Decontamination of Select Agents on Smart Cards in a High Containment Laboratory

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Abstract
Validated procedures for decontamination of laboratory surfaces and equipment are essential to biosafety and bioprocess programs at high containment laboratories (HCLs). Each HCL contains a unique combination of surfaces, procedures, and specific requirements that decontamination methods need to support specific facility practices. The Plum Island Animal Disease Center (PIADC) is an HCL operating multiple biosafety levels (BSL-3, ABSL-3 and BSL-3 Ag spaces). The PIADC facility requires the use of federalally issued smart cards, called Personal Identification Verification (PIV) cards, to access IT networks both outside of and within the HCL. Because PIV cards may require transit from the BSL-3 to office spaces, a validated procedure for disinfecting PIV card surfaces prior to removal from the HCL is critical to ensure biosafety and biosecurity. Two high risk select agents used in the PIADC HCL are Foot-and-Mouth Disease Virus (FMDV) and Swine Vesicular Disease Virus (SVDV). We evaluated disinfection of PIV cards intentionally spotted with FMDV and SVDV using a modified quantitative carrier test and the liquid chemical disinfectant Virkon® S. Our experimental design modeled a worst case scenario of PIV card contamination and disinfection by combining high concentrations of virus dried with an organic soil load and the use of aged Virkon® S. Our disinfection protocol effectively inactivated viruses on contaminated smart cards at short contact times.

Study Goal
Evaluate the ability of 1% Virkon® S to disinfect PIV card surfaces intentionally spotted with high concentrations of both FMDV and SVDV under practical conditions and contact times.

Background
• PIV cards needed to access IT systems within biocountermeasure areas

Federal Select Agent Program Guidelines: require that inactivation procedures must be validated based on “in-house” testing protocols and supported by efficacy data produced by the specific bloom

Biosafety Practices
Agents of Concern

Small non-enveloped +ssRNA picornaviruses are highly resistant to disinfection. Risk Assessment deemed these most critical to validate inactivation procedures for.

Experimental Design
Viruses tested:
• Foot and Mouth Disease Virus (FMDV) strain A24/Cruzeiro/BRA/55
• Swine Vesicular Disease Virus (SVDV) strain UKG 27/72

Test chemical: 1% Virkon® S prepared in hard water and aged 5 days.

Treatment Groups:
• Experimental: 4 contact times tested: 1, 10, 30, 60 seconds (n=3 cards/group).
• Controls: Back Titration, Drying Control, Dipping Control (n=1 card/study).
• Replicates: Two independent rounds of testing with each virus.

Methods
• Virus suspensions prepared with a soil load and inoculated onto PIV cards (50uL X 2 locations) and dried in the biosafety cabinet 1.5 hours.
• Each card was exposed to 1% Virkon® S for the required contact time and then rinsed in H2O for ~1 sec.
• Cards were placed in sterile plastic boxes with 10mL growth media (neutralizer) and shaken for 10 min on an orbital shaker.
• Eluates were serially diluted and plated on either LFBK (FMDV) or MVPK (SVDV) cells.
• Titers of infectious virus were made by TCID50 determination based on cell cytopathic effects.
• Negative supernatants were blind passaged 2X (study 2)

Results
Recovery of Infectious Virus After Exposure to 1% Virkon® S (Log10 TCID50/mL)

<table>
<thead>
<tr>
<th>Exposure Time</th>
<th>FMDV</th>
<th>SVDV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Second</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 1 Replicates</td>
<td>6.2</td>
<td>7.1</td>
</tr>
<tr>
<td>Study 2 Replicates</td>
<td>6.7</td>
<td>7.5</td>
</tr>
<tr>
<td>10 Seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 1 Replicates</td>
<td>3.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Study 2 Replicates</td>
<td>3.2</td>
<td>2.9</td>
</tr>
<tr>
<td>30 Seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 1 Replicates</td>
<td>2.7</td>
<td>1.0</td>
</tr>
<tr>
<td>Study 2 Replicates</td>
<td>2.7</td>
<td>1.0</td>
</tr>
<tr>
<td>60 Seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Study 1 Replicates</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Study 2 Replicates</td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Conclusions
• High concentrations of FMDV and SVDV select agent viruses dried on the surface of smart cards could be effectively decontaminated after being immersed in a 1% solution of aged Virkon® S for at least 30 seconds.

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