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USE OF THERMOELECTRIC FOR REDUCING TEMPERATURE OF CELL ELECTRIC FIELD CORONA OF SMELL ELIMINATOR

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Abstract

This research article presents use thermoelectric for reduce temperature of cell electric field corona of smell eliminator as this eliminator using intensity electric field force on principle of (plasma) corona discharge and pulse high voltage switching power supply. The power supply is based on a mini converter. The converter is designed to operate high frequency more than 30 kHz and Power MOSFET is switching device through high voltage high frequency switching transformer#TLF14690. The circuit is capable of electric field intensity at 15 kV/cm for electric field cell. The problem incurred is heat come up in electric field cell resulting high consumption rate of efficiency eliminate smell (smell is Hydrogen Sulfide : H_2S). Therefore researcher tries to find a way to reduce temperature of electric field cell by using cool air producing from thermoelectric to observe temperature, ozone gas quantity and H_2S gas quantity. Therefore in testing we measure temperature, ozone gas quantity and H_2S gas quantity at cell electric field before and after installation of cool air production system from thermoelectric. The testing result appears that before installation cool air production system from thermoelectric temperature is 29℃, ozone gas quantity is 1.5 ppm and H_2S quantity is 150 ppm. And after installation cool air production system from thermoelectric temperature is 23℃, ozone gas quantity is 2.95 ppm and H_2S quantity is 25 ppm. Therefore it is conclude that cool air production system from thermoelectric can reduce temperature, increase ozone gas quantity and decrease H_2S quantity. And in the future researcher will develop application of cool air system from thermoelectric to reduce temperature in other industrial system and commercial innovations application.

Keywords: *temperature, cell electric field, corona, thermoelectric, ozone gas, hydrogen sulfide, smell eliminator, cool air*

Introduction

In the past and present, the researchers took ozone gas which is manufactured using UV light. And the corona discharging process used a lot whether it is used for waste air treatment. Get rid of toxic gases from the food process. Industrial wastewater treatment and more. The major factor affecting the amount of ozone is the higher temperature of the ozone generation process in the corona electric field. Because of high temperatures, the amount of ozone is reduced.

In this article, the researcher has guidelines and methods to reduce the temperature in corona electric field. By applying three 120-watt thermostable electrodes to cool air, they send to ozone-producing corona electric fields to maintain the amount of ozone as much or more. When the amount of ozone is increased, it can be used to further reduce the pollution and toxic gases.

Materials and methods

The principle of removal of the smell eliminator using cell electric field corona.

Smell eliminator using cell electric field has been adapted ionization and static electricity high voltage. This will make the air around the wire ionization rupture a charge by entering the high

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voltage direct current to the corona wire. This will cause the electric field intensity at the wire surface. When atoms or molecules of air into the air to break down by the principle that the atoms or molecules of the gas get enough energy to make it out to one electron. Atoms or molecules that have a positive charge are called the ionization process to separate the electrons from the particles of the gas. The process by which an electron is removed from a solid is called electron emission. In this way, electron is removed from the electrodes. A process, that is crucial will make the gas conductivity up. The energy from the electric field makes the air has got high intensity until it breaks and causing ozone. The ozone will eliminate odors and it can kill germs in the air as well.

The internal structure of the smell eliminator using cell electric field corona. It consists of the following sections.

Part 1: Pre - filter and blower.

Part 2: High voltage flyback converter circuit for generate high voltage.

Part 3: Cell electric field corona.

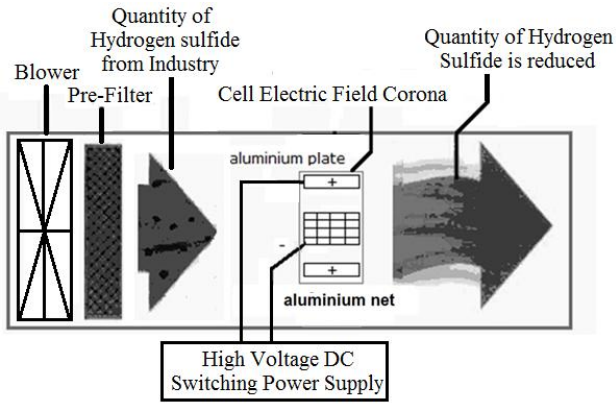
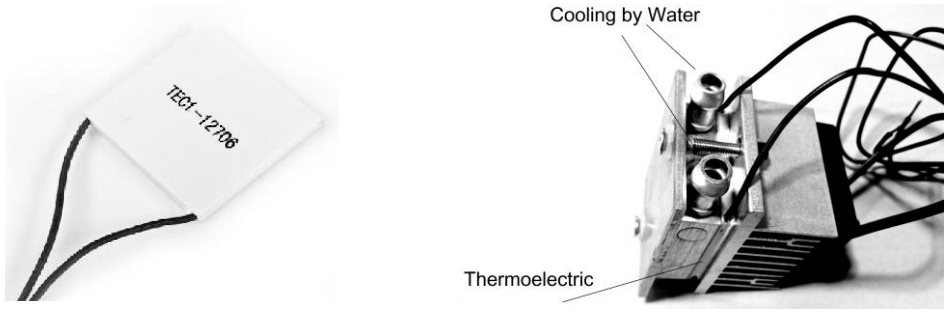


Fig. 1. The internal structure of the smell eliminator with cell electric field.

Fig. 1 shows DIY Kit Thermoelectric Peltier Cooler Refrigeration Cooling System Heat Sink Conduction Module + Fan + TEC1-12706 shown in Fig. 2. [1]

Specifications:

1. Semiconductor Chilling Plate: TEC1-12706
2. Size: 40 * 40 * 3.75mm
3. Internal Resistance: 2.1~2.4Ω
4. Max. Temperature Difference: 67°C Above
5. Rated Voltage: 12V (Vmax. 15V, Starting Current 5.8A)
6. Working Current: Imax.=4~4.6A(Rated 12V)
7. Refrigeration Power: Max. 50~60W
8. Working Environment: -55~83°C
9. Sealing Process: Standard 704 silicon rubber sealing all sides
10. Fan: DC 12V
11. Conduction Module Size: 60 * 45 * 21mm
12. Water Block Size: 40 * 40 * 12mm
13. Fan Size: 40 * 40 * 10mm
14. Package Size: 12 * 9 * 7cm / 4.72 * 3.54 * 2.75in
15. Package Weight: 211g / 7.44oz



(a) (b)

Fig. 2. (a) Thermoelectric Peltier TEC1-12706 and (b) Deduce high temperature using cooling system by water. [1]

Results and discussion

In Fig. 3 shows diagram block of the experiment result of temperature and ozone quantity and H_2S quantity measurement (before and after installation cool air production system).

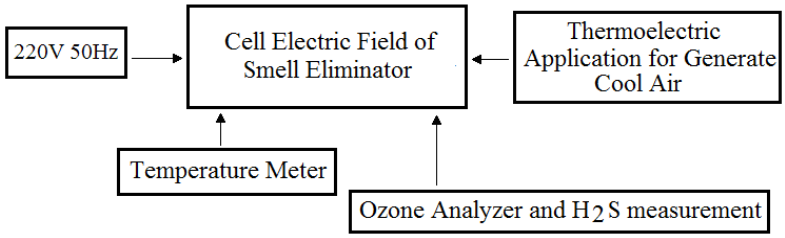


Fig. 3. Block diagram of the testing.

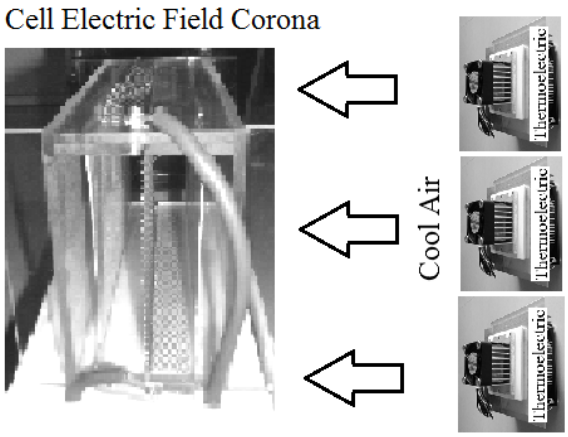


Fig. 4. Used cool air production from thermoelectric application for cell electric field corona.

The results of the temperature measurement, ozone gas quantity measurement and H_2S quantity measurement of cell electric field corona of smell eliminator (before and after installation cool air production system from thermoelectric shown in table 1.

The results of of temperature, input power, output power of high power switched power supply circuit (before and after installation cool air production system shown in table 1.

Table 1. The measurement result of temperature, input power, output power of high power switched power supply circuit (before and after installation cool air production system.

cool air production system from thermoelectric	T (°C)	Ozone Gas Quantity (ppm)	H_2S quantity (ppm)
before installation	29	1.5	150
after installation	23	2.95	25

Parameter of Table 1:

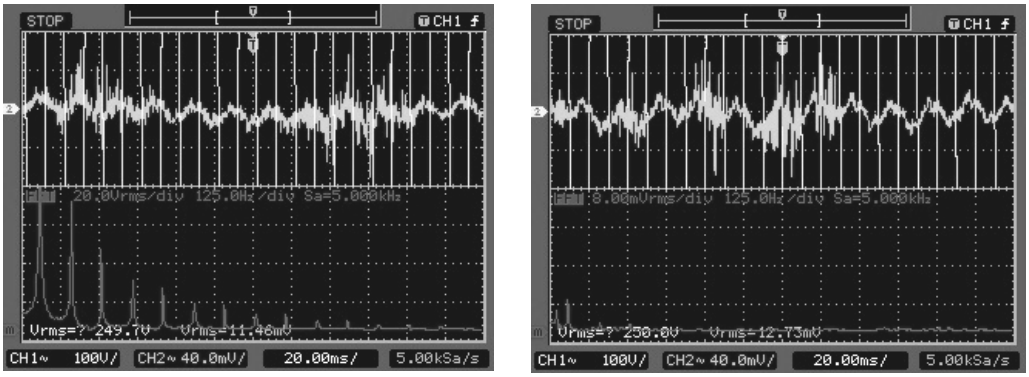
T is temperature of of cell electric field corona of smell eliminator (°C)

Ozone Gas Quantity is ozone gas quantity of cell electric field corona of smell eliminator (ppm).

H_2S quantity is Hydrogen Sulfide quantity (ppm)

The results of FFT (Harmonics) measurement of input current of high voltage DC switching power supply part

From Fig. 1 shows the testing of FFT (Harmonics) measurement of input current of high voltage DC switching power supply (before installation cool air production system) shown in Fig. 5 (a) and (b) FFT signal of input current of high voltage DC switching power supply (after installation cool air production system) shown in Fig. 6 (b).



(a) (b)

Fig. 5. (a) FFT signal of input current (before installation cool air production system) and (b) FFT signal of input current (after installation cool air production system)

From Fig. 5. (a) shows the amount of current harmonics of the order 3, 5, 7, 9 and 11 will increase (While not the cooling from thermoelectrics). But when the cooling from thermoelectrics makes the quantity of current harmonics of the order 3, 5, 7, 9 and 11 is reduced because of the quantity of heat decreased respectively as Fig. 5 (b).

Conclusion

Table 1 shows that cold air produced from thermoelectric and sent to corona electric field cells to reduce the temperature. It affects the amount of ozone and the amount of hydrogen sulfide. As before the thermoelectric was installed to produce the coolant delivered to the electric field cell the researcher measured 29°C of ozone, 1.5 ppm, and 150 ppm of hydrogen sulfide and the part of high voltage power supply produces the harmonics quantity to order 3, 5, 7, 9 and order 11 as also shown in Fig. 5.(a). But after installing thermocouples to send cold to the field researcher can measure the temperature by 23°C, the amount of ozone will increase to 2.95 ppm and the amount of hydrogen sulfide will be reduced to 25 ppm and the part of harmonics quantity of high voltage

power supply reduced as shown in Fig. 5.(b) because when the temperature of cell electric field corona decreased, the use of electricity is reduced and the harmonics decreased respectively.

Therefore, this test can be concluded that cold air from thermoelectric can reduce the temperature of the corona electric field cell. As a result, the amount of ozone increases. And when the amount of ozone increases will affect the removal of hydrogen sulfide gas to be reduced as well.

In the future, the researcher will apply this research in engineering and technology to benefit to the development of research to innovation.

References

[1] https://www.aliexpress.com/item/DIY- Kit- Thermoelectric- Peltier- Cooler- Refrigeration-Cooling- System- Heat- Sink- Conduction- Module- Fan- TEC1-12706/32756838002.html

[2] S. Ketkaew, *A study of temperature reducing of high voltage switching power supply circuit of electrostatic air cleaner by applied thermoelectricity*, **European Journal Of Materials Science And Engineering**, 2017, 2(1), pp. 23-28.

[3] S. Ketkaew, *Development of Corona Ozonizer Using High Voltage Controlling of Produce Ozone Gas for Cleaning in Cage, Modern Environmental Science and Engineering (ISSN 2333-2581)*, **Academic Star Publishing Company**, 2017, 3(7), pp. 505-509.

[4] S. Ketkaew, 2017, *The Application of Cool Air from Thermoelectric for Reduce Temperature in Ozone Tube of Ozonizer Affecting to Ozone Gas Quantity*, **International Journal of Science, Technology and Society**, 2017, 5(5), pp. 175-178.

[5] S. Ketkaew, *Plasma Ozonizer Using Micro-Converter for Ammonia (NH_3) Decreasing in Shrimp Food Production*, **Procedia Engineering**, 2012, 32, pp.148-154.

[6] S. Ketkaew, *The study of ozone gas generating technique using high frequency high voltage dc switching power supply of high ripple voltage*, **LEJ**, Vol.22, No.2, 2005, pp.1-6.

[7] TL 494 Data sheet, *Pulse-width- modulation control circuits*, **Texas instruments**, 2002, pp.1-10.

[8] S. Ketkaew, *The Case Study of 5 kHz – 25 kHz High Frequency Adjustment in Converter Circuit to Generate Ozone Gas*, **AU Journal Tech**, 2007, 11(1).

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