Antimicrobial Efficacy Testing of the HINS-light Environmental Decontamination Systems

References:

McKenzie, 2014. ***'Inactivation of Foodborne Pathogenic and Spoilage Microorganisms by 405 nm Light: An Investigation into Potential Decontamination Applications';*** **PhD Thesis, University of Strathclyde.**

Bache, 2013. ***'Clinical Evaluation of the HINS-light EDS for the Continuous light based Decontamination of the Burns Unit Inpatient and Outpatient Settings'*****, PhD Thesis, University of Strathclyde.**

PURPOSE:

To evaluate the antimicrobial efficacy of HINS-light Environmental Decontamination Systems (EDS). Antimicrobial testing was conducted by exposing surfaces, which had been seeded with microbial contamination, to increasing durations of HINS-light EDS treatment, in order to generate inactivation kinetics for a range of key bacterial pathogens.

METHODOLOGY:

Culture and Preparation of Bacteria

- Bacteria were cultured in liquid growth medium at 37°C for 18-hours under rotary conditions (120 rpm).
- Bacterial cultures were centrifuged at 4300 rpm (3939×g) for 10-minutes, and the cell pellet re-suspended in phosphate buffered saline (PBS), before serial dilution to a population density of 103 CFU ml-1 for experimental use.
- Samples were spread plated on to agar plates to provide a quantifiable starting population of approximately 100-300 CFU per plate for each microorganism.

Light Exposure of Seeded Surfaces

- For exposure of bacterial seeded plates, plates were positioned below the light source at a distance of ~1.5m and an irradiance of 0.5 (±0.03) mWcm-2.
- Seeded surfaces (with plate lids removed) were exposed to increasing durations of light treatment (n≥3). Identical control plates, left under normal laboratory lighting, were also set up.
- Post-exposure, plates were covered and incubated at 37°C for 18-24 hours.

Enumeration and Statistical Analysis

- Post-incubation, the viable bacterial colony-forming units (CFU) were enumerated, and results were reported as % reduction (CFU per plate), with the reduction at each exposure period being calculated from the % reduction of the treated versus the equivalent non-treated control.
- Data points in graphs represent mean (±SD), and statistically significant differences in contamination levels were calculated at the 95% confidence level using one-way ANOVA, MINITAB v15.

ALERA LIGHTING
ARCHITECTURAL AREA LIGHTING
BEACON PRODUCTS
COLUMBIA LIGHTING
COMPASS
DUAL-LITE
HUBBELL CONTROL SOLUTIONS
HUBBELL INDUSTRIAL LIGHTING
HUBBELL OUTDOOR LIGHTING
KIM LIGHTING
KURT VERSEN
LITECONTROL
PRESCOLITE

RESULTS:

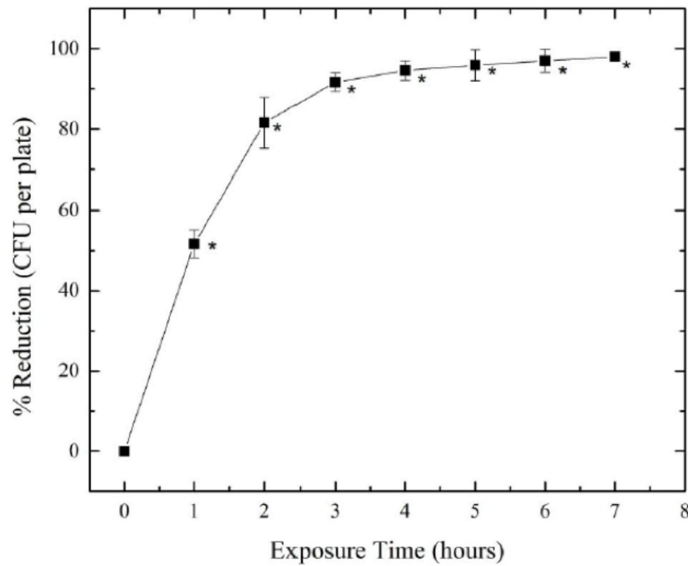

Fig 1: Inactivation of Staphylococcus aureus contamination, on agar surfaces, upon exposure to ~0.5 mWcm-2 HINS-light. * represents significant bacterial inactivation when compared to the associated non-exposed control samples (P≤0.05). [McKenzie, 2014: Figure 4.13]

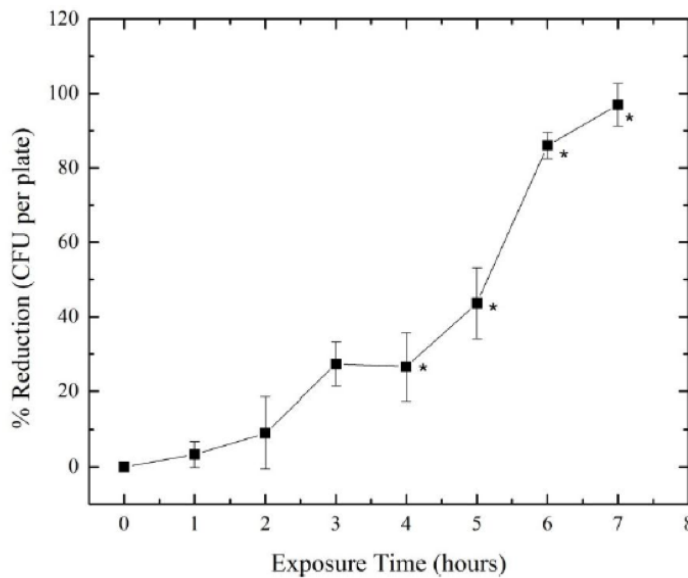

Fig 2: Inactivation of Listeria monocytogenes contamination, on agar surfaces, upon exposure to ~0.5 mWcm-2 HINS-light. * represents significant bacterial inactivation when compared to the associated non-exposed control samples (P≤0.05). [McKenzie, 2014: Figure 4.14]

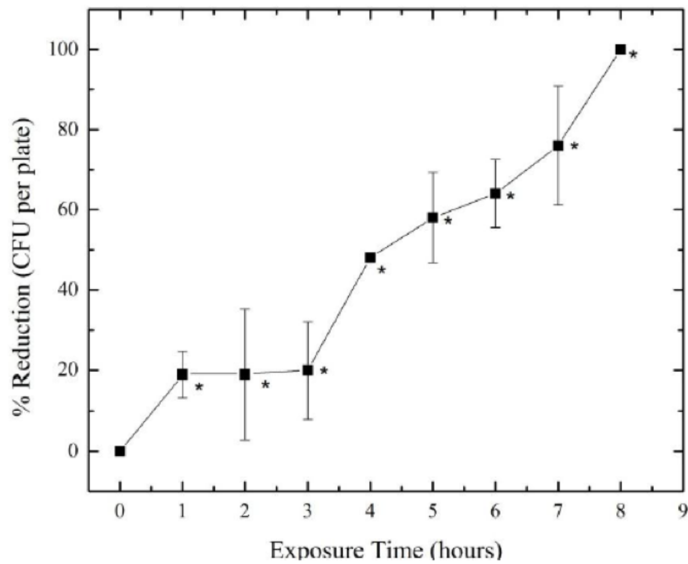

Fig 3: Inactivation of Escherichia coli contamination, on agar surfaces, upon exposure to ~0.5 mWcm-2 HINS-light. * represents significant bacterial inactivation when compared to the associated non-exposed control samples (P≤0.05). [McKenzie, 2014: Figure 4.15]

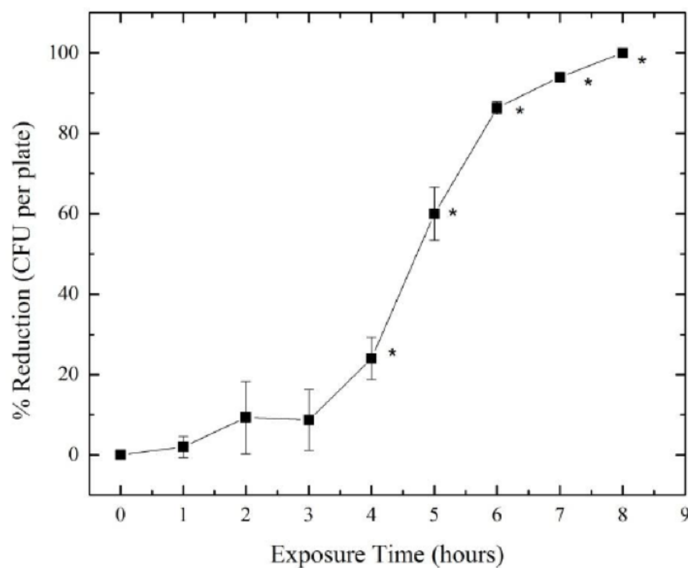

Fig 4: Inactivation of Shigella sonnei contamination, on agar surfaces, upon exposure to ~0.5 mWcm-2 HINS-light. * represents significant bacterial inactivation when compared to the associated non-exposed control samples (P≤0.05). [McKenzie, 2014: Figure 4.16]

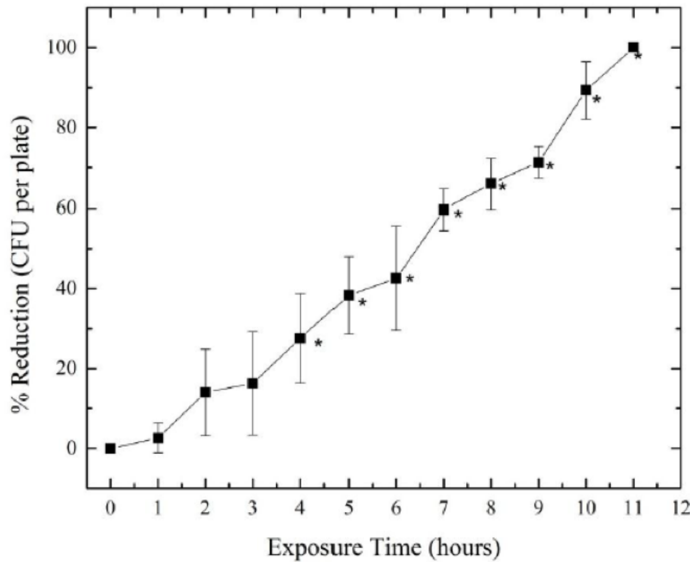

Fig 5: Inactivation of Salmonella enteritidis contamination, on agar surfaces, upon exposure to ~0.5 mWcm-2 HINS-light. * represents significant bacterial inactivation when compared to the associated non-exposed control samples (P≤0.05). [McKenzie, 2014: Figure 4.17]

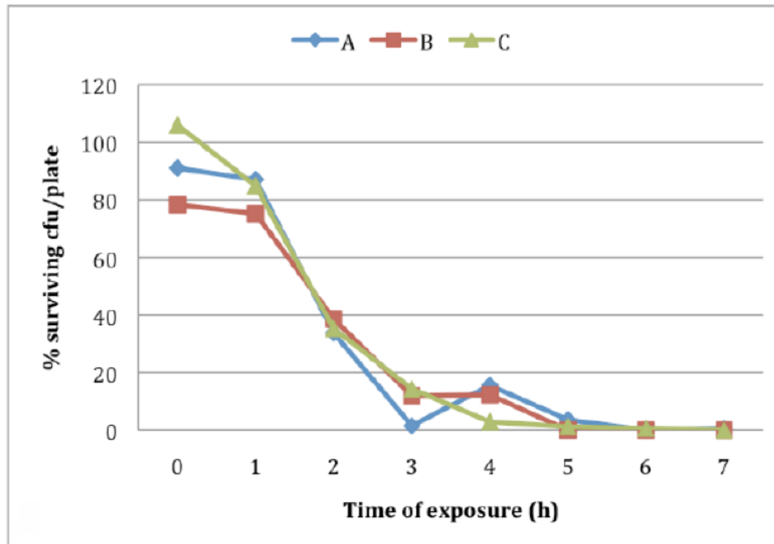

Fig 6: Inactivation of methicillin-resistant Staphylococcus aureus contamination, on agar surfaces, upon exposure to ~0.5 mWcm-2 HINS-light. Statistical analysis using a one-way ANOVA (95% CI) demonstrated that a significant difference between exposed and non-exposed control samples was achieved at 1 h (P=0.008). n=3 (A, B, C) [Bache, 2013: Figure 4.6]