Application of aqueous ozone spray on suppression of indoor bioaerosols

C.-H. Luo[1*], S. Yang[2], T.-Y. Liu[1], Y.-Y. Chen[1] and Z.-H. Yan[1]

[1]Department of Safety, Health and Environmental Engineering, Hungkuang University, Taichung, 43302, Taiwan
[2]Center for General Education, Toko University, Chiayi, 61363, Taiwan
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Presenting author email: andyluo@hk.edu.tw

There are many different indoor contaminants in which bioaerosols are the main pollutants can cause adverse effects on human health. Utilizing high oxidation power of Ozone dissolved in water (Sotelo et al., 1989) can effectively remove bioaerosols. Ozone at high concentrations is toxic, but it can invade and destroy cell membranes and DNA to cause biological death and inactivation of bioaerosols at a certain concentration. Therefore, ozone is also a good ingredient of sterilization. Generally, organelles with important functions in the cells are more susceptible to attack by ozone molecules, including: (1) the cell membrane, the channel where materials are in and out; (2) cellular proteins and enzymes; (3) genetic materials constituted by RNAs. If they are severely damaged, microorganism may be killed or have trouble in breeding.

In recent years, the ozone water is used in manufacturing processes of food plants (Zhang et al., 2016) and sterilization of agricultural and fishing products because of the high oxidizing power of ozone to inhibit microorganisms effectively. If only using gaseous ozone to remove indoor bioaerosols, high ozone concentration should be a problem (Sonntag and Gunten, 2012). Ozone covered in water film for the electrolytic ozone water spray can improve air quality, and deterioration of indoor air may be avoided. In this study, the electrolytic ozone water used in the removal of indoor bioaerosols and assess the removal effectiveness.

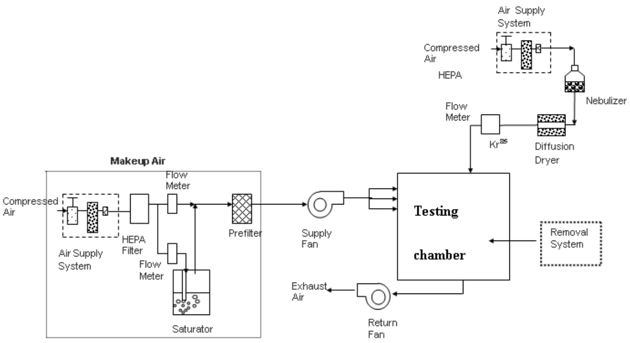

Figure 1. Experimental setup.

Experimental setup is shown in Figure 1. Pure water passed through electrolytic platinum plates of the generator was transferred to ozone water. Ozone water under high pressure becomes suspended spray with thin ozone water droplets in the air. Through the fan and pump used to maintain the systemic stability and ventilation rate, aqueous ozone spray was diffused in the testing chamber of 80×80×80 (cm^3). The ventilation rate is set from zero to 1.0 /hr, and relative humidity is set from 30 to 80%. The effective colony number at the outlet end was between 30 and 300 CFU/plate.

Results and discussions

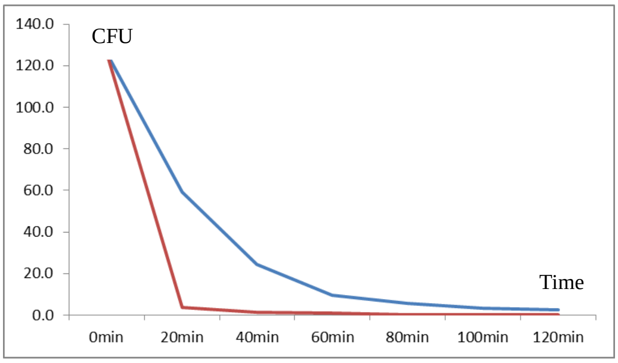

Figure 2. Natural decay (blue) and suppression by 0.01 ppm ozone water (red) for *Yeast* in the testing chamber.

The testing chamber for the electrolytic ozone water spray system has been established. The removal efficiency of bioaerosols by the ozone water spray can be detected. Gravity settling and adsorption on chamber wall are two mechanisms of natural decay. The ozone water spray additionally provided mechanical mechanisms for bioaerosol removal, including inertial impact, direct interception and diffusion adsorption. Their relative contribution will be discussed.

Acknowledgements

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