PA24) Effect of Condensational Growth of Bioaerosols on Their Viabilit

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1. Introduction

Conventional approaches to detecting and quantifying bioaerosols often rely on sampling methods using filters, impactors, impingers or wetted wall cyclones which the microorganisms may not survive from the stress caused during the collection process. Ideally, the collected microorganisms should be undamaged and the number of collected microorganisms should be representative of the airborne concentration (Cox, 1991). However, available devices differ by a number of parameters that may affect their efficiency in collection and microbial recovery. When viability is an important issue, the existing methods are not gentle enough to avoid physical stress on bioaerosols. In this study, we developed a condensational growth system of bioaerosols which uses a commercial humidifier as the water vapor supplier and a Lab-made cooler in order to enhance the survival rate of bioaerosols and increase the efficiency of a sampler.

2. Materials and Methods

The experiment for bioaerosol was performed with three species of bacteria. First, *Pseudomonas fluorescence* (ATCC13525) was tested because it was very well known to be vulnerable to mechanical stress. Second, *Staphylococcus epidermidis* (ATCC14990), which is designated as the standard bioaerosol in ISO standard for evaluation of bioeaeorol sampler, was also tested. The bacteria were dispersed into air using an atomizer (model 9302, TSI Inc., USA) at a flow rate of 2L/min. The flow enters a diffusion dryer to remove the residual humidity and an aerosol neutralizer (model 4530, HCT CO. Ltd., Korea) to eliminate the effect of surface charging which might have been generated in the atomizer. The dried and neutralized bioaerosols mixed with humid air (3L/min) generated from a Nafion humidifier, which makes large amount of water vapors effectively by perevaporation process. The Nafion humidifier generates more water vapors with increasing temperature of the supplied water. The bioaerosols surrounded with water vapor introduced into the thermo-electric cooler. When the warm and humid air flow containing bioaerosols was introduced to the thermo-electric cooler, the temperature of the flow dropped immediately and there occurred supersaturation condition for water vapors. Due to this supersaturation, excess water vapors were condensed on the surfaces of particles and the diameter of the particles became enlarged. The temperature of water supplied to the Nafion humidifier was varied as 25, 35, 45, and 75°C. The temperature of thermo-electric cooler was controlled as 5°C. The viability of the bioaerosols was measured using Anderson impactor (TE-10-800, Tisch Environmental Inc., USA).

3. Results and Discussion

The relative ratios of the numbers of CFU in the presence of the condensational growth system to those in the absence of the system are shown in Fig. 1-2. In this graph, 100% means the same sampling efficiency as the system without the condensational growth unit, therefore, y-axis values above 100% means the enhancement of the sampling efficiency and values below 100% means the opposite. As shown in the figure, the sampling efficiency for *Pseudomonas fluorescence* increased by

12%, in the presence of the condensational growth unit at the temperature of 25°C. However, it showed near-linear declining tendency from the temperature of 35°C. The *staphylococcus epidermidis*, exceptionally, showed the increased sampling efficiencies both at 25°C and 35°C (by 43% and 38%, respectively), but it also showed a declining tendency as the temperature increased.

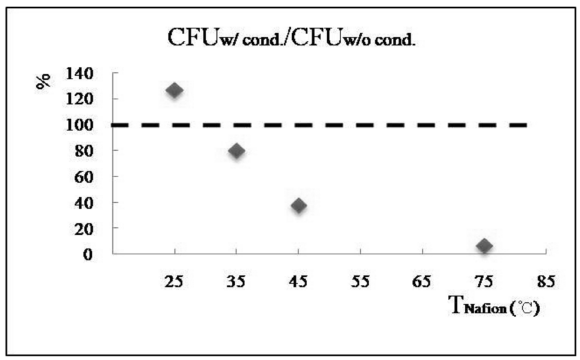

Fig. 1. The relative sampling efficiency for *P. fluorescence*.

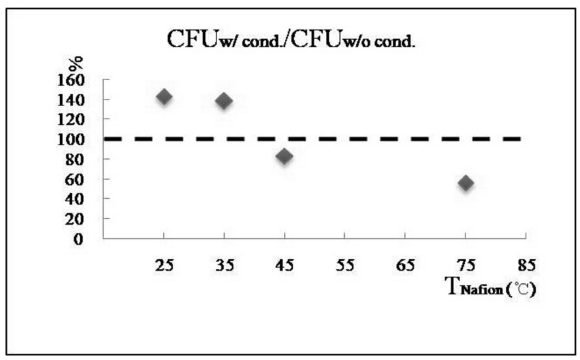

Fig. 2. The relative sampling efficiency for *S. epidermidis*.

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References

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