysis of Lard in Industrial Food Products to Improve Halal Product in Indonesia

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Abstract: The high demand for halal products in Indonesia requires chemists to produce a fast and accurate method of using them. The rapid development of Forensic Chemistry led to the emergence of a simple new method to analyze of lard in these industrial food products. In this study, the maceration method coupling electro synthesis using aluminium electrodes so that the extraction time was shorter. The investigation begins by collecting and preparing industrial food products (pork corned). The extraction time process used at 30, 60, 90, 120, 150 minutes (optimal time = 120 minutes). Analysis of the physical properties was carried out: iodine numbers, index bias, melting point, and acid number and the data obtained were 0.893, 72, 1.463, 370C, and 2,542 respectively. Lard quantity in food produced at the optimal conditions is 37%. However this method is very helpful in the field of forensic chemistry especially in the analysis of the presence or absence of lard in industrial food products. This research will support the improvement of halal products in Indonesia.

1 INTRODUCTION

Halal food is a food that does not contain elements that are unclean or prohibited for consumption by Muslims, both concerning food raw materials, food additives, auxiliary materials and other auxiliary materials including foodstuffs which are obtained through the process of genetic engineering and food, and whose management is carried out in accordance with the provisions of Islamic religious law. Halal food is food that is permitted to be consumed or not bound by the provisions that forbid it, good is delicious, good, healthy and reassuring (Hidayat, 2015).

The halal food industry is experiencing rapid growth in the world, especially in Indonesia. Halal lifestyle spread to various countries (Rohman, 2012). Halal is the main indicator for product quality assurance (Burlian, 2013). Consumers of halal products not only come from Muslims, but also countries with a majority of non-Muslims also consume halal food including Russia (Hidayat et al., 2015). The quality of halal products is the reason for using halal products (Salehudin, 2014) because there are guarantees of cleanliness, safety, and product quality for the entire production chain (Faridah Jalil, 2014). Providing halal and safe food is a must for a company so that its products are in demand by the wider community. Investigation and analysis on a laboratory scale by government and private agencies needs to be improved considering the recent halal products have received serious attention from all parties.

Lard is a basic ingredient of food commonly used as cooking oil or as a complement to dishes such as beef or goat fat, or as butter. The quality of taste and use of lard itself depends on what part of the fat is taken and how the fat is processed. Pig fat has saturated fat and cholesterol which is lower than butter. Fats in pigs need to go through a process to

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become lard which can be used as food. Pig fat contains 3770 kJ of energy per 100 grams (Hilda, 2014).

There are various food products that are very diverse, with special quality and prices. It's just that, sometimes to get it, materials are needed from one or more parts of the pig's body and then mix the parts with other processed food products. Economically, the use of pig ingredients can provide many benefits, because it is cheap and easy to obtain. These materials when processed into food products are very difficult to recognize (Nina, 2017). The cases of food containing ingredients from pigs have been prevalent in Indonesia since the 1980s until now (Fibriana, 2009). Therefore, knowledge of the various possibilities of using pig elements needs to be improved. One case example of containing pork is the Solaria restaurant pig oil case that appeared on August 15, 2013 so PT. Solaria rays experience a critical phase. PT. Sinar Solaria, under the Solarian restaurant, is currently in crisis because the restaurant does not yet have Hahal certification from MUI and Solaria restaurant and is also hit by the issue of pork oil used in its spices, besides PT. Indonesian walls, especially in Magnum ice cream products, are rumored to have pig oil in the packaging of their ice cream, and recently a horrendous case in Indonesia is the circulation of four Korean instant noodle products containing pig specific DNA fragments. The four products containing the pig, namely Samyang with the product name U-Dong, Nongshim, with the product name Shin Ramyun Black, Samnyang with Instant Kimchi flavored noodle products, and Ottogi with the name Yeul Ramen product.

Investigation is an active effort to find something (Rendle, 2005). In an investigation, chemists can provide a direction of examination that confirms the assumption that substances contained in a compound include the process of investigation and analysis (Sisco, 2018). Lard has been analyzed on pig nuggets using UV spectroscopy (max λ = 270 nm) with a 12 hour extraction time (Taufik, 2019). Analysis of the physical properties of lard fat that was adapted with beef, chicken and tuna was also analyzed using the Completely Randomized Design (CRD) method (Ardilla, 2018). The composition contained in lard was analyzed using the Chromatography and FTIR methods. Pig fat spectra differ from other animal fats. The extraction process used still uses maceration with n-hexane solvent so that the solvent is volatile and the lard is oxidized (Erwanto, Y., Rohman, A., Arsyanti, L. and Pranoto, 2018). Animal fats including lard will be damaged quickly if they are exposed to air for too long (12 hours) (Razali, 2018). However, maseration coupling electrosynthetic will be developed to reduce maceration time.

The simple maceration method is carried out by means of extracting by immersing the mashed sample. The principle of maceration is the extraction of active substances by soaking the powder in the appropriate solvent for several days at room temperature protected from light, the solvent will be inserted into the cell wall. Cell contents will dissolve because there is a difference between inner cell contents and outer cells. A high concentration solution will be pushed out and replaced by a low concentration solvent (diffusion process). This event will repeat until it occurs between cells inside and cells outside. The maceration method was developed and matched with an electrochemical method based on the electrolysis process, which is a chemical reaction in an electrochemical system that produces electricity from outside sources. This process is the opposite of the Galvani process, where chemical reactions that occur in electrochemical systems are used to produce electric currents, for example in fuel cells (fuel cells).

The other applications of electrochemical methods besides metal purification and electroplating are electroanalytic, electrocoagulation, electrocatalyst, electrodialysis and electrorefining (Walsh, 1994). Electrosynthetic techniques / methods are a way to synthesize / make and or produce a material based on electrochemical techniques. In this method there is a change in chemical elements / compounds into compounds that are desired. The use of this method by researchers in synthesizing materials is based on various advantages offered such as the equipment needed is very simple, which consists of two or three electrode rods that are connected to an electric current source, electrode potential and current density can be adjusted so that selectivity and reaction speed can be placed at the desired limits through setting the magnitude of the electric potential and the pollution level is very low and easily controlled. From the advantages offered, the electrosynthetic technique is more advantageous than conventional synthetic methods, which are strongly influenced by pressure, temperature, catalyst and concentration (Cheng, 2009).

The principle of the electrosynthetic method is based on the application of electrochemical theories as explained previously. Both electrosynthetic techniques and conventional synthetic methods have the same variables such as temperature, solvent, pH, reactant concentration, mixing method and time. But

the difference, if electrosynthetic has additional variables namely electrical and physical variables such as electrodes, electrolyte types, multiple electrical layers, material / type of electrode, electrolytic cell type used, electrolysis media and stirring degree. In electrolysis cells there will be chemical changes in the area around the electrode, because of the flow of electricity. If no chemical reaction occurs, the electrode will only be polarized, due to the electrical potential given. Chemical reactions will only occur if there is an electron transfer from the solution to the electrode (oxidation process), whereas at the cathode there will be an electron flow from the cathode to the solution (reduction process). The process of electron displacement is distinguished by the displacement of primary electrons, meaning that the subject matter reacts directly to the surface of the electrode, while in the secondary electron transfer, electrons will react with supporting electrolytes, so that an intermediate reactant will be generated which will react further with subject matter in solution. These reactants can be produced internally or externally (Lawrence, 2016; Cheng, 2009).

The electrosynthetic method has been widely used by researchers in synthesizing organic compounds (organic electrosynthetic) and electrosynthetic organic conductors as well as those that are not less prestigious and currently being developed are the use of pollutants into useful compounds through electrosynthetic methods. synthetic organic matter, based on the reaction of merging, substitution, cyclization, and elimination reactions followed by electrochemical rearrangement. This is different from the conventional method which uses the basis of aldehyde reduction, alcohol oxidation, nitro compound reduction and oxidation of sulfur compounds. The difficulty that arises during organic electrosynthesis is that if the desired intermediate has low stability, the way to overcome it is by providing trapping agents in the solution provided that these trap substances do not react with electro-active substances and do not undergo electrolysis (Taufik, 2017).

Some examples of organic electrosynthesis are the manufacture of chiral drug for the pharmaceutical industry, synthetic p-aminophenol through the reduction of electrolysis nitrobenzene, the manufacture of soda (NaOH) and sulfuric acid (H_2SO_4) from Na_2SO_4 through the electrochemistry splitting process, reduction of Triphenyl biomoethylene compounds into Triphenilethylene and Triphenylethane and hundreds of other organic compounds that have been successfully made for the purposes of medicinal raw materials (Walsh, 1994). In this research. Lard was extracted used maceration coupling electrosynthetic method. The concentration was detected used UV spectofotometry.

2 METHODS

2.1 Investigation Process (Collection, Preparation and Extraction)

Collecting of sample used purposive sampling method. In this work, we used pork corneds @ 25 g. Maceration coupling electrosynthesis was developed used n-hexane as solvent. Temperature was setting at 50 ^oC, and centrifugation process at 3000 rpm for 20 minutes, and then filtering process used anhydrous Na_2SO_4, dried and then repeated for each treatment. The electrodes used are Aluminum at the cathode and anode. Voltage was used 22 EV. The maceration time was varied at 30, 60, 90, 120, and 180 minutes.

2.2 Physical Properties Analysis

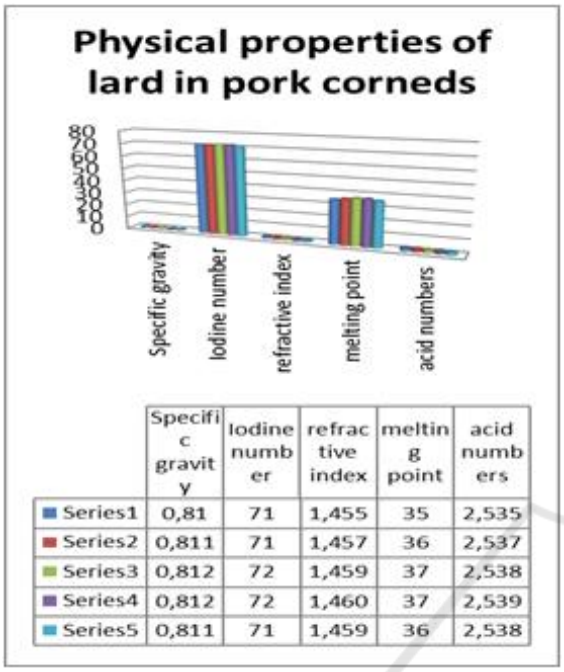
Physical properties was analysed used stain test and solubility in water test. Stain Test procedured: A total of 10 drops of fat + 2 mL of ether alcohol mixture into the test tube, shaken until dissolved. The mixture is dropped on filter paper, and the solvent is evaporated and the stain is formed. Solubility in water Test procedure: A total of 10 drops of fat are mixed with 1 mL of distilled water, shaken and then left for a while and observed the solubility properties. Physical properties analysis in this work used determination of Iodine number, refractive index, melting point, acid numbers.

3 RESULTS AND DISCUSSION

3.1 Extraction Process

In this work, maceration coupling electrosynthetic was developed in order to obtain lard in the pork corned. Non-polar solvent (n-hexane) is used to accelerate extraction at a temperature of 50^oC. The filtering process is carried out with flannel. The centrifugation process at 3000 rpm for 20 minutes is intended to precipitate impurities and final purification is done by filtering used whatman paper containing anhydrous Na_2SO_4 to bind water molecules (Taufik, 2017). Electrode aluminium was used at the cathode and anode. Voltage = 22 EV.

Maceration time was varied at 30, 60, 90, 120, and 180 minutes. Figure 1 showed the results of the physical properties of lard :



	Specific gravity	Iodine number	refractive index	melting point	acid numbers
Series1	0,81	71	1,455	35	2,535
Series2	0,811	71	1,457	36	2,537
Series3	0,812	72	1,459	37	2,538
Series4	0,812	72	1,460	37	2,539
Series5	0,811	71	1,459	36	2,538

Figure 1: The physical properties of lard.

Figure 1 shows the specific gravity values, iodine number, refractive index, melting point, and acid number of lard in pork corned.

The physical properties was obtained is not much different from the value obtained from reference (Hilda, 2014) about the physical nature of lard. The difference in melting point is caused by the fatty acid composition of each sample extracted in this work. The amount of saturated fatty acids and long chain fatty acids contributes significantly to the increase in overall fat melting point. It also gives a significant value to the value of iodine, the composition of unsaturated fatty acids in each sample extracted with a variation of time 30, 60, 90, 120, 160 minutes will contribute to the increase in the price of this iodine number.

3.2 Physical Properties Analysis

The Stain test shown the presence of lard contained in pork corned. The sample is stirred in alcohol ether into the test tube and then dripped in filter paper, the oil stains formed indicate the presence of fat. The water solubility test was also developed and showed the presence of fat in the extracted sample as shown in Table 1 about qualitative analysis below:

Table 1: Qualitative analysis data.

No	Maceration time (min)	Qualitative analysis	
		Stain test	Solubility in water
1	30	++	Not dissolved
2	60	++	Not dissolved
3	90	++	Not dissolved
4	120	++	Not dissolved
5	180	++	Not dissolved

Table 1 showed a qualitative analysis of the presence of lard in the sample. The stain test was developed simply to see lard in the extraction preparation. The positive (++) values indicate the abundance currently in this analysis. Lard obtained from extraction results is also analyzed for solubility in water using the solubility test method. The results obtained showed that all samples were insoluble in water.

3.3 Spectrophotometry UV

UV spectroscopy using DU640 UV / Vis type using a wavelength of 200-400 nm. The standard lard solution is made in concentrations of 5, 10, 15, 20, 25%. This method measured relative light energy if the energy obtained from the sample is transmitted, reflected or emitted as a function of the wavelength. In this work, UV-Vis (Ultra Violet-Visible) spectrophotometer was chosen from many instruments commonly used in analyzing lard in animals. Spectrophotometers are commonly used because of their ability to analyze so many chemical compounds and their practicality in terms of sample preparation when compared with several methods of analysis. The concentration of the solution analyzed will be proportional to the amount of light absorbed by the substance contained in the solution. The optimum wavelength is obtained at 270 nm with the absorbance value obtained in Figure 2:

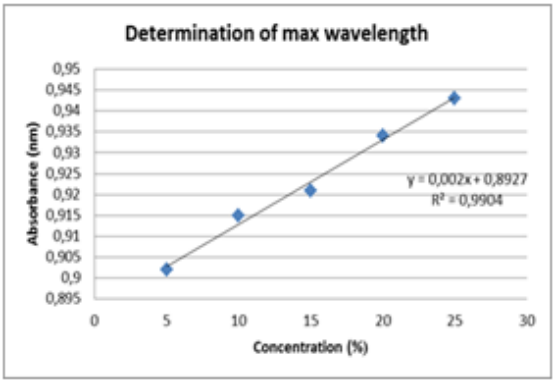


Figure 2: Determination of maximum wavelength (270 nm).

Figure 2 shows that the straight line equation produced is 0.002x + 0.8927. The absorbance curve is generated as shown in the following Figure 3:

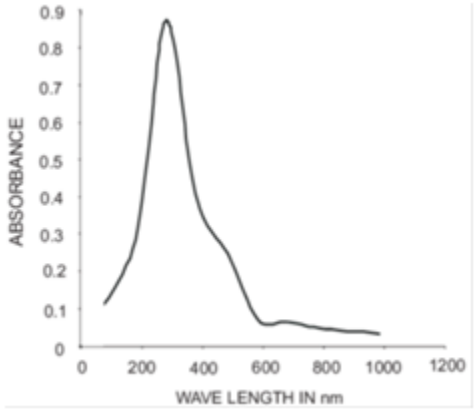


Figure 3: The absorbance curve.

The concentration of the sample with five variations of maceration time is produced in the following Table 2:

Table 2: Maceration time vs concentration.

No	Maceration time (min)	Concentration (%)
1	30	28
2	60	30
3	90	34
4	120	37
5	180	35

The concentration of lard in pork corneds can be seen in Figure 4 below:

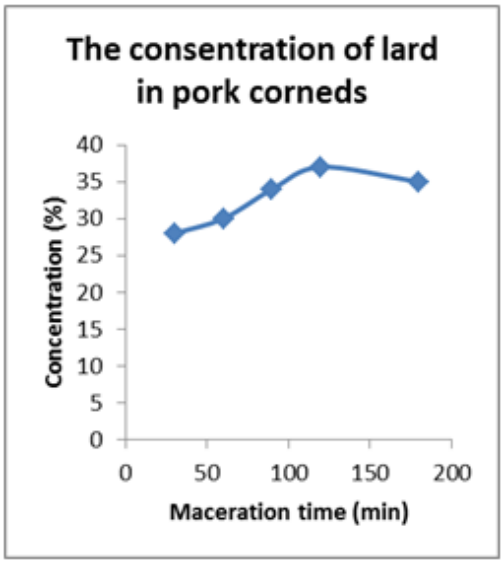


Figure 4: The concentration of lard in pork corneds.

The optimal maceration time is obtained in 120 minutes. This simple method is able to process data optimally about the use of UV spectroscopy in the analysis of lard in the laboratory. However, the application of the electrochemical method is very helpful in optimizing the extraction process, especially in determining fat and oil. This condition is very advantageous in determining halal products in Indonesia. This is due to the high demand for halal products from the people in Indonesia, which directly require simple and easy to implement technology must also be met by researchers in Indonesia. The informal investigation process also requires a scientific, up-to-date and simple method. However, this method can be developed with various considerations of processes that are fast and easy to follow so that they can become models in future research.

4 CONCLUSIONS

Investigation of lard in pork corneds (five samples) have been done. The maceration coupling electrosynthesis have been developed to extracted of the lard used variating of extraction time at 30, 60, 90, 120, 150 minutes and we had the optimal time at 120 minutes. The physical properties was carried out by analyzing iodine numbers, index bias, melting point, and acid number and the data obtained were 0.893, 72, 1.463, 370C, and 2,542 respectively. Lard quantity in food produced at the optimal conditions is 37%. This research will support the improvement of halal products in Indonesia. This method can be developed to investigate the other of samples.

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