Airborne influenza virus survival in the air environment

O.Pyankov[1,2], O.Pyankova[2], E.V. Usachev[1] and I.E. Agranovski[1]

[1]Griffith School of Engineering, Griffith University, Brisbane, 4111 QLD, Australia
[2]State Research Centre of Virology and Biotechnology "Vector", Koltsovo, Novosibirsk region, 630559, Russia
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Presenting author email: i.agranovski@griffith.edu.au

Recent interest towards investigations in the area of airborne virus behavior was ignited by a number of respiratory infection outbreak events, including Avian and Swine Influenza and SARS virus spread in various countries causing substantial social and economic damages. A significant number of corresponding papers have been published in the first decade of this century. The main research effort was focused on identification of virus transmission routs, exposure effects, transmission dynamics, monitoring methods and techniques, and rapid detection of targeted pathogens in the ambient air. This paper reports results on time related inactivation of pathogenic influenza strains in the ambient air under controlled laboratory conditions involving a range of influenza virus strains obtained in various countries.

A laboratory setup used in this project is shown in Fig 1. A virus containing suspension was aerosolized into an aerosol chamber by a nebulizer (BGI, Inc., USA). A rotating aerosol chamber was used to ensure minimal aerosol settlement under action of gravitation.

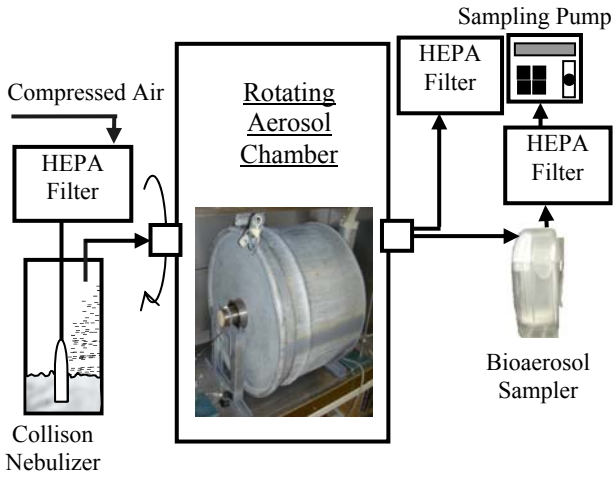

Figure 1. Laboratory setup

Three personal bioaerosol samples each charged with 50 ml of collecting liquid were used for monitoring viable virus concentration at 0, 15, 30, 60 and 90 min after virus aerosolization enabling determination of time related virus inactivation. A modified Hank's solution, consisted of Hank's solution containing 2% volumetric of inactivated bovine serum, 100 U/mL of penicillin and 100 μg/mL of streptomycin was used as the samplers' collection liquid for all experiments. Six viral strains including A/CALIFORNIA/04/2009 (H1N1), A/Moscow /225/2009(H1N1), /Chicken/Kurgan/05/2005(H5N1), A/Chicken/Suzdalka/Nov-11/2005(H5N1), A/Chicken/ Crimea/08/2005(H5N1) and A/AICHI/ 2/68(N3H2) were used in the experiments.

The results obtained for H1N1 and H5N1 strains show close trend with regards to inactivation in the ambient air; rapid inactivation of approximately 60% of microorganisms over the first 30 minutes with following inactivation at much slower rate over the remaining 60 minutes of experiment. A different picture was observed for the H3N2 strain, which demonstrated much higher robustness compared to other subtypes; even after 90 minutes, around 50% of viral particles were still alive. Based on quite substantial number of experimental repeats some generalized conclusions could be made. The most important is based on a fact that two subtypes of influenza virus, which recently caused pandemics demonstrate very similar inactivation behavior in aerosol form. The results of this research could be directly used in health and epidemiological studies, modeling of HVAC systems, microbiological studies and many others.

It should also be noticed that rotating aerosol chamber was found to be very useful device for time related investigations of airborne microorganisms' behavior. It allowed keeping them in the air for quite substantial time periods with relatively low gravitational losses.

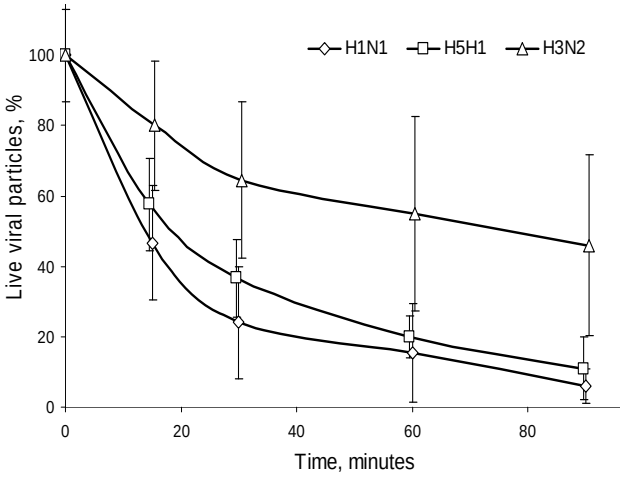

Figure 2. Inactivation of various strains of Influenza virus in the ambient air

Agranovski et al. (2005). *J.Aerosol Sci*. **36**, 609-617.
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