

# STERILIZATION OF *ESCHERICHIA COLI* IN WATER USING ATMOSPHERIC AIR PLASMA

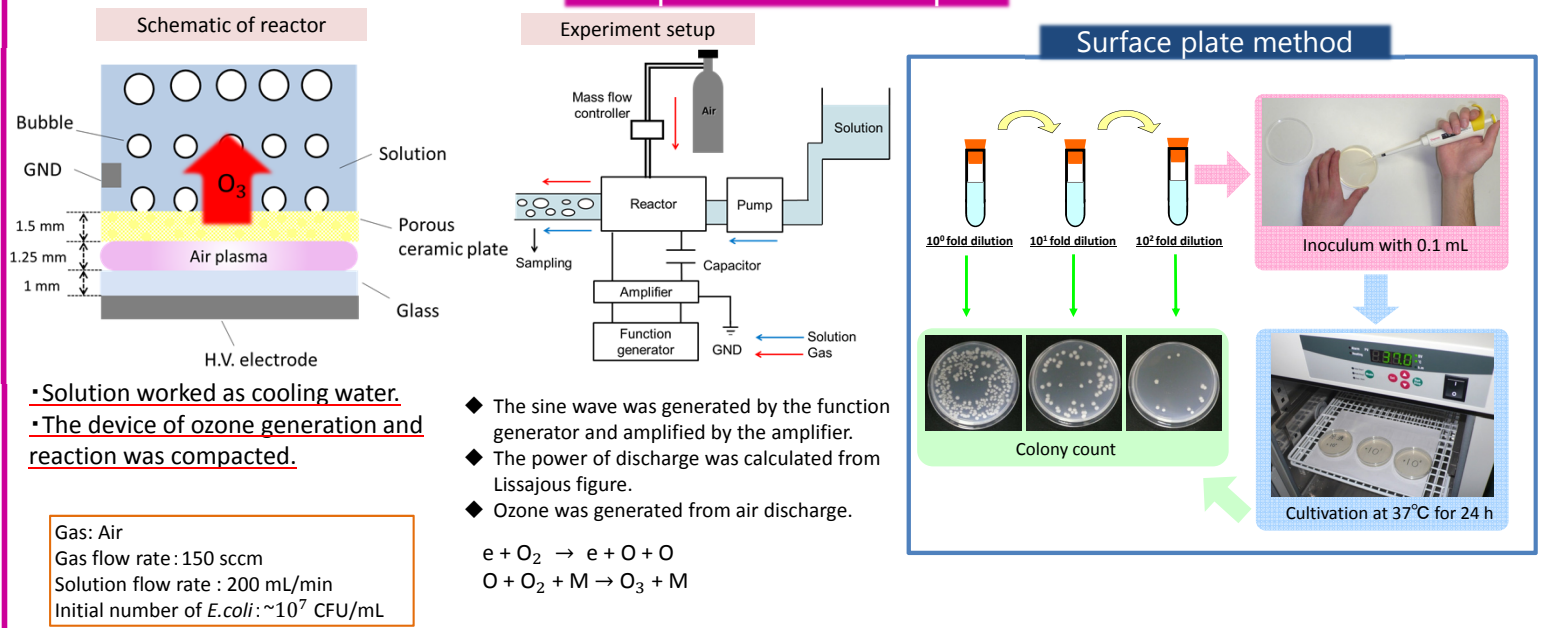
## Summary

Sterilization of water containing *Escherichia coli* (*E. coli*, NBRC 3972) was examined using an atmospheric air plasma. Ozone was generated from an air plasma, and the solution with an initial *E. coli* concentration of  $\sim 10^7$  CFU/mL was inactivated after 20 s. The concentration of dissolved nitrogen oxides increased with increasing power density, and the concentration of dissolved ozone decreased by the reaction with nitrogen oxides. The sterilizing rate got worse with high power density, because the primary factor of inactivation was dissolved ozone. The lowest D-value was 3.4 s.

## Objectives

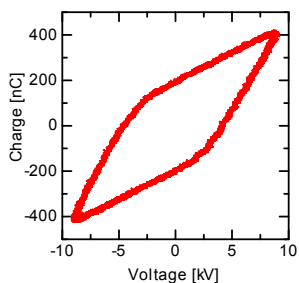
The worse microbial quality of water for domestic use cause hazard to health. According to WHO Guidelines for drinking-water quality, *E. coli* should be not detected per 100 mL. So the water treatment devices for sterilization is needed. In this research, ozone was generated by an atmospheric air plasma, and the compact reactor of ozone generation and ozone reaction was developed.

## Experimental Setup

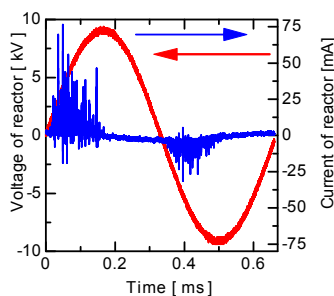


## Results and Discussions

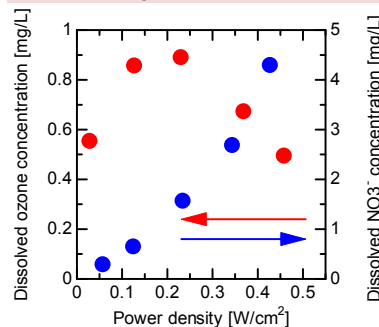
Q-V Lissajous figure (0.14 W/cm<sup>2</sup>)



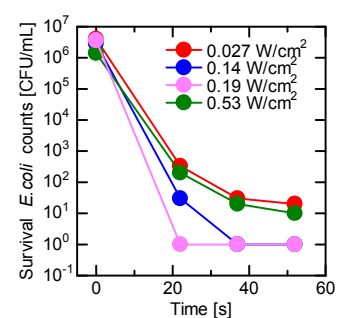
Wave forms (0.14 W/cm<sup>2</sup>)



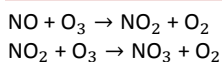
Experimental result of dissolved ozone and HNO<sub>3</sub> (not containing *E. coli*)



Experimental result of *E. coli* sterilization



Decomposition of ozone by the reaction with NO<sub>x</sub>



- The rate coefficients related to the ozone decomposition increase exponentially with increasing temperature.

- ✓ The sterilizing properties got worse with high power density. The reason for this is that the gas temperature increased with increasing power density, and it was result in the promotion of ozone decomposition by the reaction with nitrogen oxides.
- ✓ The concentration of dissolved NO<sub>3</sub><sup>-</sup> increased with increasing power density, but it was smaller than 50 mg/L (WHO Guidelines for drinking-water quality, 2011).
- ✓ The lowest D-value which shows the time required to kill 90% of the organisms was 3.4 s.