The Effect of Giving High Voltage to the Concentration of Free Fatty Acids in Crude Palm Oil (CPO)

Nurhafiz Ahmad Rangkuti, Kerista Tarigan and Syahrul Humaidi
Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Medan, Indonesia

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Abstract: The effect of giving a High Voltage to the concentration of free fatty acids in Crude Palm Oil has been observed. This research was done to use 20 KV high voltage source originating from a simple circuit FBT (Flyback Transformer) using duty cycle and the frequency used was 50% and 3 Hz respectively. In its application, this is done by passing the high voltage to two positive and negative electrodes dipped in palm oil with time variations of 0, 1, 2, and 3 hours. The test results show that the giving of high voltage variations in the duration of 0, 1, 2, and 3 hours gives a change in the content of free fatty acids in CPO oil that is equal to 5.16%, 5.42%, 3.24%, and 2.89% respectively. These results provide knowledge about a new method that can be developed for applications to reduce levels of free fatty acids contained in CPO oil for consumption needs such as vegetable oils which are healthier because they are low in free fatty acids.

1 INTRODUCTION

Palm oil has been one of the results of the agricultural industry that has high economic value. This is because this oil has been successfully utilized into various products such as edible oils, soaps, cosmetics and fuels (Misra & Murthy, 2011). However, the presence of free fatty acids in palm oil is a negative value on the use of CPO itself (Cornelius J.A. & Agric., 1966) CPO oil which has a high content of free fatty acids has poor quality and provides various disadvantages so the process of reducing free fatty acid levels needs to be done (Atinafu & B Bedemo, 2011).

The existing method and commonly used to reduce the content of free fatty acids is the thermal method. The thermal method that is commonly used in palm oil processing factories still has many weaknesses, including the high operational costs and the ability to reduce free fatty acid levels themselves. Thus, alternative methods for reducing free fatty acids are needed.

High voltage electricity has been widely applied in various field, in this case the use of high voltage electricity to reduce free fatty acid levels will be carried out. High voltage generation is generated by large and complex circuits. As research develops on the application of high voltage in all fields today, a simpler circuit is needed to generate high voltage. A simpler circuit can facilitate research in the laboratory to develop this application (Nader & Stanly, 2015).

In high voltage equipment a simple circuit using Flyback Transformer to produce voltages up to kilovolts can be utilized electric fields generated from the equipment. The effect of the electric field that is generated can affect the properties in a material such as: Clarity (appearance), Density, Kinematic Viscosity (kinematic viscosity), Flash Point (flash point), pour point (pour point) Neutrality and Conductivity (Malik et al., 1998) (Abdel-Salam et al., 2000); (Meher et al., 2013) (Plank et al., 2017).

In this study, a high voltage of 40KV will be applied to reduce the levels of free fatty acids from CPO oil.

2 METHODS

The method of conducting this research is to design a high voltage tool using the Flyback Transformer method with a parallel plate to palm oil (CPO). In the manufacture of high voltage devices using Flyback Transformer which is coupled with a series of circuits and produces an output voltage up to

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kilovolts, several electronic equipment, ATmega 328, optocoupler, and driver are needed. The advantage of using this flayback method is that it can produce high output voltages with low input voltages. The process of the circuit can be seen in Figure 1 below:

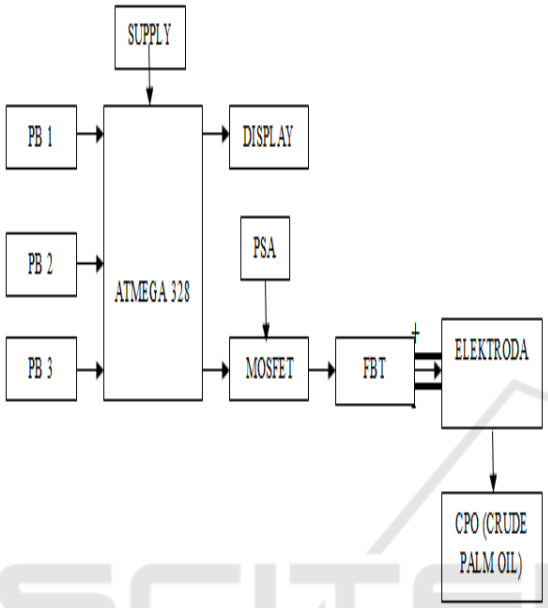

Figure 1: Block Diagram of The Tool.

In the process a minimum voltage of 5 volts is needed to activate ATmega 328, to provide regulating the duty cycle at the foot of the Atmega 328, setting the duty cycle using a program that is entered through a computer to the Atmega 328, the duty cycle can be adjusted using a potentiometer which will then be displayed on the LCD.

In this circuit all components must be in a high voltage phase, so it is not damaged, such as the optocoupler. The function of the optocoupler is to deliver high voltage to the IGBT driver, which will then be transmitted to the flyback transformer leg. Then from the flyback a high voltage will come out in the kilovolt scale, which is measured using a 40kV Lutron High Voltage Probe. The circuit of the entire instrument can be seen in Figure 2 below:

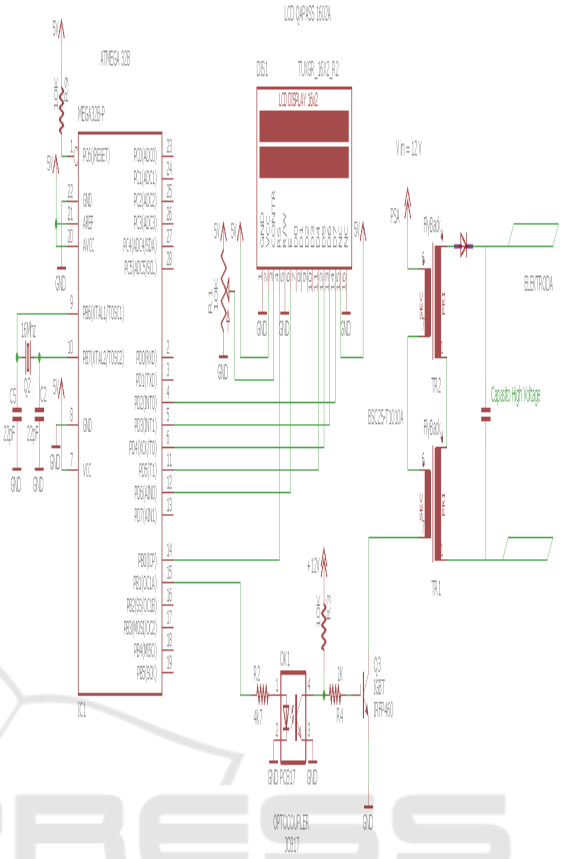

Figure 2: Overall set of tools.

Simple high voltage equipment circuit can be seen in the picture below:

Figure 3: Overall Tool Photo.

3 RESULTS AND DISCUSSION

From a current of 220 ACV the current is changed to 12 DCV using a power supply and then converted to 5 DCV using a Regulator IC, which will then be connected to the Atmega 328. From the Atmega 328 microcontroller circuit, the frequency that passes through the optocoupler is 3 kHz.

3.1 Results of Measurements of Large High Voltage Devices

The results of measurements of high voltage in high voltage circuits with a probe using a 40 kV Lutron HV probe.

Table 1: Results of Measuring High Voltage in The Circuits.

Duty Cycle (%)	frequency (KHz)	Output (KV)
50	3	20

3.2 The Test Results of Free Fatty Acid Levels (ALB)

In this study, before and after being given a high voltage using parallel plate electrodes on palm oil (CPO).

Table 2: Test Results for Free Fatty Acid Levels (ALB).

Time (hours)	Free Fatty Acids Levels (%)
0	5.60
1	5.42
2	3.24
3	2.89

4 CONCLUSION

Manufacture of high voltage devices using FBT (Flyback Transformer) with an output voltage source of 20 kV with duty cycle 50% frequency of 3 KHz which is flowed on palm oil (CPO) to determine the effect of a strong electric field on free fatty acids (ALB) with a time variation of 0 , 1,2, and 3 hours and percent change in free fatty acids (ALB) produced 5.60%, 5.42%, 3.24%, 2.89%.

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