

# The experimental study on the high-voltage electrodes absorption water phenomenon

Hu Yucai, Liu Peng, Sun Yang, Huang Qiang, Qu Bing  
Dalian Fisheries University

**Abstract:** This paper reports the result of the high-voltage electrodes absorption water experimental phenomenon. When the high voltage power supply output is positive, the mist biases anode plate; when the high voltage power supply output is negative, the mist biases cathode plate; When the high voltage power pulse output is positive or negative, the mist does not deviate from the direction of entrance. Absorption water is proportional to the size of the power supply output and duration, that is to say: if the time is fixed, the higher the voltage, the greater the electrode absorption water; if the power output voltage is fixed, the longer the electrode continues, the more water gathers. We find that the phenomenon of high-voltage electrode is different from water accumulation which is reported in according to the analysis of experimental results, and the mechanism of its occurrence remains to be studied further.

**Keywords:** High voltage electric field; Negative electrode; Electrode; Absorption water

## 1 Introduction

In recent years, the research of electric environment's biological effects had received extensive attention [1-8]. In the experiments, scientists found that negative electrode absorption water at the High-voltage Electric Fields and the phenomenon had been researched and exploited. For example, the Xuying Li group [9] use the method of building the positive space electric field, which made the suspended fog particles floating in the air move in a certain direction under the electrostatic force. And then the fog particles quickly gather toward the soil interface which was regarded as the negative electrode. At the same time, the evaporation of the soil water was inhibited. Afterwards, the negative electrode absorption water at the Space Electric Fields was achieved. They design an experimental system that hetero pole distance and regulated test system of electric field absorption water with intermittent work [10]. The way that the Space Electric Fields effected the water content was also be researched. The matter to effectively solve the problem of the water lacked plants in the arid zone and also the water resource issue. Besides, the phenomenon of the negative electrode absorption

water at the Electric Fields was also be put into use in the field of the rotary dehumidifier reclamation system[11], the fuel cell system[12] and the electrostatic cleaning system[13]. However, the mechanism and process of the electrode absorption water at the High-voltage Electric Fields had not been explained persuasively. Therefore, the research on the phenomenon of negative electrode absorption water at the High-voltage Electric Fields is necessary in order to discuss the mechanism and expand the applied range.

## 2 Laboratory Instruments and System Design

### 2.1 Laboratory Instruments

The DMS-70 High-voltage Pulse Generator was made by Dalian Special Power Supply Co.,Ltd. The instrument can change the polarity, size, frequency of the output voltage, et al. It was the special equipment for science study. UM316S Ultrasonic Humidifier, mist was melted into ultrafine particles of one to five microns by ultrasonic of high frequency vibration, through pneumatic device that the mist had spread to the electrode absorption water device. The electrode absorption water device was closed container of a self-made, Length x Width x High was  $40 \times 35 \times 30 \text{cm}^3$ , it was equipped with two spacing 14cm, the acreage of the parallel aluminum electrodes plate was  $26 \times 14 \text{cm}^2$ .

### 2.2 Experimental System Design

Experimental system include high-voltage power, electrode absorption water device and Ultrasonic Humidifier, high-voltage power connected to two plates of the electrode absorption water device, mist was output through Ultrasonic Humidifier's the catheter to electrode absorption water device, make sure the direction of enter air was parallel to the ground and located at the middle of positive and negative plates, From Figure 1 show.

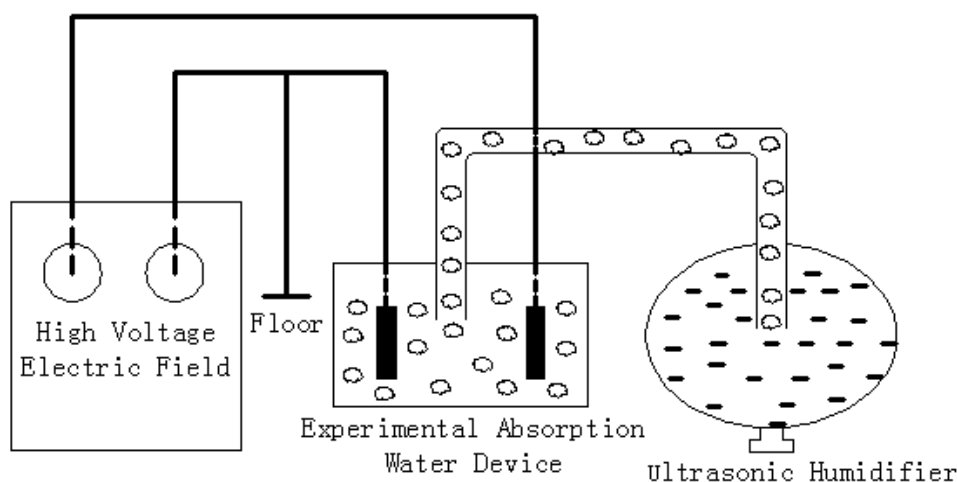


Figure 1 experimental system sketch map

### 3 results

This paper studied the factor of positive high-voltage power output , negative high-voltage output , pulse voltage output , the voltage between the size of the bipolar plates and the times of absorption water which influenced the effect of electrode absorption water. In the process of the experiment, the Ultrasonic Humidifier was fixed at 200cc/h; by comparing the results of the experiments, we can discuss the basic rules of the high-voltage electrode absorption water.

#### 3.1 Positive High-voltage Output

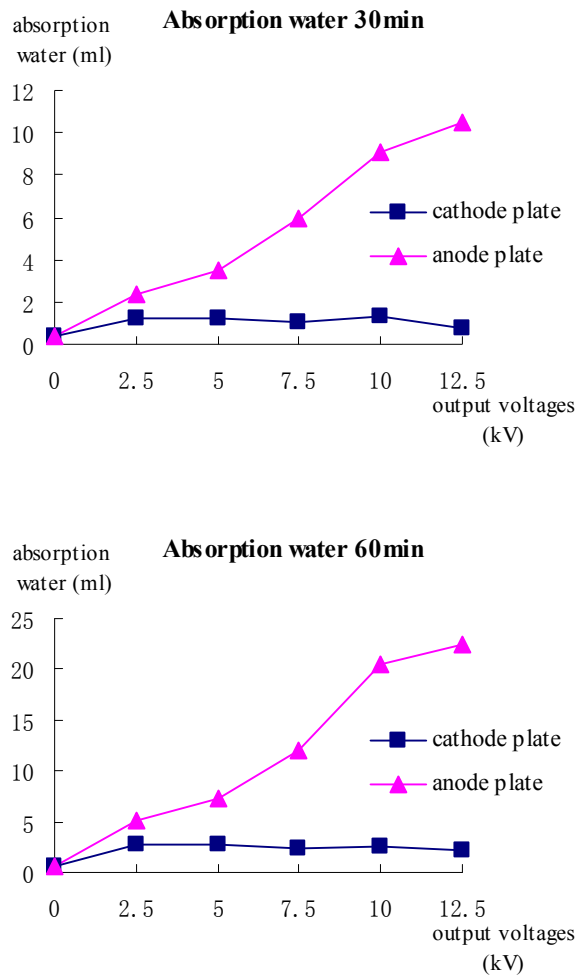


Figure 2 : the relation of electrode absorption water measures and output voltages when absorption water for a certain time (30 min or 60min)

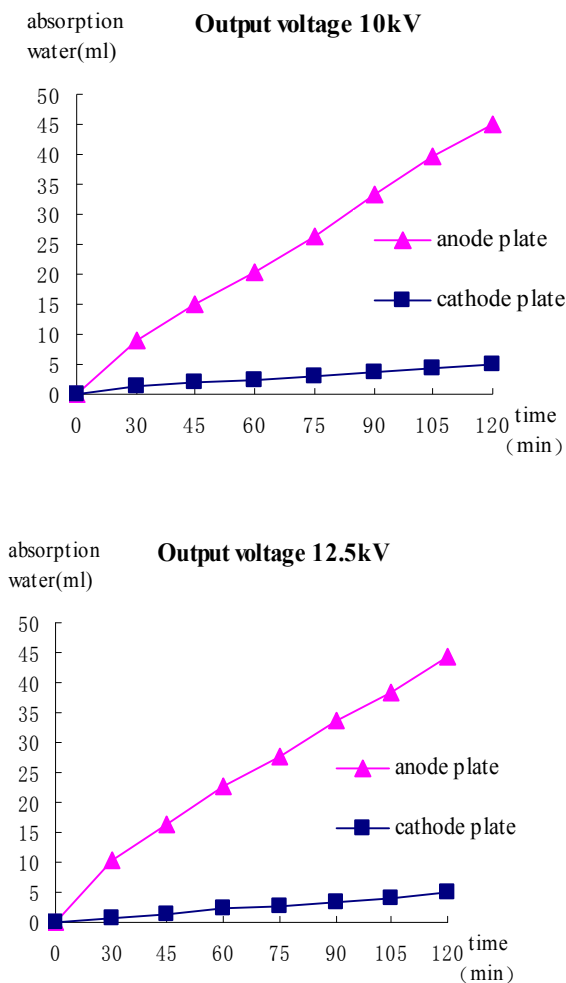


Figure 3 : the relation of electrode absorption water measures and times when output voltages for a certain voltage (10kV or12.5kV)

Experiments were conducted in two clusters: one for the time certain (30 min or 60 min), power supply output voltage were taken 2.5kV, 5kV, 7.5kV, 10kV, 12.5kV, by changing the voltage to study the relationship between the voltage magnitude and the measures of electrode plates absorption water. Another group for the certain voltage (10kV or 12.5kV), duration were taken 30min, 45 min, 60 min, 75 min, 90 min, 105 min, 120 min, measured by continuous absorption water at different times.

From Figure 2 and Figure 3, when the power supply output was positive high-voltage, absorption water of positive electrode plate was significantly higher than absorption water of negative electrode plate, and the larger electric field strength between the electrode plates, the more water absorbed in the electrode plates. When the power supply output is fixed or for a certain electric field strength between the plates, the longer duration for experiment, the more electrode plates absorption water.

3.2 Negative High-voltage Output

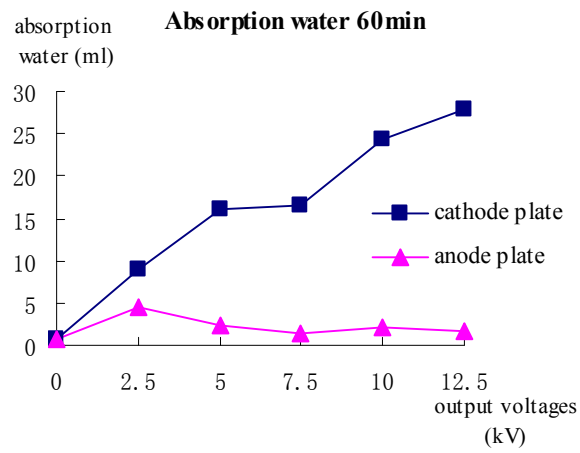
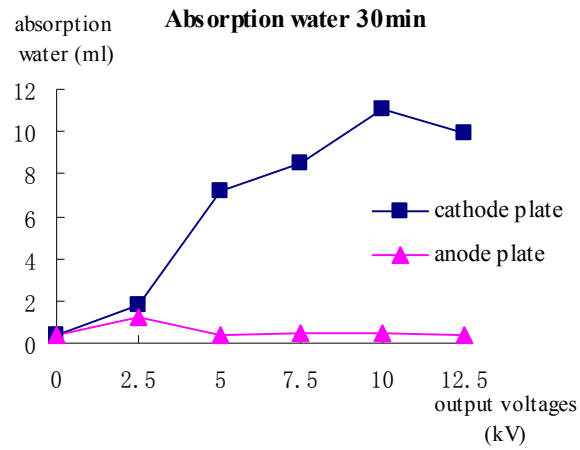
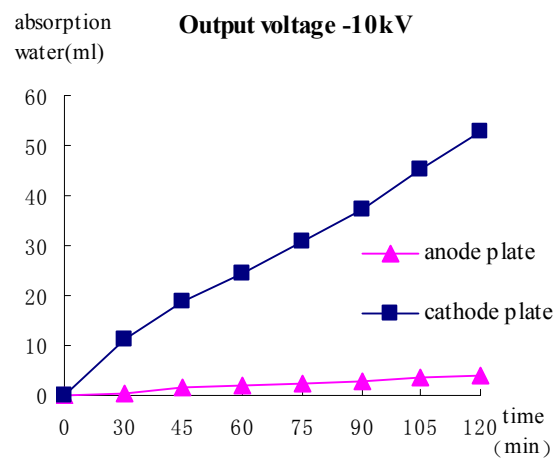


Figure 4 : the relation of electrode absorption water measures and output voltages when absorption water for a certain time (30 min or 60min)



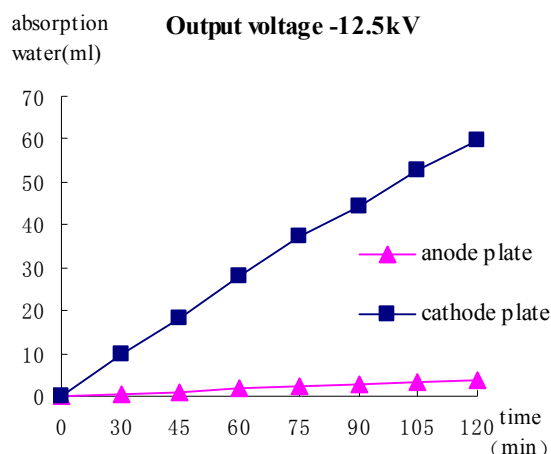


Figure 5 : the relation of electrode absorption water measures and times when output voltages for a certain voltage (-10kV or -12.5kV)

From Figure 4 or Figure 5, it shows that when the power output was the negative high-voltage, absorption water of negative electrode plate was significantly higher than the absorption water of positive electrode plate. when sorption water for a certain time, the greater output or the larger electric field strength between the electrode plates, the more electrode absorption water plates. When the power output voltage was fixed or for a certain electric field strength between the electrode plates, the longer the electrode absorption water, the more electrode plates absorption water.

### 3.3 Positive pulse output

Fixed power output of the positive pulses of 200 times per second, the experiment was taken with the packet mode of high-voltage output: a group of time was certain (30 min), power output voltage were taken 5kV, 7.5kV, 10kV, 12.5kV, by changing the voltage to study the relationship between the voltage magnitude and the measures of electrode plates absorption water. Another group of voltage was certain (10kV), duration times were taken 15min, 20min, 25min, 30min, measured by continuous absorption water at different times.

**Table 1 : when output Positive high-voltage pulse, voltage influenced on electrode absorption water.**

type	positive (ml)	negative (ml)	voltage	temperature	spray	time(min)
positive pulse	0	0	5.0 KV	21.2°C	200	30
					CC/h	
positive pulse	0	0	7.5 KV	21.2°C	200	30

positive pulse	0	0	10.0KV	21.2°C	200 CC/h	30
positive pulse	0	0	12.5KV	21.2°C	200 CC/h	30

**Table 2 : when output positive high-voltage pulse, absorption water times influenced on electrode absorption water.**

type	positive (ml)	negative (ml)	voltage	temperature	spray CC/h	time(min)
positive pulse	0	0	10 kV	21.2°C	200 CC/h	15
positive pulse	0	0	10 kV	21.2°C	200 CC/h	20
positive pulse	0	0	10 kV	21.2°C	200 CC/h	25
positive pulse	0	0	10 kV	21.2°C	200 CC/h	30

From Table 1, Table 2 shows that when the power output was positive pulse voltage, duration in 30 minutes, the two electrode plates had not collected to measurable amount of water, only to find the two electrode plates and absorption water device wall had small spray of the small number.

### 3.4 Negative pulse output

Fixed power output of the negative pulses of 200 times per second, the experiment was taken with the packet mode of high-voltage output: a group of time was certain (30 min), power output voltage were taken -5kV, -7.5kV, -10kV, -12.5kV, by changing the voltage to study the relationship between the voltage magnitude and the measures of electrode plates absorption water. Another group of voltage was certain (-10kV), duration times were taken 15min, 20min, 25min, 30min, measured by continuous absorption water at different times.

**Table 3 : when output negative high-voltage pulse, voltage influenced on electrode absorption water.**

type	positive (ml)	negative (ml)	voltage	temperature	spray CC/h	time(min)
Nega	0	0	5.0 KV	21.2°C	200	30

tive pulse					CC/h	
negative pulse	0	0	7.5 KV	21.2°C	200	30
negative pulse	0	0	10.0KV	21.2°C	200	30
negative pulse	0	0	12.5KV	21.2°C	200	30

**Table 4 : when output negative high-voltage pulse, absorption water times influenced on electrode absorption water.**

type	positive (ml)	negative (ml)	voltage	temperature	spray	time(min)
negative pulse	0	0	-10 KV	21.2°C	200 CC/h	15
negative pulse	0	0	-10 KV	21.2°C	200 CC/h	20
negative pulse	0	0	-10 KV	21.2°C	200 CC/h	25
negative pulse	0	0	-10 KV	21.2°C	200 CC/h	30

From Table 3, Table 4 shows that when the power output was negative pulse voltage, duration in 30 minutes, the two electrode plates had not collected to measurable amount of water, As being the same as the positive pulse voltage output, only to find the two electrode plates and absorption water device wall had small spray of the small number.

#### 4 Conclusion

When the macro phenomenon of the high-voltage field electrode absorption water was that the power output positive high-voltage, the mist clear had been partial anode. When the power output negative high-voltage, the mist clear had been partial to cathode. When the power output was pulse- voltage, whether had output positive pulse-voltage or negative pulse voltage, the mist didn't bias any of the electrode plates and the electrode plates had not absorption water. Measuring result of the high-voltage electrode absorption water phenomenon show when the power output was negative high-voltage, cathode plate had obviously absorbed water; when the power output was positive high-voltage, anode plate had



obviously absorbed water; when the power output was pulse-voltage, whether output positive pulse-voltage or negative pulse-voltage, two plates had seldom absorbed water, time of short period was unable to collect the amount of the water or measure it. The experimental results were opposite to reference documents [9-10] with the phenomenon of cathode absorption water, the remain reasons will to be further research.

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