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The development of dust smoke eliminator using C-Ozonize electrical system

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Abstract. This article offers dust smoke eliminator using c-ozonize (corona ozonize) electrical system. The high voltage direct current applying the principle of the flyback converter to use. And control of power MOSFET with IC number TL494 at 20 kHz frequency through the high-voltage switch to get high voltage direct current of 1 kV to 5 kV. A voltage of 36 volts is applied to the platinum wire placed 1 cm away from the aluminum plate in the package. Ozonize and electric field set the efficiency of dust trap is 98.95% and designed to work for 1 hour. The machine can product ozone gas 127 mgO₃/hour to 293 mgO₃/hour and ozone gas content of 258 mgO₃/hour can be used to reduce the hydrocarbon gases from lead smoke very well.

1. Introduction

The current environment of Thai society has a large amount of toxic gases that are harmful to human, plant and animal, and the wider community of living in the city. Especially the effect nearby us. Most of us are polluted by the air, sometimes we see or not see it. We breathe toxic gases into the body, destroying the internal organs of the body such as the respiratory tract, lungs, and destroying the surrounding environment. The atmosphere of the world is deteriorating. Especially human actions. Tribal deforestation causes haze. Ignition of industrial plants the impact on the environment in that area. Pollution can be divided into many types: air pollution, noise and smoke. The inventor is studying the solution and eliminates the pollution to reduce the amount of toxins and human risk in airborne conditions. The human being is dependent on the air, so it does not affect our body in the long term. This is the reason for the inventor to find solutions to this problem continuously.

Researchers have created this innovation to help eliminate smoke and toxins from smoke, led by applying high voltage, and direct current to the air pollution reduction, which has been applied to transformers to produce power. High voltage to create a dust trap from smoke that affects human health or other living organisms. It is undesirable or harmful to the well-being of both direct and indirect. There are many types of toxins or impurities in the air, including dust, mists, smoke, soot, and toxic gases such as carbon monoxide (CO), sulfur dioxide (SO_x), nitrogen oxide (NO_x), hydrocarbon (HC). If these toxic gases exceed the airborne limit, they can be harmful to humans, animals and plants. Acute effects can be life threatening. Some types also Chronic Effect to death later. Toxins may enter the body by direct contact with the body, such as the nose and the food we consume, stick to the clothes and transplant into our body.



This research has led to the field of electric field for dust and ozone cell that able to convert oxygen into the air into ozone, emphasizing the design and construction of vacuum and lead smoke, Solder by electric energy and suitable to use to dissolve the smoke and helps to save electricity (the optimal power consumption to maximize use. Reduces power consumption unnecessarily. This will save you some electricity) to achieve the health benefits of most users. The unit consists of two main parts: the first part is designed to create a power supply to control the DC voltage is high voltage from 1 kV to 5 kV and led IC number TL494 is a pulse modulation switching circuits of the Power MOSFET in the converter circuit. High voltage transformers are used to induce pulse signals to generate high power DC to apply to electric field and ozonice cell, And second part is designed to create an electric field set for dust from smoke. The aluminum plates are placed parallel to each other and the ozonice cell (Which Ozonize cell contains platinum wire inserted between the aluminum plates) In the experiment, the voltage applied to 2 sets. At the power level the difference will affect the level of power used for aerosols.

2. Materials and methods

2.1 Principles and procedures are divided into two parts

2.1.1 Part 1 Principles and Procedures of Electric Field Shells. The light field cell will cause the air around the wire to become ionized. By feeding high-voltage direct current to the conductor wire, it creates a high-intensity electric field at the surface of the conductive wire, and when the atoms or molecules of air pass through, the air breaks down. The principle that atoms or molecules of gas. Getting enough energy causes the electrons to fall out. One electron makes the atoms or molecules so positive. This is called ionization. The process that separates an electron from a gas particle causes a cation to rise, called the ionization process and the process that causes the electron to fall out of the solid, called the electron emission. In this case, the electrons are released from the electrolyte, which is a very important process that makes the gas conductive and when the air is dirty such as dust and pollution are passed into the electric field. These air is circulated through a rough filter. The filter or dust filter. Front row with large particle Then the air is energized by the electric field, which is highly intense until it decays. And the electrostatic charge to the dust, then the dust has been charged. On the contrary, it will get clean air, dust-free from smoke.

2.1.2 Part 2 Principles and Procedures of ozonize cell. Corona cell will give air around the area. Platinum wire is discharged by feeding high voltage direct current to copper wire. This will cause a high intensity electric field at the surface of the wire and when the air passes it will cause the air to break up, resulting in ozone (ozone gas is oxygen gas in status 3 atom O_3 It is caused by the use of high voltage, shake the oxygen molecule by the method of corona discharge in status 2 atom O_2 disintegrate and condense into oxygen molecules. 3 atoms O_3 will get ozone) Ozone gas helps to dissolve odors and toxic gases from smoke. And it turns into oxygen and can kill germs in the air.

2.2 Electric Field cell Kit

The electric field cell consists of a set of aluminum plates that feed on the positive and negative electric fields alternately.

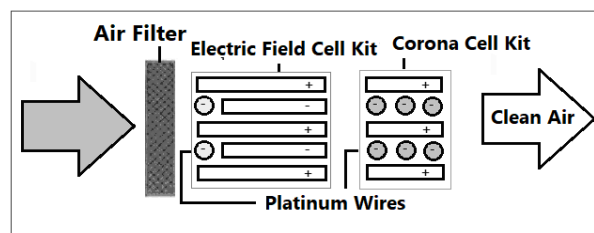


Figure 1. Dust smoke eliminator using c-ozonize (corona ozonize) electrical system structure.

It is recommended to use a small thickness to prevent the flow of air, causing turbulent airflow and will reduce the efficiency of the smoke trap. Therefore, the thickness of the aluminum dust trap is 0.09 cm. so the spacing of the electron separator and the dust trap is as follows.

2.2.1 Principles of designing electric field kit. Consisting of an electron-separated cell series and a dust cell series.

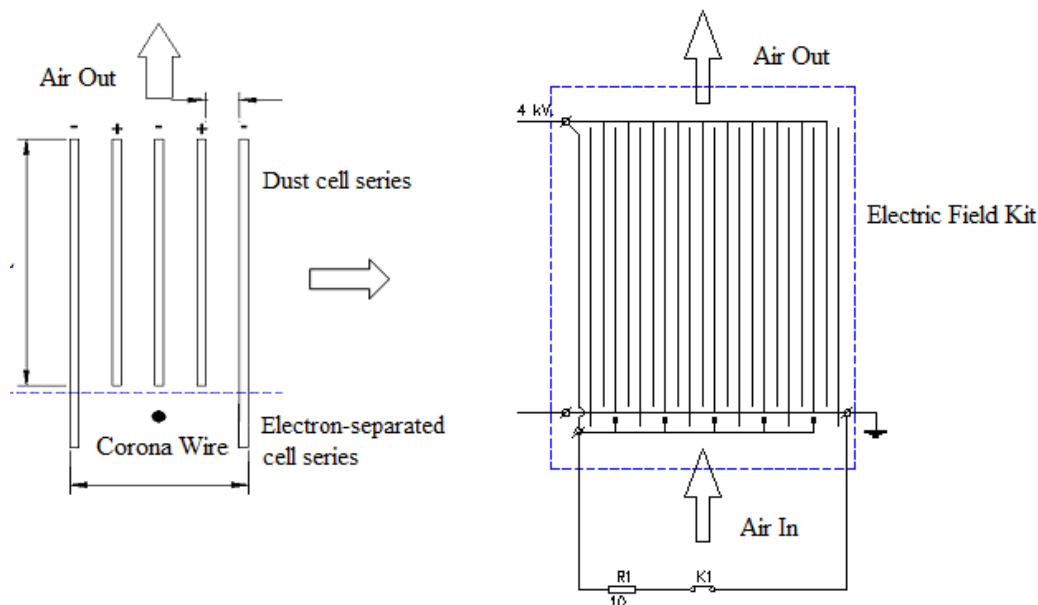


Figure 2. Electric field kit.

2.2.2 Electric field Electric Field Theory (Electric field cell). The electric field is electrically uniform this means that the electrodes have the same electric field at each point between the electrolytes. When V is the input voltage between the electrodes, d is the distance between the electrodes, E is the electric field stress at any point between the electrodes and the E_{\max} is the electric field stress:

$$E_{\max} = E = \frac{V}{d}$$

2.3 Ozonize cell by theory of ozone

Ozone is a gas formed by the formation of three oxygen atoms. To make oxygen dissipate, the bonding energy must be fed from outside to encourage the oxygen to break down. Free of oxygen (O), then combine the secretion O_2 to O_3 , where the energy of is less than O_2 . That is, if the energy is added to the system with O_3 , only a small amount of energy can cause O_3 to decay. Therefore, the system should not overheat within the air gap, such as the heat generated by the downshift. For ozone gas production, the energy required is 493.2 kJ/mol to 682.8 kJ/mol. The conversion from molar to volumetric refers to the behavior of gases in the chemical. Idle gas is a point-and-no-force to act 1 mole model. The ideal gas molecule is written as a relation called the gas equation in equation 1 where n is the number of moles, equation (1):

$$PV = nRT$$

Real gas is a gas molecule and the force acting on the molecule is Van der Waals force, the size of this molecule and force are the characteristics of each gas. The approximate equation of real gas is presented by Van der Waals is equation (2):

$$\left(p + \frac{a}{v^2}\right)(v - b) = RT$$

The equation (1) and equation (2) required energy is 5.58 kWh/m³ to 7.73 kWh/m³, but because oxygen is present in the air, it is approximately 21% So the required power is 1.172 kWh/m³ to 1.62 kWh/m³, as it is sufficient for ozone generation (Air gap within the electrolyte cell).

2.4 Design and construction of ozonize cell series

Ozonize cells are composed of platinum wire placed between the aluminum plates, which have the opposite voltage. Considering the strain, the electric field of the ozonize cell will be in accordance with this equation.

When E = electric field intensity, v = voltage, d = distance between aluminum plate and platinum wire and η^* = electric field factor

Therefore, the Ozonize cell chose to use a 0.2 mm diameter copper wire because of its durability, smooth surface, and good conductivity. The distance between the aluminum sheets is 1 cm.

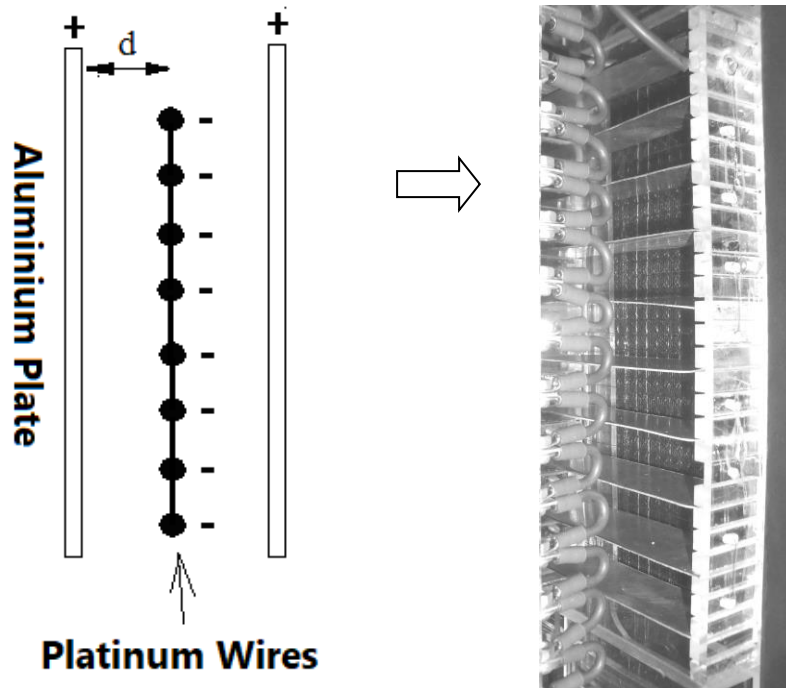


Figure 3. Ozonize cell.

2.4.1 Calculating high voltage direct.current of Ozonize cell. At the distance between the plates (d) = 1 cm., $\eta^* = 20\%$, $V = E \times d \times \eta^*$

At electric field: $E_i = 16.27$ kV/cm, $V = 16.27$ kV $\times 1 \times 0.2 = 3.254$ kV

At electric field: $E = 19.129$ kV/cm, $V = 19.27$ kV $\times 1 \times 0.2 = 3.854$ kV

Therefore, the voltage range that causes the corona to start is 3.254 kV to 3.854 kV at an electric field of 16.27 kV/cm to 19.129 kV/cm.

2.5 Design and construction of high voltage switching power supply for electric field cells and ozonize cells.

2.5.1 High Voltage Power Supply Structure. High voltage switching power supply design has adopted the flyback converter circuit principle using IC number MB3579.

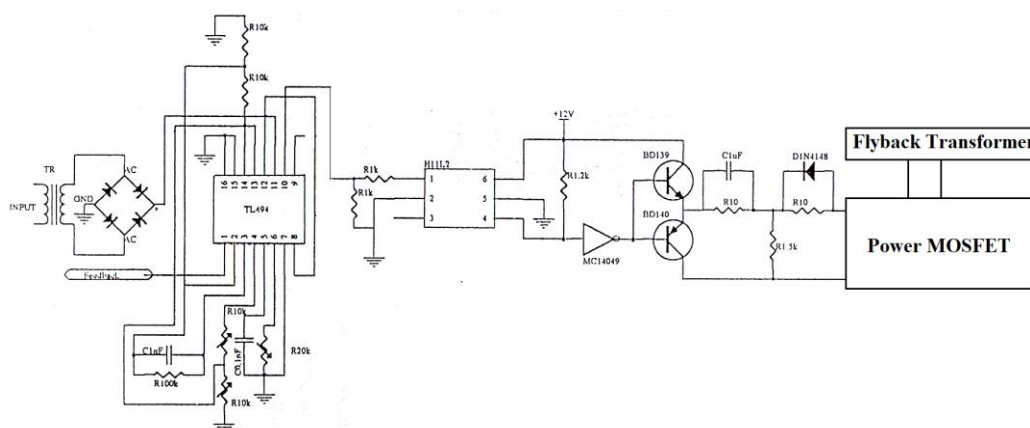


Figure 4. High voltage switching power supply.

It is a pulse-modulation pulse generator as a switching control circuit. The MOSFET is a current-carrying device with a switching frequency of approximately 20 kHz. To achieve high voltage as required.

Therefore the set of electrode choose aluminum mesh because it has good electrical conductivity and when electric power is supplied, it can create a highly uneven electric field. With the distance between aluminum sheet and aluminum mesh equal to 2 cm.

3. Results and discussions

3.1 Test results of electric field cells with dust meter

The efficiency of dust trap is 98.95%.

3.2 The relationship between the parameters and the production volume of ozone gas and its ability to decompose and decay toxic gas

Table 1. The relationship between the parameters and the production volume of ozone gas and its ability to decompose and decay toxic gas.

High voltage for electric field and ozonize cell, V _{OUT} (kV)	Ozone Quantity (mgO ₃ /hr)	Ability to decompose and decay toxic gas
1	127	✖
2	195	✖
3	258	✓
4	271	✓
5	293	✓

4. Conclusions

Experimental result design and construction of electric field cells. In the field of electric field cells, aluminum plates are placed parallel to each other. And high voltage direct voltage. To force electric field to trap small dust from smoke. And test results. The efficiency of dust trapping using dust extraction instrument was 98.95% and designed to create a ozonize cell kit to dissolve toxic gas. The platinum wire between the aluminum sheets has been used to produce corona discharged to produce ozone and can adjust the amount of ozone.

By adjusting the DC voltage, the high voltage on the output of the flyback transformer. If the high voltage DC voltage is higher, the higher the rate of ozone production, the higher the output. This is due to the higher electric field stress. (The reason for the design is to adjust the energy to control the amount of ozone that the researcher will find the amount of ozone that is suitable for the dissolution of toxic gas from the smoke to reduce energy consumption).



Figure 5. Dust smoke eliminator using c-ozone (corona ozone) electric energy.

And the result is ozone cell can reduce the toxic gas ((By measuring VOCs)). It can eliminate bacteria, bacteria. Smoke detectors can actually dissolve smoke within a short time to reduce the risk and reduce the amount of toxins that will accumulate in the body. It is a threat to humans, plants and animals, so it is a positive benefit of innovation. To bring the inventions to the highest level, and to partner with the environment in a sustainable way.

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