To: Mitsubishi Electric Corporation Nakatsugawa Works

Test Report

Evaluation of airborne virus (phage) cross contamination for the LOSSNAY core

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Kitasato Research Center of Environmental Sciences
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1. Object

The present test was conducted to verify that there is no airborne virus (phage) cross contamination from the outlet air to the inlet air of the LOSSNAY core in the heat exchange process.

2. Client

Name: Mitsubishi Electric Corporation Nakatsugawa Works

Address: 1-3 Komaba-cho, Nakatsugawa-shi, Gifu, Japan

3. Institution and Analyst

Name: Kitasato Research Center of Environmental Sciences

Address: 1-15-1 Kitasato, Sagamihara-shi, Kanagawa, Japan

Analyst: Microbiology Department

Shunji Okuda, Noriko Shimasaki

4. Test Period

December 22, 2004

(Test materials was operated by engineers of your company)

5. Test Materials

New LOSSNAY core "Hyper Element"

6. Organism

6-1. Test virus

E.coli phage φX174 ATCC 13706-B

6-2. Host bacteria

Escherichia coli ATCC 13706

6-3. Host bacteria culture

Escherichia coli (explained in 6-2.) was inoculated into 0.5% NaCl-added Nutrient Broth(Difco), and was cultivated overnight at 35℃. The resultant medium containing approximately 10^9 CFU/ml of host bacteria was used as host bacterium solution.

6-4. Test virus solution

E.coli phage φX174 was mixed with host bacterium solution (explained in 6-3.) and cultivated. The resultant medium was filtrated by membrane filter owing to removal of *Escherichia col*i, and was diluted with sterile ion-exchanged water to obtain test virus solution of approximately 10^7 PFU/ml.

7. Method

7-1. Outline

The test apparatus is schematically shown in Fig. 1. The air flow rate was 250 m^3/hr in the outlet and inlet ducts intersecting each other at the LOSSNAY core. Air-sampling tubes were attached, with their openings against the air flow, at the each center of 4 sites, outlet duct upstream (location A) and downstream (location B) and inlet duct upstream (location C) and downstream (location D) of the LOSSNAY core.

The test was performed as follows: Test virus solution was sprayed from the upstream side of the outlet duct, and a specified quantity of air was then simultaneously sampled with midget impingers at 4 sites, locations A, B, C, and D around the LOSSNAY core to count the number of airborne viruses contained in the air.

7-2. Spray of test virus solution

The test virus was sprayed in the outlet duct at a pressure of

1kgf/cm^2 while supplying compressed air from the compressor into the nebulizer containing the test virus solution.

7-3. Sampling of airborne viruses

Airborne viruses were collected using the midget impinger as described below. Air in the duct was aspirated at a rate of 5 liters per minute for 4 minutes. Hence, a total of 20 liters of air was collected in 25 ml of sterile ion-exchanged water in the midget impinger.

7-4. Method for counting the number of viruses

Ion-exchanged water in the midget impingers, which possibly contained airborne viruses (*E. coli phages*), was used as the sample stock solution, and its 10-fold serial dilutions were then made. 0.2ml of the stock solution and each dilution were mixed with 0.2 ml of host bacterium solution of about 10^9 CFU/ml, and then mixed with 4.0 ml of soft agar for top layer. The mixture was then layered on the surface of 0.5% NaCl-added Nutrient Agar. The resultant medium was incubated for 18 hr at 35℃. The number of plaques formed was counted to determine the number of airborne viruses per 20 L of sampled air.

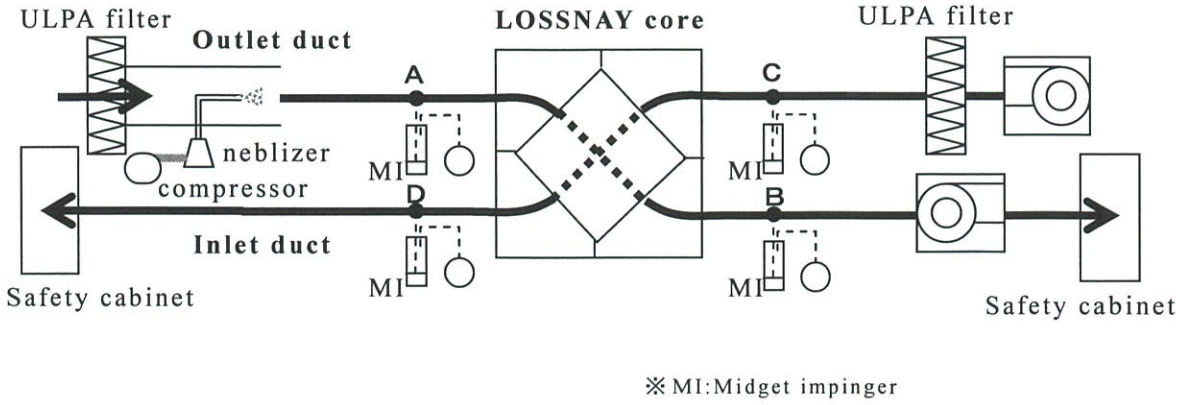

Fig. 1 Schematic diagram of the test apparatus

8. Test result

The concentration of test virus solution was 1.2×10^7 PFU/ml.

The result of test is shown in table-1.

9. Consideration

The test virus was *E. coli phage ϕX174* with a small viral particle diameter (about 20 nm).

Test viruses were detected at locations A and B on the outlet side, from which the test virus solution was sprayed. In contrast, no test viruses were detected in 20L of sampled air at location C (in the air filtered by the ULPA filter) or location D(in the air crossed in the LOSSNAY core) on the inlet side. Therefore, it can be concluded that airborne viruses in the outlet side will not cross the dividers (specially processed paper) of the LOSSNAY core to the opposite inlet side even when heat is exchanged there.

Teble-1 Airborne virus counts on each location

Test virus : *E.coli phage φX174* ATCC 13706-B

Test No.	Location A	Location B	Location C	Location D
1	3.1×10^2	2.8×10^2	< 1	< 1
2	4.4×10^2	1.2×10^2	< 1	< 1
3	1.9×10^2	6.2×10	< 1	< 1
Average	3.1×10^2	1.5×10^2	< 1	< 1

(Unit of measurement: PFU/20L-air)