A Case Study of Fabrication of Film with Spark Technique

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***Abstract*- It is well known that the ozone gas can be disinfected. On the other hand, if the ozone gas has a high concentration as result in harm to the body when inhaled. This research, the study of the relationship of gas flow rate and safety distance for human on disinfect bacteria with ozone generator from corona discharge technique with 20 kHz frequency for ozone generator while the voltage ware 10 and 20 kV. In addition, the gas flow rate and the distance from generating point to measurement point for the study of the relationship were 0-10 L/min and 0-40 cm, respectively. It was found that, the gas flow rate ware not than 7 L/min and the voltage were not than 20 kV can measure the concentration of the ozone was 0.1 ppm. which harmless to the body from 30 cm distance at generating point. Besides, the generating point of ozone for treatment was the concentration of the ozone than 10 ppm. which sufficient for disinfect.**

I. INTRODUCTION

At present, the government has given importance to community enterprises by transforming the community's agricultural crops into products for the general consumer. However, with the limitation of the production system to turn into products and the distribution of community enterprise. Some steps can be contaminated by fungi or bacteria in the product, which is very important to make the product inferior. It is certain that the best of products must be clean and free of contamination to create good hygiene for every consumer. Therefore, it is necessary to reduce the contamination of products of community enterprises to become a premium grade product.

At present, there are many ways to reduce contamination and disinfect from heat, such as pasteurization method, sterilization method or ultra-high temperature (UHT) method. However, this method and procedure is always complicated and it may be that some products that are not suitable for reduce contamination and disinfect from heat due to the use of heat may reduce the quality of the product. The contamination reduction and disinfect for community enterprises must be easy to Use, convenient and a few steps. In addition, it has been reported that the ozone gas can be used to reduce contaminants and disinfect [1]-[2]. However, when the ozone concentration is too high, it can irritate the body and can be toxic to the respiratory system and blood vessels, endocrine system, Reproductive system and central nervous system [3]-[4]. On the other hand, if using ozone in the amount of concentration suitable for each type of sterilization, it will benefit for reduce contaminants on a products [5]-[6].

It has been reported that the ozone gas at concentrations of 0.04 to 0.1 ppm can be benefit a bacteria by about 40% after a treatment time of about 5 minutes and bacteria can be reduced again when using the longer treatment time. However, the concentration of ozone gas of 0.02 to 0.04 ppm, humans can detect odors and begin to have headaches. In addition, when the concentration of ozone gas of 0.1 ppm can cause irritation of the respiratory tract, nausea and vomiting. In the case of the ozone concentrations above 6 ppm, which can cause pneumonia, and extremely harmful to health [7].

Therefore, the ozone gas used for disinfection requires control of the concentration of ozone gas produced in order to maintain benefit properties, but must not be too high to be harmful to users' health [8]. This research studied the effect of ozone concentrations for safe for health while still disinfecting properties from the ozone generator with corona discharge technique and investigated of ozone concentrations with the ozone meter.

II. EXPERIMENTAL DESIGN

Fig. 1 shown diagram of the ozone generator with corona discharge technique which includes air pump, gas flow controller, ozone generator and ozone tube.

The air pump serves as the main gas to change from oxygen gas to the ozone. An oxygen gas flow rate is controlled by the 0-10 L/min of gas flow controller. The ozone generation has created a 20 kV, 20 kHz high-voltage power supply from the flyback transformer with pulse width modulation (PWM) technique. The ozone tube is made from coaxial cylindrical glass with a radiuses r1 and r2 are 21.4 mm. and 25.0 mm.

respectively, while the length of tube is 150 mm. which the volume of gas can be calculation from the equation [9].

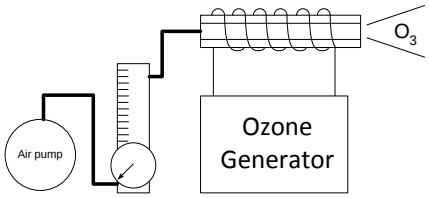

Fig. 1. diagram of the ozone generator with corona discharge technique

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The volume of gas is 78.715 cm3, where the energy in the electrodes for the ozone generates are 5.58 kWh/m3 to 7.73 kWh/m3. Since the amount of oxygen in the atmosphere is about 21%, Therefore, the energy in the electrodes is required to be 1.172 kWh/m3 to 1.620 kWh/m3 [10] which can be design the energy in the electrodes at 1.172 kW-h/m3 and 1.620 kW-h/m3 as 0.0922 Wh and 0.1275 Wh, respectively. In addition, the lowest and highest of electric field energy is 16.271 kV/cm and 19.129 kV/cm. respectively,.

The plate of the ozone tube is made from aluminum. When the radius of the electrical insulation (r0) was 19.6 mm, the minimum voltage of ozone generation was 5.796 kV. Therefore, the electric field was 16.271-19.129 kV/cm while the energy in the electrodes was 0.0922 -0.1275 Wh, where the high voltage at 5.796 kV can be generating of ozone. In addition, the concentration of ozone can be adjusted by increasing the voltage or frequency.

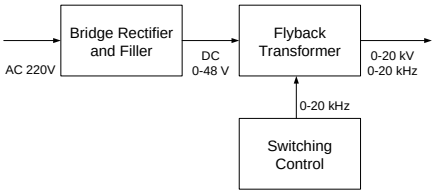

Fig. 2. The Spark control circuit

Fig 2 shows the block diagram of the power supply for ozone generator, which using a bridge rectifier and regulator for output voltages at 48 Vdc. In order to connect to the Flyback transformer for generation of ozone with corona discharge technique. The input voltage of the Flyback transformer has 48 V. and voltage was step up to 20 kV. for output side. Using the pulse width modulation (PWM) for controlled frequency at 1-20 kHz on switching circuits.

The ozone generation with the corona discharge technique test set using IC TL494 for the switch controller of the device. In addition, the switching frequency was designed to be able to adjust from 0-20 kHz with PWM techniques. While the IGBT number IRG4PC50UD was used as a switching device for Flyback transformer.

In this test set, Flyback transformer number TLF14511F was a high voltage generator of 5 to 20 kV and it was connected to an ozone tube for generating ozone gas with Corona Discharge technique. The switching frequency was a fix at 20 kHz for the test of the relationship between flow rate and safety distance for ozone users from ozone generation with the Corona Discharge technique while the voltage is 10 kV and 20 kV. Besides, the gas flow rate was adjusted to 0.5-10 L/min by each step 0.5 L/min of an increment and distance adjusting from the ozone generating point to the measuring point was 0 to 40 cm. by each step 10 cm. of an increment for study the effect of the concentration of ozone generated by measuring the ozone concentrations from the GS100-O33 model of the ozone meter.

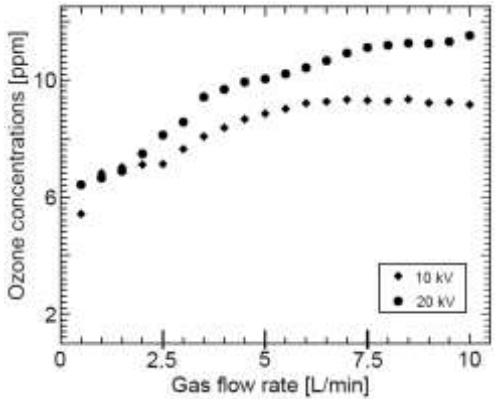

Fig 3. Fig. 3.the relationship between the gas flow rate and the ozone concentrations at 0 cm

Fig 3 shows the relationship between the gas flow rate and the ozone concentrations at 0 cm. distance when gas flow rate was 0-10 L/min while voltage was 10 and 20 kV. It was found that when gas flow rate was increased as a consequence the ozone concentration was increased. However, it was reported that the concentration of ozone at 0.04 to 0.1 ppm can reduce the amount of bacteria about 40%. From the graph, the minimum voltage and the minimum gas flow rate was 10 kV and 0.5 L/min respectively, can to produce the concentration of ozone was 5.5 ppm. which sufficient

for bacteria disinfects. On the other hand, It was confirmed that the concentration of ozone gas at 2.5 ppm. has resulted for harmful to users' health. However, the distance was 0 cm, and it means that the nose must be at the treatment point which in practice is impossible.

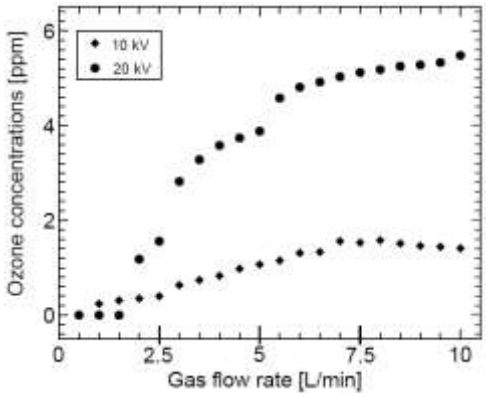

Fig 4. the relationship between the gas flow rate and the ozone concentrations at 10 cm

Fig 4 shows the relationship between the gas flow rate and the ozone concentrations at 10 cm. distance when gas flow rate was 0-10 L/min while voltage was 10 and 20 kV. It was reported that, the ozone concentrations at 0.1ppm can to

bacteria disinfects and it was used for analysis in this paper. The relationship between voltage and gas flow rate was 10 kV, 1.0 L/min and 20 kV, 1.5 L/min as a consequence the ozone concentrations was more 0.1 ppm. In addition, the ozone concentration can increase from increasing adjustment of the gas flow rate which it will be dangerous for the user when get inhaled. Therefore, the ozone concentration for bacteria disinfects at a distance of 10 cm requires a voltage and flow rate not less than the above.

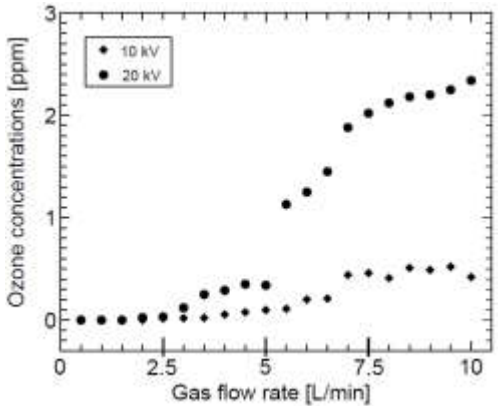

Fig. 5. the relationship between the gas flow rate and the ozone concentrations at 20 cm

Fig 5 shows the relationship between the gas flow rate and the ozone concentrations at 20 cm. distance and the adjustment of voltage and gas flow rate as the same conditions in Fig 3. From the figure, the voltage at 10 kV and 20 kV requires a gas flow rate more than 6.0 L/min and 3.0 L/min respectively, in order to the bacteria disinfects with ozone gas. In addition, the trend of the ozone concentrations was increased from increasing adjustment of the gas flow rate as well. Likewise, it can be to health damage when the ozone concentrations were high level.

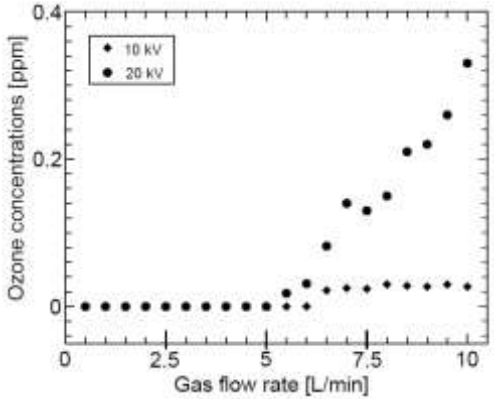

Fig. 7 the relationship between the gas flow rate and the ozone concentrations at 40 cm

Fig 7 shows the relationship between the gas flow rate and the ozone concentrations at 40 cm. distance and the adjustment of voltage and gas flow rate as the same conditions in figure 3. It was found that, the ozone concentrations for a bacteria disinfects cannot generate in distance at 40 cm from all condition of voltage there are adjusted. It was confirmed that, the ozone concentrations at 40 cm. distance cannot used for disinfection of bacteria. On the other hand, the distance was safe from the hazard of ozone gas due to the ozone gas has a few concentrations until it does not affect health of ozone user.

IV. CONCLUSIONS

The study of the relationship of gas flow rate and safety distance for human on disinfect bacteria was successfully performed with the ozone generator from corona discharge technique. In this research, the using of ozone treatment for disinfection of bacteria was possible from the concentration generated. On the other hand, when the ozone concentrations exceed, 0.1 ppm can affect to the respiratory system. It was confirmed that, the ozone concentrations was decreased when distance from the generation point was more. In general operation, the distance between the treatment point to respiratory system (nose and mouth) was about 30 cm. This distance must use a voltage was not more than 20 kV and the gas flow rate was not more than 7 L/min. as a consequence the ozone concentration was not more than 0.1 ppm which it was safety from the hazard of ozone gas.

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