Test Report: BS EN 14476:2013 + A2:2019 Chemical disinfectants and antiseptics – Quantitative suspension test for the evaluation of virucidal activity in the medical area- Test method and requirements (Phase 2/Step 1)

Test Laboratory	**BluTest Laboratories Ltd** 5 Robroyston Oval, Nova Business Park, Glasgow, G33 1AP

Identification of sample

Name of the product	WHO01
Batch number	B00951
Client	SMC Cosmetics UK Limited
Client Address	Unit 2 Inverbreakie Steading, Inverbreakie Industrial Estate, Invergordon, IV18 0LP
Project Code	BT-SMC-01-02
Date of Delivery	23 April 2020
Storage conditions	Ambient
Active substances	Not supplied
Appearance	Liquid
Condition upon receipt	Undamaged

Test Method and its validation

Method	1 part interfering substance + 1 part virus suspension + 8 parts biocide were mixed and incubated at the indicated contact temperature for the indicated contact times. Assays were validated by a cytotoxicity control, interference control, neutralisation control and a formaldehyde internal standard.
Neutralisation	Dilution-neutralisation/gel filtration Eagles Minimum Essential Medium + 5.0% v/v foetal bovine serum at 4°C

Experimental Conditions

Period of analysis	18 May 2020 to 22 May 2020
Product diluents used	Sterile distilled water
Product test concentrations	10.0% v/v; 50.0% v/v; 80.0% v/v
Appearance product dilutions	No changes noted- stable
Appearance in test mixture	Turbidity and sedimentation observed at 80.0% v/v
Contact times (minutes)	2 ± 10s
Test temperature	20°C ± 1°C
Interfering substances	3.0 g/l bovine albumin + 3.0 ml/l erythrocytes
Temperature of incubation	37°C ± 1°C + 5% CO_2
Identification and passage (P) of virus	***Vaccinia virus* VR-1549 Elstree strain (P6)**
Identification and passage (P) of cells	Vero Cells (P 16) (*Vaccinia Virus*)

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PROTOCOL SUMMARY

The basic virucidal efficacy test is set up with three concentrations of test product solution and a 2-minute contact time. Virus is exposed to disinfectant in 24-well plates, then neutralised, serially diluted and virus titred in 96-well tissue culture plates to determine the tissue culture infectious dose$_{50}$ ($TCID_{50}$) of surviving virus. *Vaccinia virus* VR-1549 Elstree strain / Vero cells are assayed in parallel in each test. $TCID_{50}$ is determined by the method of Karber[1].

Cytotoxicity control
The test product solution is measured for its effects on the host cells used to propagate the virus, to determine the sensitivity of the assay.

Interference control
The effect of the cells after treatment of the test product solution are verified to ensure the cells can show susceptibility for virus infection. This is compared against cells that have not been treated with test product.

Disinfectant suppression control VS1
Virus is added to the highest concentration of test product solution and then the mixture immediately removed and neutralised. The neutralised virus titre is then determined to assess the efficiency of the neutralisation procedure.

Disinfectant suppression control VS2
Internal control which adds virus to neutralised test product solution to assess the efficiency of the neutralisation procedure.

No column Control
Internal control on the highest contact time to assess any impact of the Microspin™ S 400 HR columns.

Virus recovery control
Virus titre is determined for virus in contact with sterile distilled water at t=0, t = 2 and at t =15. The virus titre after 2 minutes is then compared to the recovery of disinfectant-treated virus to measure the log reduction in virus titre. The virus titre at 15 minutes is compared to the reference virus inactivation control.

Reference virus inactivation control
Virus is exposed to 0.7% W/V formaldehyde and the recovery of virus determined by $TCID_{50}$ after 5 and 15 minutes, in order to assess that the test virus has retained reproducible biocide resistance. In addition, the formaldehyde cytotoxicity of neutralised formaldehyde is determined, to measure assay sensitivity.

1Kärber, G.: Beitrag zur Kollektiven Behandlung Pharmakologischer Reihenversuche. Arch. Exp. Path. Pharmak. 162 (1931): 480-487.

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Vaccinia virus (VR-1549) Elstree strain Test Results

EN14476:2013 + A2:2019 Suspension test for the efficacy of WHO01, BT-SMC-01-02 from SMC Cosmetics UK Limited against Vaccinia virus VR-1549 under DIRTY conditions						
Test Results						
Concentration	**10.0% (v/v)**		**50.0% (v/v)**		**80.0% (v/v)**	
Exposure Time	data	$TCID_{50}$/ml	data	$TCID_{50}$/ml	data	$TCID_{50}$/ml
t = 2 minutes	4.33	**6.81E+05**	3.83	**2.15E+05**	0.83	**2.15E+02**
Raw Data	666620	**6.81E+05**	666410	**2.15E+05**	410000	**2.15E+02**
log		**5.83**		**5.33**		**2.33**
log difference		**0.67**		**1.17**		**4.17**

EN14476:2013 + A2:2019 Suspension test for the efficacy of WHO01, BT-SMC-01-02 from SMC Cosmetics UK Limited against Vaccinia virus VR-1549 under DIRTY conditions									
Summary Table									
Product:	Interfering substance	Concentration	Level of cytotoxicity	lg $TCID_{50}$					>4 lg reduction after 'X' Min
				0 min	2 min	15 min	30 min	60 min	
WHO01	3.0g/l BSA + 3.0ml/l erythrocytes	80.0% (v/v)	1.50	5.67	2.33	n.a.	n.a.	n.a.	<2 mins
		50.0% (v/v)	1.50	n.a.	5.33	n.a.	n.a.	n.a.	>2 mins
		10.0% (v/v)	1.50	n.a.	5.83	n.a.	n.a.	n.a.	>2 mins
WHO01	3.0g/l BSA	80.0% (v/v)	1.50	n.a.	3.33	n.a.	n.a.	n.a.	>2 mins
		50.0% (v/v)	1.50	n.a.	5.50	n.a.	n.a.	n.a.	>2 mins
		10.0% (v/v)	1.50	n.a.	5.50	n.a.	n.a.	n.a.	>2 mins
Virus Control	DIRTY			6.17	6.50	6.33	n.a.	n.a.	n.a.
Virus Control	CLEAN			6.17	6.00	6.00	n.a.	n.a.	n.a.
							5 min	15 min	
Formaldehyde	PBS	0.7% (w/v)	0.00				4.50	3.50	>15 mins

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Vaccinia virus (VR-1549) Elstree strain Control Data

EN14476:2013 + A2:2019 Suspension test for the efficacy of WHO01, BT-SMC-01-02 from SMC Cosmetics UK Limited against Vaccinia virus VR-1549 under DIRTY conditions

Controls

Virus Recovery 0 min		Virus Recovery 2 min		Virus Recovery 15 min		Cytotoxicity		Disinfectant Suppression VS		Disinfectant Suppression VS2	
raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml
4.67	**1.47E+06**	5.00	**3.16E+06**	4.83	**2.15E+06**	0.00	**3.16E+01**	4.17	**4.64E+05**	4.50	**1.00E+06**
666640	**1.47E+06**	666651	**3.16E+06**	666650	**2.15E+06**	000000	**3.16E+01**	666610	**4.64E+05**	666630	**1.00E+06**
	6.17		**6.50**		**6.33**		**1.50**		**5.67**		**6.00**
									0.83		**0.50**

Formaldehyde reference inactivation controls

Cytotoxicity		Exposure time	0.7% Formaldehyde			
			5 mins		15 mins	
raw data	$TCID_{50}$/ml		raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml
2.00	**3.16E+03**		3.00	**3.16E+04**	2.00	**3.16E+03**
660000	**3.16E+03**		666000	**3.16E+04**	660000	**3.16E+03**
	3.50	log		**4.50**		**3.50**
		log difference		**1.83**		**2.83**

No column Control	
2 mins	
raw data	$TCID_{50}$/ml
4.50	**1.00E+06**
666630	**1.00E+06**
	6.00

Interference control	Virus dilution					
	-3	-4	-5	-6	-7	-8
PBS Control	1	1	1	0.5	0	0
	3.16E+02	3.16E+02	3.16E+02	1.00E+02	3.16E+01	3.16E+01
	2.50	**2.50**	**2.50**	**2.00**	**1.50**	**1.50**
Raw Data	**6**	**6**	**6**	**3**	**0**	**0**
Product	1	1	1	0.83	0	0
	3.16E+02	3.16E+02	3.16E+02	2.14E+02	3.16E+01	3.16E+01
	2.50	**2.50**	**2.50**	**2.33**	**1.50**	**1.50**
Raw Data	**6**	**6**	**6**	**5**	**0**	**0**
Log Difference	**0.00**	**0.00**	**0.00**	**-0.33**	**0.00**	**0.00**
Product Cyt Dilution	-1	-1	-1	-1	-1	-1
PBS Dilution	Neat	Neat	Neat	Neat	Neat	Neat

Stock Virus ($TCID_{50}$)
5.83
2.14E+07
6666650

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Vaccinia virus (VR-1549) Elstree strain Control Data

Parallel Control Test												
Controls						Test Results						
Virus Recovery 0 min		Virus Recovery 2 min		Virus Recovery 15 min		Concentration	10.0% (v/v)		50.0% (v/v)		80.0% (v/v)	
raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml	raw data	$TCID_{50}$/ml	**Exposure Time**	data	$TCID_{50}$/ml	data	$TCID_{50}$/ml	data	$TCID_{50}$/ml
4.67	**1.47E+06**	4.50	**1.00E+06**	4.50	**1.00E+06**	**t = 2 minutes**	4.00	**3.16E+05**	4.00	**3.16E+05**	1.83	**2.15E+03**
666640	**1.47E+06**	666630	**1.00E+06**	666630	**1.00E+06**	Raw data	666600	**3.16E+05**	666600	**3.16E+05**	632000	**2.15E+03**
	6.17		**6.00**		**6.00**	log		**5.50**		**5.50**		**3.33**
						log difference		**0.50**		**0.50**		**2.67**

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CONCLUSION

Verification of the methodology

A test is only valid if the following criteria are fulfilled:

a) The titre of the test suspension of at least 10^8 TCID50 /ml is sufficiently high to at least enable a titre reduction of 4 lg to verify the method.

b) Detectable titre reduction is at least 4 $\log_{10}$.

c) Difference of the logarithmic titre of the virus control minus the logarithmic titre of the test virus in the reference inactivation test is between:
   - Between 0.75 and 3.5 after 5 min and between 2.0 and 4.0 after 15 min for Vaccinia virus

d) Cytotoxicity of the product solution does not affect cell morphology and growth or susceptibility for the test virus in the dilutions of the test mixtures which are necessary to demonstrate a 4 $\log_{10}$ reduction of the virus.

e) The interference control result does not show a difference of < 1.0 $\log_{10}$ of virus titre for test product treated cells in comparison to the non-treated cells.

f) Neutralisation validation. This is called the disinfectant suppression test in this protocol. The disinfectant was neutralised by column chromatography through an Illustra Microspin S-400 HR column to achieve the best possible neutralisation available for this test. The difference for virus is greater than 0.5 $\log_{10}$ indicating rapid irreversible virucidal activity of the disinfectant by dilution at a concentration of 80.0% v/v for VS1. This neutralisation validation has been verified by VS2, which shows the product has been successfully neutralised.

According to EN 14476:2013 + A2:2019, **WHO01 POSSESSES VIRUCIDAL** activity at a concentration of **80.0% v/v** of the working concentration as tested after **2 MINUTES** at **20°C** under **DIRTY** conditions (3.0 g/l bovine albumin + 3.0 ml/l erythrocytes) against *Vaccinia virus* VR-1549 Elstree strain / Vero cells.

This product therefore is effective against all enveloped viruses as defined in EN 14476:2013 + A2:2019 Annex A*. This therefore includes all coronaviruses and SARS-CoV-2.

Authorised signatory

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Glasgow, UK
Date: 22 May 2020

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*EN 14476 2013 + A2 2019 Annex A (informative – Enveloped viruses)

Poxviridae
Herpesviridae
Filoviridae (e.g. Ebola, Marburg)
Flavivirus
Hepatitis C Virus (HCV)
Hepatitis Delta Virus (HDV)
Influenza Virus
Paramyxoviridae
Rubella Virus
Measles Virus
Rabies Virus
Coronavirus (e.g. SARS, MERS)
Human Immunodeficiency Virus (HIV)
Human T Cell Leukemia Virus (HTLV)
Hepatitis B virus (HBV)

Reference: Van Regenmortel MHV et al.,Eds.: Virus Taxonomy, Classification and Nomenclature of Viruses, seventh report of the international committee on taxonomy of viruses. Academic Press, San Diego, 2000

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