# A Novel Sampler for Viral Aerosols through Water-based Condensation Particle Growth

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**Abstract**

Respiratory and other infections can be acquired through the inhalation of aerosolized virus particles. Cases of severe acute respiratory syndrome (SARS) in 2003 and pandemic H1N1 influenza in 2009 sparked global concerns and are recent examples of serious outbreaks that required investigations of airborne transmission of the causative agents. Existing air samplers collect viral aerosols (20 - 100 nm) with low efficiencies (5 – 10%). A laminar flow water-based condensation particle growth technology has been demonstrated to have a cut-off size of 4.5 nm for ambient aerosols by introducing the aerosol into a wetted-wall tube held at higher temperature. In this study, the performance of an Aerosol into Suspension Collector (ASC) based on this technology to amplify the size of viral particles for enhanced physical and biological sampling efficiency was evaluated. MS2 bacteriophage (diameter = 28 nm) was aerosolized using a Collison Nebulizer and then dried to imitate viruses in ambient air. Afterwards, viral aerosols were collected by both the ASC and SKC® BioSampler. Condensation particle counter (CPC) and optical particle counter (OPC) were used to determine the number concentration and size distribution of viral particles before and after collection, while the single-layer bioassay method was used to determine the plaque forming unit (PFU) of MS2. Experimental results demonstrated that the nanometer viral particles were amplified to 2 to 4 μm particle size range and the physical collection efficiency was more than 90% using the ASC compared to less than 10% by the BioSampler. For the collection media, tryptic soy broth collected more viable MS2 than DI water. The viable collection efficiency of this new collection system for MS2 viral particles was approximately 10 times greater than that of SKC® BioSampler. This is the first time water-based condensation technology has been effectively used for viral aerosol sampling.