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**Stack sampling: Comparison of three methods for the detection of airborne viruses**

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**Abstract:**

**Background/Objective:** Emitting airborne infectious agents from livestock productions into the ambient air may pose a risk for adjacent farms or residential areas. In times of infectious viral disease outbreaks, reliable measurements of virus concentrations via air sampling can help to assess transmission risks. This raises the question which method is suitable to sample viruses from the exhaust air of barns.

**Methods:** In this study, we compared the stack sampling efficiencies of teflon filters in three part filter cassettes and gelatine filters in GSP3.5 filter holders as well as AGI-30 impingers at air velocities of 3 m/s. Two non-pathogenic surrogate viruses were used for aerosolisation. First, the coliphage MS2, a non-enveloped ssRNA bacteriophage and established surrogate organism for noroviruses and several pathogenic respiratory viruses. Second, the enveloped dsRNA bacteriophage Phi6, typically used as a surrogate for influenza and coronaviruses in recent years.

The air samples were analyzed by counting plaque forming units (PFU) and by detecting RNA copy numbers. The Kruskal-Wallis test with the post-hoc Dunn’s test were used for multiple comparisons.

**Results:** All sampling methods showed significantly higher RNA copy numbers compared to PFU, as the RT-PCR does not only detect viable, but also non-cultivable and incomplete virus particles. Samples from AGI-30 impingers resulted in significant higher PFU concentrations than both filter methods and showed less deviations. Interestingly, the efficacy of the gelatine filter, often recommended, was not higher compared to the used teflon filter.

**Conclusion:** For sampling viruses in ducts, the impingement can be recommended as a sampling method for infectious particles. However, the teflon filter seems significantly more efficient to detect viral RNA from air flows.

**Keywords:** stack sampling, air flow, viruses, AGI-30 impinger, teflon filter, gelatine filter