

DIRECT EXPOSURE TO A SINGLE FILAMENT OF DBD PLASMA LEADS TO THE INACTIVATION OF AIRBORNE BACTERIA

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Airborne transmission is the cause of the spread of many deadly diseases. There are bacteria that can be easily aerosolized and transmitted far distances inside HVAC systems. To control the spread of these contaminants, HEPA filters are used. These filters however, do not kill bacteria and viruses but only trap them. They also cause large pressure drops inside HVAC systems. DBD plasma discharge has been used as a method of inactivating airborne bacteria^[1]. The focus now is on determining the major mechanism of this inactivation. The main distinguishing parameter used to evaluate the sterilization of bacteria is whether this effect is due to direct exposure to plasma or the indirect effect of long living species produced by it. The hypothesis here is that the charges produced by DBD are responsible for this inactivation.

A system was designed to understand the influence of a DBD filament on airborne *E. coli*. The cross section of the discharge was ~500 μm . A large volume nebulizer was modified to produce aerosol that could be transmitted through the discharge gap. The bacteria were added to the solution and nebulized through this arrangement. The post treatment sample of the bacteria was taken by impaction on an agar plate. The colonies were then measured after overnight incubation.

The results indicate complete inactivation of bacteria flying through the single filament discharge zone. However, when the injection of bioaerosol was performed outside of the single filament discharge zone, there was significant reduction in the inactivation. These results have lead to the conclusion that direct exposure to a DBD discharge is far more effective in inactivating airborne bacteria. This can be due to the bacteria being bombarded by the charges produced by a filament of DBD. This supports the earlier hypothesis about the charges being the major inactivating agents.

1. M. J. Gallagher, Jr., N. Vaze, S. Gangoli, V. N. Vasilets, A. F. Gutsol, T. N. Milovanova, S. Anandan, D. M. Murasko, and A. A. Fridman, "Rapid inactivation of airborne bacteria using atmospheric pressure dielectric barrier grating discharge," *IEEE Trans. Plasma Sci.*, vol. 35, no. 5, pp. 1501–1510, Oct. 2007.