

HIGH DENSITY COLD CORONA GENERATOR FOR INCREASE OXYGEN IN WATER STORAGE

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Abstract

This paper presents high density cold corona generator for increase oxygen in water storage system by applied high intensity electric field corona energy. Using converter principle and controlling of the switching by IC#555. The flyback converter is designed to operate at 15 kHz frequency through a AC high voltage switching transformer at output voltage of 1 kV to 3 kV, and at the input voltage of 36 VAC. By adapting the stainless net between aluminium plates in electric field cell set, One - hour operating yields the ozone gas (O₃) generating capacity of 1.5 ppm to 5.7 ppm and the oxygen dissolved in water decreases, respectively, is 3.2 mg/L to 1.8 mg/L to 5.7 ppm ozone gas causes the oxygen dissolved in water decreases the most. Which in future could be used in the production of drinking water as well.

Keywords: Corona generator; machine design,

Introduction

Natural ozone is caused by the chemical process of oxygen reacting together. Resulting in ozone Ozone is a natural gas that is colorless and has energy. By conducting high oxidation reactions without leaving any toxic residues. Ozone also has the ability to destroy bacteria, fungi and ozone has the ability to limit the smell. Destroy and inhibit the growth of germs. More than 30 countries around the world have used ozone to treat and rehabilitate the environment, such as using ozone to treat wastewater. Medical use and use in daily life.

At present, the ozone gas is used in the course of life, such as using ozone gas to wash vegetables instead of pomegranate. To kill germs and reduce the amount of chlorine in the water. The use of ozone to purify the air. But ozone has disadvantages as well. If used in too much doses, it can cause irritation to the body. But if we use the right amount and suitable for the work that uses ozone gas in the application above, it will bring good health benefits. Therefore, it is the source in the study of ozone generation. And ways to control the ozone content to be suitable for the job as a high-voltage switching power supply. In this article, a high voltage switching power supply will be created by using IC No. 555 as a pulse modulation generator is a switching controller sends pulse waveforms to the mosfet power driver circuit. With the IC number 4049 as a signal booster driver and bring the current to the high voltage switching transformer to work to send voltage and current to the electric field cells in which ozone can be formed through the principle of the breakdown of oxygen molecules. And it can withstand a certain voltage, and heat also affects the amount of ozone that occurs. Therefore, it is necessary to control the amount of electricity and frequency to be suitable for ozone production. The chemical energy needed is 493 kJ/mol to 762.23 kJ/mol to convert the unit, the required energy area is 5.583 kWh/ m³ to 8.631 kWh/m³, but since the air contains approximately 21% oxygen, the required energy range is 1.172

kWh/m³ to 1.812 kWh/ m³, which is enough to produce ozone in the air gap of the electric field cells.

Therefore, this research work will bring electric field cells that can convert oxygen in the air into ozone gas. With a cold corona discharge process which will notice the glow in the dark with emphasis on design and machine building which will consist of 2 main parts, part 1 is the design. The creation of a high voltage power source is possible. By using the principle of the fly back converter and the second part is the design of the electric field cell set because these two parts are related to the amount of ozone gas produced and dissolved oxygen (DO) in the experimental results. It will experiment to adjust the high voltage to increase the intensity of the electric field supplied to the electric field cell set. Because at different intensity levels of the electric field will cause the intensity level of the amount of ozone gas produced and affects the amount of dissolved oxygen (DO).

Note: Cold corona is a corona discharge process which can control the temperature to be suitable to produce ozone gas with the highest intensity.

Objectives

To design and build a cold corona machine By using the corona discharge method To produce ozone.

In order to use the cold corona machine to increase the amount of oxygen in the water storage system.

Research methods

Principles and working procedures of the cold corona machine.

Cold corona production machine introduced the principle of oxygenation and high voltage pulse type will cause the air around the ionized wire to become discharged by feeding high-voltage electricity to the electric field cells in a stainless steel mesh sheet and aluminum sheet. It will create a high intensity electric field at the surface of the aluminum sieve and when the atoms or molecules of the air pass through it will cause the air to break down. The principle is that atoms or molecules of a gas, when given enough energy, will make one electron slip away. This causes the atoms or molecules to have a positive charge. This is called ionization. The process that separates the electrons from the gas particles creates more positive ions, called Ionization processes and processes that release electrons from solids are called electron emission. Here, the electrons will fall out of the electrode which is a very important process that allows the gas to conduct electricity In which the air is supplied from the electric field which has high intensity until it breaks down resulting in ozone gas. This ozone gas can be used to eliminate germs and reduce chlorine in the water storage system in order to produce drinking water eliminate odors in the kitchen, bedroom, bathroom and inside the passenger car. While also able to kill germs in the air as well.

Design and construction.

In creating the ozone generator, use a consistent electrode to produce ozone to see the ozone production rate in which the high voltage power source is used to supply power to the electrode plates. But does not cause braking down, only the intensity of the electric field is high. Therefore, the system should not allow excessive heat generation within the air gap. Because it will cause ozone gas to decompose quickly. Therefore, it is important to adjust the high voltage to the appropriate condition, which is only the corona.

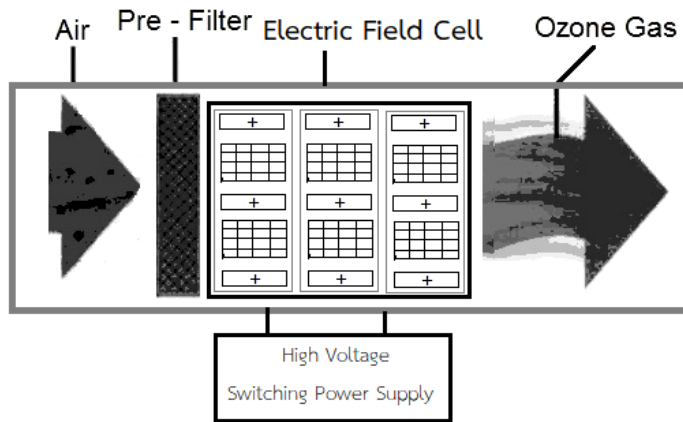


Fig. 1. Structure of a cold-pressed corona machine designed and built

Electric field cell sets.

The electric field cell set consists of a stainless net plate placed away from the aluminum plate. Which has the opposite voltage if considering the electric field stress of the electric field cell set it will be according to the equation:

$$E = \frac{V}{d \times \eta^*} \tag{1}$$

When: E - Equal to the electric field intensity; V - Equal to high voltage; d - Equal to the distance between the stainless net plate and the aluminum plate; η^* Equal to the electric field factor.

Therefore, the electric field cell set selects a stainless net plate placed 1 cm away from the aluminum plate (d)

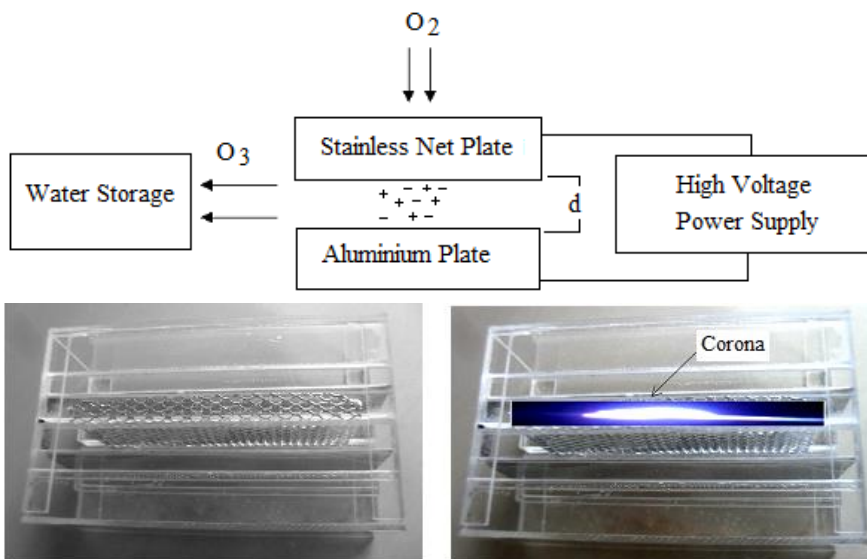


Fig. 2. The generated electric field cell set

Calculation of high voltage electricity.

Coronary Eye Cell Kit has a distance between the stainless steel mesh sheet and the aluminum plate (d) equal to 1 cm and η^* is equal to 0.2. Therefore, Equation (1) will get a high voltage equal to $V = E \times d \times \eta^*$.

Therefore, at the electric field $E_i = 16.27$ kV/cm, V gets 3.254 kV.

Therefore, at the electric field $E = 19.129$ kV/cm, we get V equal to 3.825 kV.

Therefore, the corona voltage range is 3.254 kV to 3.825 kV at the electric field area 16.27 kV/cm to 19.129 kV/cm.

Design and construction of a high-voltage switching power supply

Switching high-voltage power supply design introduced the principle of the fly back converter circuit by using IC No. 555 as a pulse generator modulation is a switching control circuit which uses mosfet as a device for conducting currents which has a switching frequency of approximately 15 kilohertz. Finally, it will pass through a high frequency transformer. To get a high voltage voltage as required, figure 3.

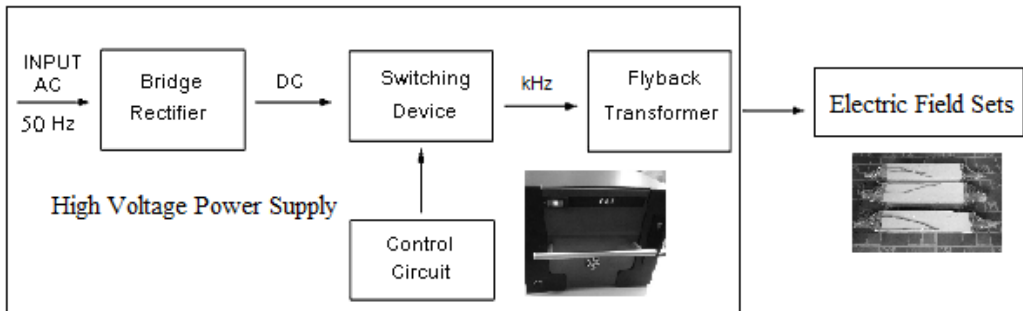


Fig. 3. Block diagram of the high voltage power supply structure

Switching high-voltage power supply (Control circuit and fly back converter)

The high-frequency converter circuit is approximately 15 kHz, consisting of fly back converter circuits which serves to convert approximately 36 volts DC electricity into high voltage electricity. And use the Power MOSFET number IRFP460 as a switching device to control the converter set. And flyback transformers is a high voltage generator to supply to the electric field cells (Ozone production cell) as in figure 4.

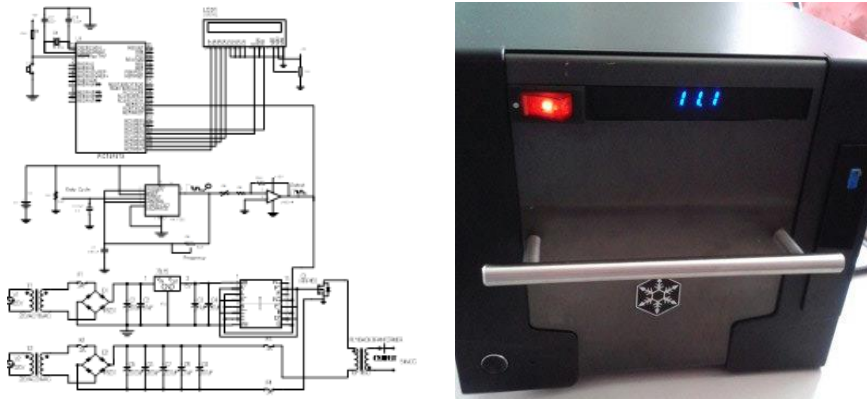


Fig. 4. Structure of high voltage power supply.

Results and Discussion

Testing of V_{GS} for Power MOSFETs and Signal Measurement (V_{OUT}), High Voltage of Flyback Transformer for supplying to the electric field cells as in figure 5.

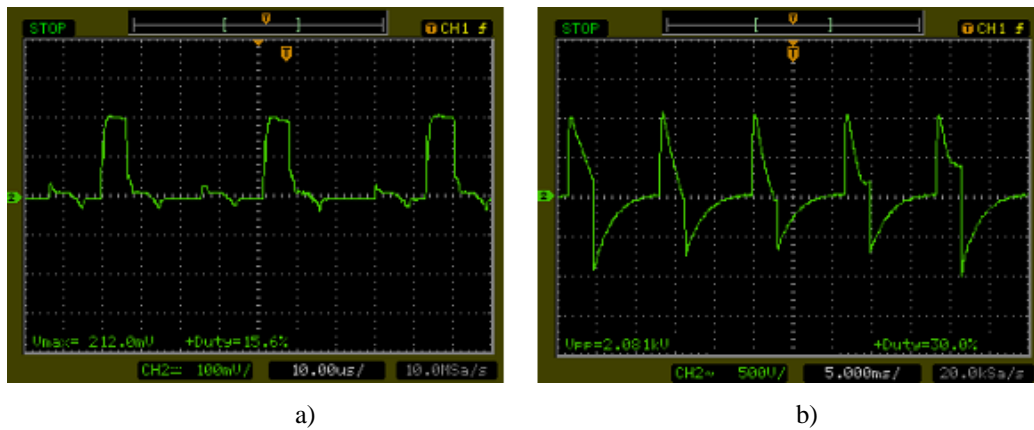


Fig. 5. a) V_{GS} signal for power MOSFETs and b) Signal (V_{OUT}) high voltage flyback transformer for distribution to electric field cells.

Table 1. Output voltage Ozone content and amount of DO (initial DO value of 3.9 milligrams per liter) tested at 3,000 liters of water (dissolved oxygen; DO)

Output High Voltage (kV)	Ozone Quantity (ppm)	Amount of DO (mg/L)
1.09	1.5	3.2
2.08	3.2	2.9
3.15	5.7	1.8

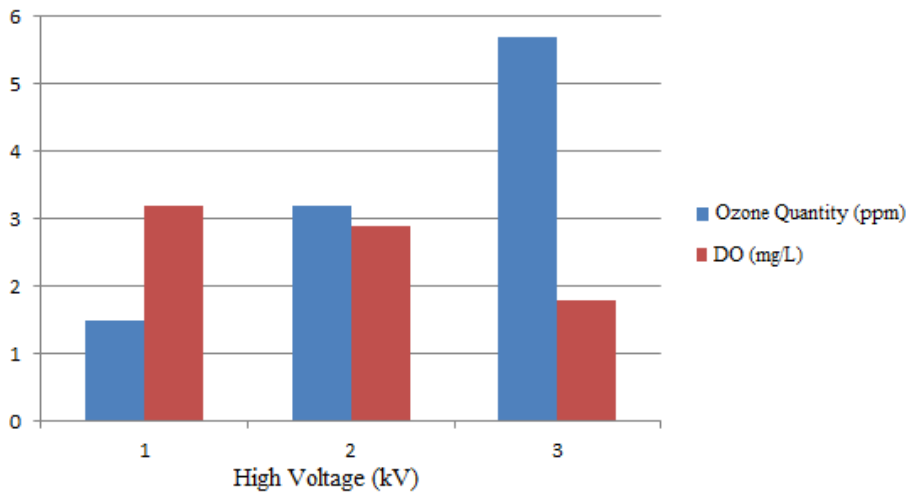
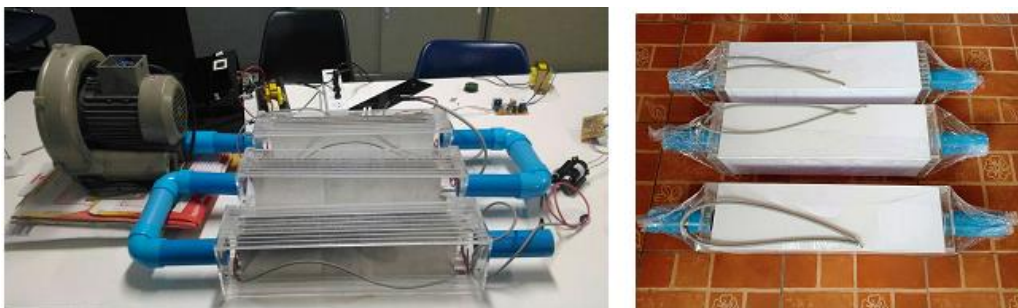


Fig. 6. In table 1 graph the output voltage, ozone quantity and DO value

High intensity cold corona machine for adding oxygen to the water storage systems designed and built A high-voltage, high-frequency alternating current power source is applied to supply electrical energy to the electric field cells (Stainless steel mesh between the aluminum

sheet) for use in the production of ozone gas. In the test results, the amount of high voltage alternator is adjusted to see the rate of change of ozone gas and the DO value. The result is that when the amount of high voltage alternator is increased, the rate of Produce higher ozone content and the DO value will decrease respectively because in the test, the voltage is selected from 1.09 kV to 3.15 kV which has the amount Ozone gas from 1.5 ppm to 5.7 ppm, which at a high voltage of 3.15 kV, will get the maximum ozone gas of 5.7 ppm. By analyzing the amount of ozone, PHOTOMETRIC O₃ ANALYZER is used. - MODEL 400E and the DO can be reduced to a maximum of 1.8 milligrams per liter (because the DO is the dissolved oxygen value) by using the DO Meter EZDO to analyze the dissolved oxygen According to the test results in Table 1 and in the future, the cold corona production machine can be further used in drinking water production systems.



a) b)
Fig. 7. a) High intensity cold corona machine and b) electric field cells

Conclusion

Should test to increase the number of electric field cells to see the amount of ozone and DO values that have changed because it will be used to analyze test results and develop further cold corona production machines.

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