

Inactivation of airborne viruses by tea tree oil

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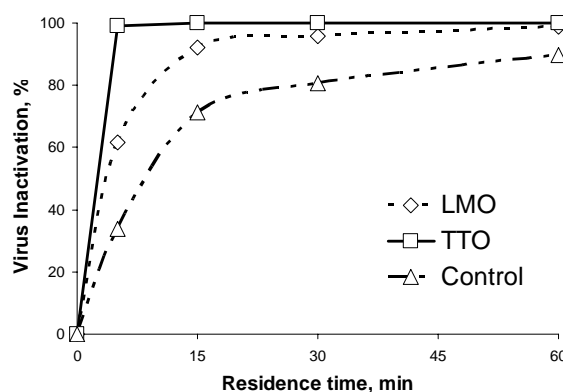
As discussed in our previous publications (Pyankov et al., 2008), although filtration remains the most efficient method of removal of airborne particles, some issues related to possible re-entrainment of captured particles from the rear face of the filter back into the carrier gas need to be addressed. Obviously, viable biological particles blown off from the filter surface could still cause substantial damage to human and animal health and contaminate the ambient environment. We suggested a new technology utilizing coating of filter fibres by biologically active tea tree oil (TTO). It was found (Pyankov et al., 2008) that pre-wetting the filter fibres with TTO, prior to its usage for bacterial aerosol control, could provide significant benefits in terms of rapid inactivation of captured microorganisms, thereby minimizing the number of live/viable particles which could be reentrained from the filter by the air.

In this project we investigate some performance characteristics of TTO for control of viable airborne viruses, using the H11N9 non-pathogenic (to humans) Influenza strain. Two strategies are suggested:

1. Using TTO to coat the filter fibres, followed by their utilization for the control of viral particles. In this case, the removal efficiency of the filter would not be significantly enhanced, due to the very small alteration of the filter properties by a thin TTO film/droplets. However, such a system would inactivate collected particles, thereby minimizing/eliminating any risk of re-entrainment to the gas carrier. The experiments were performed according to the procedure described in detail in (Pyankov et al., 2008). In brief, four TTO coated filters were installed in parallel in a special holder and used for the removal of concentrated airborne viral particles, generated using a Collision nebulizer over a 1 min period. Then, one of the filters was immediately placed into 50 ml vessel containing sterile water, to wash all collected viral particles from the filter surface and eliminate any further action of the TTO to inactivate the captured virions. The second filter was placed into the similar water container 5 minutes after the first one, then the third and fourth at 30 and 60 minutes respectively. All liquids were then analyzed by plaque assay to enumerate viable particles remaining on the filter after the above time periods. Biologically neutral light mineral oil (LMO) was used for control

purposes *i.e.*, the above experimental program was identically repeated for LMO coated fibrous filter.

2. A second method of utilizing the TTO was to add TTO mist to the H11N9 contaminated air, to evaluate microbial inactivation in the natural ambient air environment. To perform the experiments, viral particles were generated using a Collision nebulizer and fed into a rotating aerosol chamber (~200 liters) capable of holding submicron particles in airborne form for up to 6-8 hours with low settling losses. A sample of the air was extracted by a personal bioaerosol sampler (Agranovski et al., 2005), at 5, 15, 30 and 60 minute intervals after commencement of the experiment. These samples were then analyzed by viral assay. LMO was again used as a control case. Additionally, the natural inactivation of H11N9 in air was examined with no oil aerosol present. The results of the natural inactivation of H11N9 in the rotating aerosol chamber are presented in the figure.



As can be seen, almost 100% of the viral particles were inactivated 5 minutes after the discharge of TTO into the chamber. Inactivation was much less rapid with LMO and slower still for the control experiments. Without oil aerosol, some viable particles remained after 60 minutes duration. Similar results were obtained for fibre coating experiments when almost all viral particles were inactivated within the first 5 minutes (for TTO). The efficiency was much lower for LMO, which was not significantly distinctive from the “no oil” case.

Pyankov, O., et al. (2008). *CLEAN, (Special Bioaerosol Issue)*, **36(7)**, 609-614

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