



ANTI-VIRAL (SWINE FLU) EFFECTIVENESS OF *TEA TREE LIQUIDION* FORMULATIONS

Introduction

Atrium Innovation Ltd's *LiquidIon*[™] droplets have a proven effect in interacting with airborne particles and helping to remove them from the air. Where a *LiquidIon* combines with an airborne droplet containing germs such as bacteria and viruses, a payload of active ingredients could eliminate the germs and neutralize the droplet. This is particularly important at times when there is a greater risk of spread of harmful germs such as swine 'flu H1N1.

Atrium Innovation Ltd is developing a system for whole room sanitization. The virus-inactivating properties of its new *Tea Tree* formulation have been shown to produce a 99.99% reduction of the influenza A virus H1N1.

Quantitative suspension assays following EN 14476:2007-02 were used to assess the ability of Atrium's new formulations (which can be dispensed using its *Aerstream*[™] technology) to inactivate this harmful virus.

Results

Undiluted test formulation was able to inactivate influenza A virus H1N1 (swine) after five minutes in the quantitative suspension test. At that time point, none of the virus was detectable. The reduction factors were ≥ 3.25 and ≥ 3.25 .

Using column measurement, a reduction of four log₁₀ steps ($\geq 99.99\%$ reduction) was determined after five minutes, with a reduction factor of 4.75.

Conclusions

Atrium Innovation's new *LiquidIon Tea Tree* formulation, which is suitable for treating the air from its *Cleanaer*[™] devices, was able to achieve a 99.99% reduction in swine flu virus on contact.

When used undiluted as intended to treat a room, each *Tea Tree LiquidIon* can help neutralize the virus load of an airborne droplet and reduce sneeze germs in the air within 5 minutes of coming into contact with them.

Experimental information

Atrium Innovation Ltd *Tea Tree* formulation tested following EN 14476:2007-02 against influenza A virus H1N1 (sw/Greven/IDT2889/2004 H1N1 from Institute of Virology at the School of Veterinary Medicine Hannover (Tierärztliche Hochschule, D-30559 Hannover)) as surrogate of the pandemic strain influenza A virus /California/04/2009 H1N1) in *MDCK cell* culture at MikroLab GmbH, Bremen.





AIRBORNE PARTICLE CLEARANCE USING *LiquidIons*

Introduction

Airborne pollutants including dust, dander and allergens can reduce air quality and can contribute to respiratory-related problems.

Atrium Innovation Ltd is developing a system for whole room cleaning. Using its *Aerstream*TM technology to produce specialized long-lifetime droplets, it has been possible to demonstrate a fast action effect in increasing the rate of removal of particles from the air.

These trials examined the rates at which a dose of contaminant particles were removed from the air with and without the *Aerstream* technology.

Ultra-violet aerodynamic particle sizing (UV-APS) methodology was used to distinguish between the *Aerstream*-generated partially-charged droplets (*LiquidIons*TM) and nebulized latex spheres. The *LiquidIons* were fluorescently-labelled in order to differentiate them from the latex contaminants.

Results

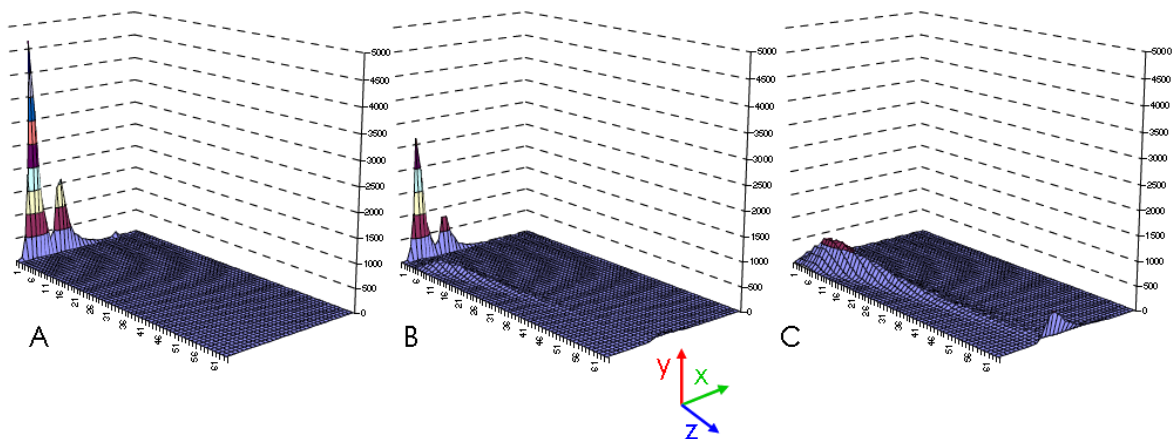


Figure 1 UV-APS fluorescence correlation data (y-axis particle counts; x-axis aerodynamic particle size; z-axis relative fluorescence) showing (A) initial latex challenge, (B) latex challenge + *LiquidIon* treatment (+2 hrs), and (C) *LiquidIon* treatment alone (+2hrs).

Using UV-APS, it was possible to distinguish between latex challenge and *LiquidIon* particle populations (**Figure 1**). The *Aerstream* technology-produced *LiquidIons* shortened the airborne half-life of the latex challenge to 2hrs, compared with 4hrs in the untreated condition where the latex challenge was allowed to precipitate under gravity alone.

When the duty cycle of the *Cleanaer*TM dispensing devices was increased (to 82%), the half-life of the latex was reduced to a third of its untreated time.

Conclusions

Atrium Innovation's *Aerstream*-technology delivering *LiquidIons* from its *Cleanaer* devices was able to accelerate the removal of airborne contaminants from the air.

The technology, which forms part of a whole room sanitization system, more than doubled the rate of air clearance compared to the untreated control.

Experimental information

Two *Cleanaer* devices using *Aerstream* technology activated (29% duty cycle unless otherwise stated) in a 45 m³ test chamber containing a latex nebuliser (sphere diameters: 0.6, 1.0 and 3.0 µm) and UV-APS (TSI UV-APS model 3314; sampling period 30s/1 min).





AIRBOURNE BACTERIAL LOAD SUPPRESSION USING *LiquidIons*

Introduction

The air we breathe can contain many forms of contaminants including bacteria. Micro-organisms such as these can be introduced into the air through sneezes or other aerosols, including sprays from washing down surfaces and cleaning floors.

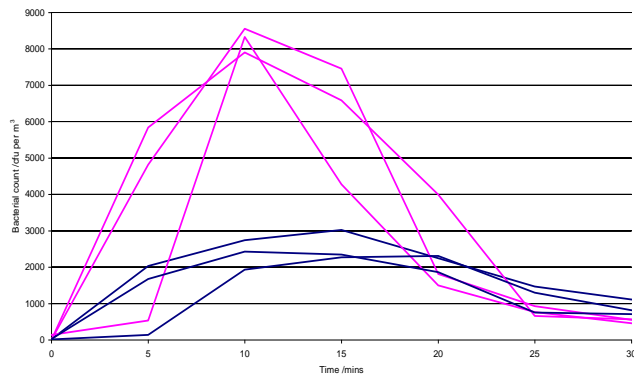
Atrium Innovation Ltd is developing a system for whole room cleaning. Using its *Aerstream*TM technology to produce specialized long-lifetime droplets (*LiquidIons*TM), it has been possible to demonstrate a suppression effect of the impact of introduced bacterial aerosols.

These trials, conducted at the Bradford Infection Group at Bradford University, UK, examined the amounts of bacteria (as colony forming units) that could be collected from the air after deliberately introducing an aerosol of *Staph. epidermis* then with and without the *Aerstream* technology being applied.

Bacterial sampling of the air was conducted over time using an Anderson impactor in conjunction with laser particle counting.

Results

A



B

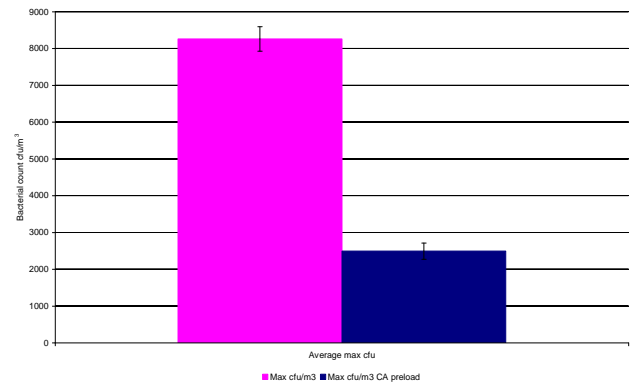


Figure 1 Anderson impactor results showing (A) variation of bacterial colonies (cfu/m³) with time (min) and (B) average maximum bacterial count (+/- SE). In both graphs, the untreated condition is shown in pink and the *LiquidIon*TM treatments are shown in blue.

Using Anderson impactor sampling of air deliberately loaded with a bacterial aerosol, it has been possible to observe a suppressive effect of *LiquidIons* on the ability for a bacterial challenge to contaminate the air (**Figure 1**).

When the air in the test chamber had been treated to a steady-state level of *LiquidIons*, the amount of bacteria that could be sampled from the air was significantly reduced.

On average, 70% of the average maximum load was suppressed by treatment with the *Aerstream* technology compared to the untreated control.

Conclusions

By treating the air in a room using Atrium Innovation's *Aerstream* technology to deliver *LiquidIons* from its *Cleanaer* devices, it was possible to suppress and reduce the effects of sudden introductions of bacterial aerosols into the room space.

The technology, which forms part of a whole room sanitization system, reduced the bacterial challenge to 30% of its untreated level. With the inclusion of an anti-microbial active ingredient into the *LiquidIons* formulation, the effect on bacteria could be even greater.

Experimental details

Two *Cleanaer* devices using *Aerstream* technology activated in a 80 m³ test chamber containing a bacterial nebulizer, Anderson impactor (sampling period 3 min/5min), and laser particle counter (Kanomax GEO-5a). Clean room condition determined when airborne particle counts <300 counts per liter air sampled; steady-state *LiquidIons* condition taken as 20k counts per liter air sampled; bacterial nebulization permitted for 15 minutes prior to impactor sampling.

