# Investigation of inactivation effect by corona discharge using a fluorescence microscope

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## 1. Introduction

An electrostatic precipitator (ESP) has a high collection performance for particles smaller than 1μm. An ESP using corona discharge is expected to inactivate microorganisms. Authours have investigated to inactivate microorganisms collected on a plate electrode using corona discharge for improving ESP performance. As a result, it was cleared that a survival ratio decreased due to corona discharge[1)].

In this study, it was investigated to comfirm dead microorganisms and the inactivation process using a fluorescent microscope.

## 2. Experimental Method

The schematic diagram of the experimental apparatus is shown in Fig. 1. The apparatus consists of discharge wire and grounded plate electrodes. *Staphylococcus aureus* (NBRC13276) was used as model airborne microorganisms. *S. aureus* diluted with pure water was put on conductive slide glass (thickness 0.02ml). The glass was located under the discharge wire. A control was located at the outside for estimating natural decrement of *S. aureus*. After natural drying for 0.5 hours, microorganisms on the glass were exposed to corona discharge. The applied voltage was approximately DC -8.6 kV, the discharge current was between 20 and 24 μA, the ozone concentration was approximately 1 ppm. The wind velocity was 0.5 m/s, the temperature was approximately 22 ℃, the relative humidity was approximately 50%. Ctrl and the apparatus were installed in a clean bench.

After corona discharge treatment, dead and live microorganisms on the glass, which were stained with fluorescent dye, were observed using a fluorescent microscope. The threshold of fluorescence intensity to distinguish live or dead was decided in a preliminary experiment.

## 3. Result and Discussion

Fluorescent microscope image of the Ctrl after the experiment is shown in Fig. 2. SYTO®9 and PI were used for fluorescence reagent, therefore live or dead microorganisms emit green or red light, respectively. Yellow parts may indicate layers of live and dead microorganisms. Dead and live microorganisms were observed in the image. Dead microorganisms in the Ctrl, which was not exposed to corona discharge, were due to natural drying.

Fluorescent microscope image under the discharge wire after operation is shown in Fig. 3. Most microorganisms emit red light. In comparison with Ctrl as show in Fig 2, dead microorganisms emitting red light significantly increased. This result shows the inactivation effect of corona discharge, and cell walls was destroyed because of staining with red.

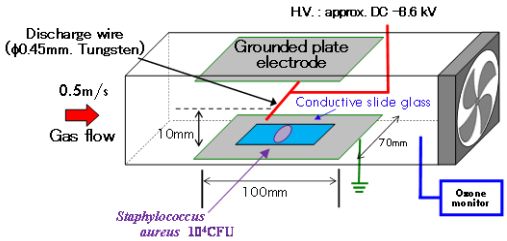


Fig.1 Schematic diagram of experimental apparatus.

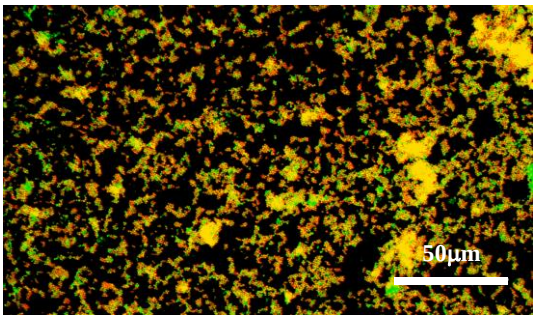


Fig. 2 Fluorescence microscope image on the Ctrl.

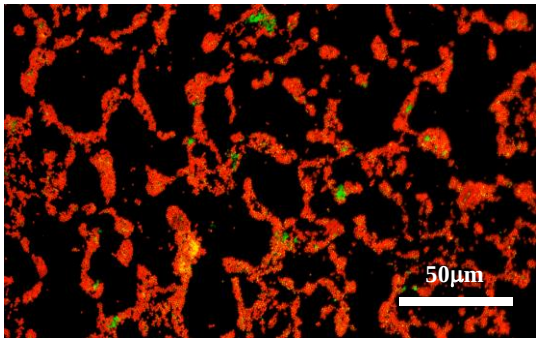


Fig. 3 Fluorescence microscope image under the wire electrode.

## References

1) Akinori Zukeran, Yuki Miura, Tomohiro Oku, Risei Wada, Jun Sawai, "Humidification effect on inactivation of *Staphylococcus aureus*in by ozone generated in corona discharge" *Europian Aerosol Confereuce 2015*, 1ELE_P0008, 2015.