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The Virucidal Efficacy of A Spray & Wipe Microbicide on Hard Non-porous Surfaces

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Abstract

Microbial contamination of inanimate surfaces is a serious public health risk. Contamination and cross-contamination result from the everyday deposit of virus-containing organic soil, including fingerprints and body fluids. Conventional disinfectants require pre-cleaning of surfaces followed by application/flooding of microbicides for specific organism-dependent time periods. Unelko Corporation, Scottsdale, AZ has introduced their newly-patented microbicidal agent, marketed as Sani-Shield, that does not require any pre-cleaning and which simultaneously forms a water, soil and microbe repellent barrier coating. The objective of this study was to evaluate the virucidal efficacy of the spray and wipe Sani-Shield for the control of viruses on surfaces. Poliovirus type 1 (PV1), Hepatitis A virus (HAV) and Murine Norovirus (MNV) were propagated using BGM, FRhK-4 and RAW cell lines, respectively. Specified numbers of viruses were deposited on sterilized glass slides in petri dishes and air dried at room temperature. The test product was sprayed on the dried viral films and the slide was wiped dry. The now-cleaned and coated treated surface was flooded with buffer and was sealed before vortexing. To ensure that the viruses were actually inactivated instead of just transferred from the surface onto the wipes, each wipe was also eluted to recover viruses for testing. The eluted/recovered viruses were analyzed using plaque assay for poliovirus and $TCID_{50}$ for MNV and HAV. The percent inactivation, respectively, on wipes and surfaces was 99.98% and 99.99% for MNV, 99.99% and 99.99% for HAV and 99.97% and 99.99% for PV1. The data proves the efficacy of the Sani-Shield technology for the inactivation of a broad range of viruses on surfaces using efficient 1-step spray and wipe procedures.

Introduction

The U.S. Environmental Protection Agency (EPA) requires that a specific virucidal claim for a product intended for use on hard surfaces be supported by appropriate scientific data demonstrating the efficacy of the test substance against the claimed virus. The agency accepts adequate data generated by any appropriate technique in support of a virucidal efficacy claim. This is accomplished by treating the target virus with the test substance under conditions, which simulate as closely as possible, in the laboratory, the actual conditions under which the product is designed to be used. Currently, EPA has no protocol for testing spray & wipe products intended for use on hard surfaces.

STUDY OBJECTIVE: To study the virucidal efficacy of Sani-Shield spray and wipe microbicide formulation on hard surface.

Materials and Methods

Test Virus and Cell Lines

Hepatitis A Virus, HM-175 strain (ATCC VR-2093), *Murine Norovirus*, and *Poliovirus*, Type 1, Chat strain (ATCC VR-192). Cell lines for viral culture: Fetal Kidney Rhesus Monkey FRhK-4, Mice Macrophages RAW 264.7, and Monkey Kidney Cells BGM.

Preparation of Test Material

For all three test viruses tested at appropriate concentration; an aliquot of 0.2 mL of stock virus was spread, with the cell scraper, over glass surface and allowed to dry at room temperature. After the carrier preparation, 2 mL of test product (Sani-Shield RTU 25) was sprayed on the inoculated test surface. The test surface was then wiped with Kimwipes for at least 30 seconds until the surface was completely dry.

Recovery of Test Viruses

The viruses remaining on the glass surface and in wipes were recovered by vortexing the surface and the wipe in Tris Buffer. Serial ten-fold dilutions of viruses recovered from surface and the wipe were assayed in cell culture system.

Calculations

Cultural assays used to calculate the number of infectious viruses in each sample. The $TCID_{50}$ was calculated using Karber equation.

Controls

Experimental design included inoculated non-treated surfaces. The controls were prepared as described previously for spray & wipe operation. In addition, positive and cytotoxicity controls were included in all the assays.

Table 1: Summary of virus inactivation by Sani-Shield RTU 25 using a spray & wipe dry procedure

Test Organism	Percent inactivation (log_{10} reduction)			
	Repeat #1		Repeat # 2	
	Wipe	Surface	Wipe	Surface
Hepatitis A Virus	99.992 (4.18)	99.996 (4.64)	99.992 (4.18)	99.998 (4.80)
Murine Norovirus	99.985 (3.84)	99.994 (4.21)	99.974 (3.59)	99.997 (4.47)
Poliovirus type1	99.976 (3.61)	99.998 (4.61)	99.966 (3.47)	99.988 (3.92)

Results and Discussion

Table 2: Procedural recovery efficiency of virus after spray & wipe dry procedure of Sani-Shield RTU 25

	Influent (PFU)	Wipe (PFU)	Recovered (%)	Not Recovered (%)
Wipe	900,000	490,000	54.4	46
Surface	900,000	31,000	3.4	97

Results of virucidal efficacy of Sani-Shield and procedural recovery efficiency are presented in Tables 1 & 2. The viral recovery and analysis methods used in this study resulted in greater than 54% recovery efficiency. Application of RTU 25 of test formulation consistently resulted in greater than 3 log_{10} of the all three test viruses. Spray and wipe operation of Sani-shield on surfaces resulted in more than 4 log inactivation of murine norovirus and hepatitis A. According to the US EPA, the test formulation passes the virucidal effectiveness test if it results in four log reduction in the titer of the challenge viruses. The results indicates that product meets the USEPA criteria for registration as virucidal agent.

Conclusions

- ✓ Sani-Shield RTU 25 passed the EPA's test for virucidal effectiveness when surfaces inoculated with, hepatitis A virus, murine norovirus and poliovirus type 1 containing 5% organic loads were sprayed with Sani-Shield and were wiped for at least 30 seconds until the surface was completely dry.
- ✓ The wipes employed to dry the surface were also more than 99.9% free of infectious virus; proving that the surface inoculums were inactivated and not merely transferred from the surface to the wipes.

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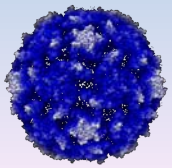
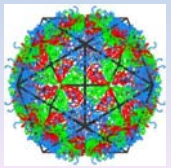
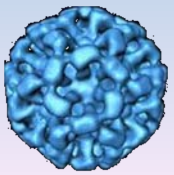
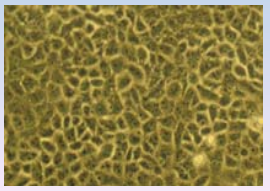






non- infected cells



infected cells