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Test report L17/0666dM.1

Evaluation of the effectiveness of Chemisept GEL

Test virus: murine norovirus (as surrogate of human norovirus)

Method: EN 14476:2013+A1:2015 (clean conditions)

quantitative suspension test for the evaluation
of virucidal activity of chemical disinfectants and
antiseptics used in human medicine

Sponsor:
Chemi-Pharm AS
Pollu 132
EST – TALLINN 10917

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1. Identification of test laboratory

Dr. Brill + Partner GmbH Institute for Hygiene and Microbiology, Norderoog 2, DE - 28259 Bremen

2. Identification of sample

Manufacturer	Chemi-Pharm AS
Name of product	Chemisept GEL
Confirmation no.	203905
Product diluent recommended by the manufacturer	-
Batch number	198251017
Application	hand disinfection
Production date	25/10/2017
Expiry date	25/10/2020
Active compound (s) (100 g)	72.5 g ethanol 7.5 g IPA
Appearance, odour	clear, colorless liquid product specific
pH-values	undiluted: 7.16 (20 °C)
Storage conditions	room temperature in the dark (area with restricted access)
Date of arrival in the laboratory	01/11/2017

3. Materials

3.1 Culture medium and reagents

- Dulbecco's Modified Eagle's Medium (DMEM, Biozym Scientific GmbH, catalogue no. 880006)
- Fetal calf serum (Thermo Fisher, article no. CH30160.02)
- 1.4 % formaldehyde solution (dilution of Roti®-Histofix 4 %, Carl Roth GmbH)
- Aqua bidest. (SG ultrapure water system, type Ultra Clear; serial no. 86996-1)
- PBS (Invitrogen, article no. 18912-014)
- BSA (Sigma-Aldrich-Chemie GmbH, article no. CA-2153).

3.2 Virus and cells

Murine norovirus (MNV) was obtained from PD. Dr. E. Schreier, Head of FG15 Molecular Epidemiology of Viral Pathogens at the Robert Koch-Institute (RKI) in Berlin. Prior to inactivation, MNV was passaged three times in *RAW 264.7 cells* (a macrophage-like, Abelson leukemia virus transformed cell line derived from BALB/c mice, ATCC TIB-71). *RAW 264.7 cells* were cultured with Dulbecco's Modified Eagle's Medium with 4.5 g/l glucose and fetal calf serum with low endotoxin. Furthermore, cells (passage 25) were inspected regularly for morphological alterations and for contamination by mycoplasmas. No morphological alterations of cells and no contamination by mycoplasmas could be detected.

3.3 Apparatus, glassware and small items of equipment

- CO₂ incubator, Nunc GmbH & Co. KG, model QWJ 350
- Agitator (Vortex Genie Mixer, type G 560E)
- pH measurement 315i (WTW, article no. 2A10-100)
- Centrifuge (Sigma-Aldrich-Chemie GmbH, type 113)
- Microscope (Olympus, type CK 30)
- Centrifuge 5804 R (Eppendorf AG)
- Water bath (JULABO, Julabo U 3)
- Adjustable and fixed-volume pipettes (Eppendorf AG)
- Polystyrol 96-well microtitre plate (Nunc GmbH & Co. KG, Wiesbaden)
- Cell culture flask (Nunc GmbH & Co. KG, Wiesbaden)
- Sealed test tubes (Sarstedt AG & Co., Nümbrecht).

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4. Experimental conditions

Test temperature	20 °C ± 1.0 °C
Concentration of test product	undiluted (80.0 %) and as 50.0 % and 10.0 % (demonstration of non-active range) solutions
Appearance of product dilutions	no precipitation
Contact times	30 and 60 seconds and 30 minutes
Interfering substance	0.3 g/l bovine serum albumin (clean conditions, EN 14476)
Procedure to stop action of disinfectant	immediate dilution
Diluent	water
Stability of product in the mix with virus and interfering substance (80.0 % solution)	medium clouding, no precipitation
Virus strain	murine norovirus (Berlin 06 / 06 / DE Isolate S99)
Date of testing	29/12/2017 – 28/03/2018
End of testing	28/03/2018

5. Methods

5.1 Preparation of test virus suspension

To prepare the test virus suspension, *RAW 264.7 cells* which have been cultured with Dulbecco's Modified Eagle's Medium with 4.5 g/l glucose and 10 % fetal calf serum with low endotoxin were inoculated with MNV (stock virus solution) in a 175 cm² cell culture flask. Once a cytopathic effect had been induced (approx. 1-3 days), freezing and thawing was carried out two times. The cell debris was removed by low speed centrifugation and the supernatant was recovered as test viral suspension, aliquoted and stored at -80 °C.

5.2 Preparation of disinfectant (dilutions)

The test product was tested undiluted. Due to the addition of interfering substance and test virus suspension an 80.0 % solution resulted. Furthermore, the product was evaluated as 50.0 % and 10.0 % solutions (demonstrating of non-active range). This solution was prepared with water immediately before the inactivation tests.

5.3 Infectivity assay

Infectivity was determined as endpoint titration according to EN 5.5 transferring 0.1 ml of each dilution into eight wells of a microtitre plate to 0.1 ml of *RAW 264.7 cells* ($10\text{--}15 \times 10^3$ cells per well) freshly prepared by scraping, beginning with the highest dilution. Microtitre plates were incubated at 37 °C in a 5 % CO₂-atmosphere. The cytopathic effect was read by using an inverted microscope after five days. Calculation of the infective dose TCID₅₀/ml was calculated with the method of Spearman (2) and Kärber (3) with the following formula:

$$-\log_{10} \text{TCID}_{50} = X_0 - 0.5 + \sum r/n$$

meaning

X_0 = log₁₀ of the lowest dilution with 100 % positive reaction

r = number of pos. determinations of lowest dilution step with 100 % positive and all higher positive dilution steps

n = number of determinations for each dilution step.

5.4 Calculation and verification of virucidal activity

The virucidal activity of the test disinfectant was evaluated by calculating the decrease in titre in comparison with the control titration without disinfectant. The difference is given as reduction factor (RF).

According to the EN 14476, a disinfectant or a disinfectant solution at a particular concentration is having virus-inactivating efficacy if the titre is reduced at least by four log₁₀ steps within the recommended exposure period. This corresponds to an inactivation of ≥ 99.99 %.

5.5 Inactivation assay

Determination of virucidal activity has been carried out in accordance to EN 5.5. The test product was examined undiluted (80.0 %) and as 50.0 % and 10.0 % (demonstration of non-active range) solutions in water at 20 °C according to EN 14476. 30 and 60 seconds and 30 minutes were chosen as contact times.

Immediately at the end of a chosen contact time, activity of the disinfectant was stopped by dilution to 10⁻⁸.

Titration of the virus control was performed at the beginning of the test and after the longest exposure time (EN 5.5.7). One part by volume of test virus suspension was mixed with one part interfering substance and eight parts by volume of WSH or Aqua bidest. (RTU products).

Furthermore, a cell control (only addition of medium) was incorporated.

Inactivation tests were carried out in sealed test tubes in a water bath at $20\text{ °C} \pm 1.0\text{ °C}$. Aliquots were retained after appropriate exposure times and residual infectivity was determined.

5.6 Determination of cytotoxicity

Determination of cytotoxicity was performed according to EN 5.5.4.1.

5.7 Cell sensitivity to virus

For the control of cell sensitivity to virus two parts by volume of water were mixed with eight parts by volume of the lowest apparently non-cytotoxic dilution of the product. This mixture or PBS as control was added to a volume of double concentrated cell suspension. After 1 h at 37 °C the cells were centrifuged and re-suspended in cell culture medium (EN 5.5.4.2b).

Finally, a comparative titration of the test virus suspension was performed on the pre-treated (disinfectant) and non-pre-treated (PBS) cells as described above.

5.8 Control of efficacy for suppression of disinfectant's activity

Furthermore, a control of efficiency for suppression of disinfectant's activity was included (EN 5.5.5.1).

5.9 Reference virus inactivation test

As reference for test validation a 0.7 % formaldehyde solution according to EN 5.5.6 was included. 5, 15, 30 and 60 minutes were chosen as contact times. In addition, cytotoxicity of formaldehyde test solution was determined following EN 5.5.6.2 with dilutions up to 10^{-5} .

6. Verification of the methodology

The following criteria as mentioned in EN 5.7 were fulfilled:

- The titre of the test virus suspension allowed the determination of a $\geq 4 \log_{10}$ reduction (maximal virus reduction $\geq 5.88 \pm 0.35$, 80.0 % assay).
- The test product (80.0 % solution) showed cytotoxicity in the 1:10 dilutions thus allowing the detection of a $4 \log_{10}$ reduction of virus titre.
- The comparative titration on pre-treated (disinfectant) and non-pre-treated (PBS) *RAW 264.7 cells* showed no significant difference ($< 1 \log_{10}$; EN 5.7) of virus titre: 8.38 ± 0.41 (PBS) versus 8.50 ± 0.35 (1:100 dilutions of disinfectant as 80.0 % solution) $\log_{10}$ TCID₅₀/ml.
- The control of efficacy for suppression of disinfectant's activity (80.0 % solution) showed no decrease ($\leq 0.5 \log_{10}$; EN 5.5.5.1) in virus titre (8.00 ± 0.38 versus $8.25 \pm 0.33 \log_{10}$ TCID₅₀/ml).
- One concentration demonstrated a $4 \log_{10}$ reduction and (at least) one concentration demonstrated a $\log_{10}$ reduction of less than 4.

Since all criteria according EN 5.7 were fulfilled, examination with MNV according to EN 14476 is valid.

7. Results

Results of examination are shown in tables 1 to 8. Tables 1 to 7 demonstrate the raw data, whereas table 8 (a+b) gives a summary of results.

The undiluted test product (80.0 %) was able to inactivate MNV after 30 seconds under clean conditions in this quantitative suspension test (tables 1 and 2). The reduction factors were 4.63 ± 0.61 and $\geq 4.63 \pm 0.45$. The mean value was $\geq 4.63 \pm 0.38$. This corresponded to an inactivation of ≥ 99.99 %.

Tested as 50.0 % solution, the test product was not active within 30 seconds of exposure time (table 3).

Tested as 10.0 % solution, the test product was not active within 30 minutes of exposure time (table 4).

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8. Conclusion

The hand disinfectant Chemisept GEL tested undiluted demonstrated effectiveness against MNV after an exposure time of 30 seconds under clean conditions.

Therefore, the hand disinfectant Chemisept GEL can be declared as active against MNV as follows:

undiluted 30 seconds clean conditions

Bremen, 28/03/2018



- Dr. Britta Becker -
Head of Laboratory



- Dr. Dajana Paulmann -
Scientific Project Manager



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9. Quality control

The Quality Assurance of the results was maintained by performing the determination of the virus-inactivating properties of the disinfectant in accordance with Good Laboratory Practice regulations:

- 1) Chemicals Act of Germany, Appendix 1, dating of 01.08 1994 (BGBl. I, 1994, page 1703). Appendix revised at 14. 05. 1997 (BGBl. I, 1997, page 1060).
- 2) OECD Principles of Good Laboratory Practice (revised 1997); OECD Environmental Health and Safety Publications; Series on Principles of Good Laboratory Practice and Compliance Monitoring – Number 1. Environment Directorate, Organization for Economic Co-operation and Development, Paris 1998.

The plausibility of the results was additionally confirmed by controls incorporated in the inactivation assays.

10. Records to be maintained

All testing data, protocol, protocol modifications, the final report, and correspondence between Dr. Brill + Partner GmbH and the sponsor will be stored in the archives at Dr. Brill + Partner GmbH.

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The test results in this test report relate only to the items examined.

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11. Literature

1. EN 14476:2013+A1:2015: Chemical disinfectants and antiseptics – Quantitative suspension test for the evaluation of virucidal activity of chemicals disinfectants and antiseptics in human medicine test - Test method and requirements (phase 2, step 1)
2. Spearman, C.: The method of 'right or wrong cases' (constant stimuli) without Gauss's formulae.
Brit J Psychol; 2 1908, 227-242
3. Kärber, G.: Beitrag zur kollektiven Behandlung pharmakologischer Reihenversuche.
Arch Exp Path Pharmac; 162, 1931, 480-487

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Appendix:

Legend to the Tables

Table 1:	Raw data for Chemisept GEL (80.0 %) tested against MNV (1 st assay)
Table 2:	Raw data for Chemisept GEL (80.0 %) tested against MNV (2 nd assay)
Table 3:	Raw data for Chemisept GEL (50.0 %) tested against MNV
Table 4:	Raw data for Chemisept GEL (10.0 %) tested against MNV
Table 5:	Raw data for formaldehyde solution (0.7 %) tested against MNV
Table 6:	Raw data for control of efficacy for suppression of disinfectant's activity (80.0 %)
Table 7:	Raw data (MNV) for cell sensitivity (80.0 %)
Table 8 (a+b):	Summary of results with Chemisept GEL and MNV

Legend to the Figures

Figure 1:	Virus-inactivating properties of Chemisept GEL (80.0 %)
Figure 2:	Virus-inactivating properties of formaldehyde (0.7 %)



Table 1: Raw data for Chemisept GEL (80.0 %) tested against MNV at 20 °C (quantal test; 8 wells) (#5355) (1st assay)

Product	Concentration	Interfering substance	Contact time	Dilutions (log ₁₀)								
				1	2	3	4	5	6	7	8	9
test product	80.0 %	clean conditions	15 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			20 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			30 s	tttt tttt	4444 4444	0000 3000	0200 0000	0000 0000	0000 0000	0000 0000	n.d.	n.d.
			60 s	tttt tttt	4004 0440	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	n.d.	n.d.
test product cytotoxicity	80.0 %	clean conditions	n.a.	tttt tttt	0000 0000	0000 0000	0000 0000	0000 0000	n.d.	n.d.	n.d.	n.d.
virus control	n.a.	clean conditions	0 min 60 min	n.d. 4444 4444	n.d. 4444 4444	n.d. 4444 4444	n.d. 4444 4444	n.d. 4444 4444	n.d. 4444 4444	n.d. 0444 4400	n.d. 0000 0304	n.d. 0000 0000

n.a. = not applicable
n.d. = not done

0 = no virus present; t = cytotoxic
1 to 4 = virus present (degree of CPE in 8 cell culture units) (wells of microtitre plates)



Table 2: Raw data for Chemisept GEL (80.0 %) tested against MNV at 20 °C (quantal test; 8 wells) (#5378) (2nd assay)

Product	Concentration	Interfering substance	Contact time	Dilutions (log ₁₀)								
				1	2	3	4	5	6	7	8	9
test product	80.0 %	clean conditions	15 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			20 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			30 s	tttt tttt	4444 0444	0000 0000	0000 0000	0000 0000	0000 0000	n.d.	n.d.	n.d.
			30 min	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
test product cytotoxicity	80.0 %	clean conditions	n.a.	tttt tttt	0000 0000	0000 0000	0000 0000	0000 0000	n.d.	n.d.	n.d.	n.d.
virus control	n.a.	clean conditions	0 min	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	0000 0000	0040 0000	0000 0000
			60 min	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	0044 0440	0000 0000	0000 0000

n.a. = not applicable
n.d. = not done

0 = no virus present; t = cytotoxic

1 to 4 = virus present (degree of CPE in 8 cell culture units) (wells of microtitre plates)



Table 3: Raw data for Chemisept GEL (50.0 %) tested against MNV at 20 °C (quantal test; 8 wells) (#5378)

Product	Concentration	Interfering substance	Contact time	Dilutions (log ₁₀)								
				1	2	3	4	5	6	7	8	9
test product	50.0 %	clean conditions	15 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			20 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			30 s	n.d.	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	0400 0444	n.d.	n.d.
			30 min	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
test product cytotoxicity	50.0 %	clean conditions	n.a.	tttt tttt	0000 0000	0000 0000	0000 0000	0000 0000	n.d.	n.d.	n.d.	n.d.
virus control	n.a.	clean conditions	0 min	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	0000 0000	0040 0000	0000 0000
			60 min	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	0044 0440	0000 0000	0000 0000

n.a. = not applicable

0 = no virus present; t = cytotoxic

1 to 4 = virus present (degree of CPE in 8 cell culture units) (wells of microtitre plates)

n.d. = not done



Table 4: Raw data for Chemisept GEL (10.0 %) tested against MNV at 20 °C (quantal test; 8 wells) (#5378)

Product	Concentration	Interfering substance	Contact time	Dilutions (log ₁₀)									
				1	2	3	4	5	6	7	8	9	
test product	10.0 %	clean conditions	15 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			20 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			30 s	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
			30 min	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	3400 0004	0000 0400	n.d.	n.d.
test product cytotoxicity	10.0 %	clean conditions	n.a.	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	n.d.	n.d.	n.d.	n.d.	
virus control	n.a.	clean conditions	0 min	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	0040 0000	0000 0000	0000 0000	
			60 min	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	0044 0440	0000 0000	0000 0000	

n.a. = not applicable
n.d. = not done

0 = no virus present; t = cytotoxic

1 to 4 = virus present (degree of CPE in 8 cell culture units) (wells of microtitre plates)



Table 5: Raw data for formaldehyde solution (0.7 %) tested against MNV at 20 °C (quantal test; 8 wells) (#5378)

Product	Concentration	Interfering substance	Contact time (min)	Dilutions (log ₁₀)								
				1	2	3	4	5	6	7	8	9
formaldehyde	0.7 % (m/V)	PBS	5	tttt	tttt	tttt	4444	4444	4444	0400	n.d.	n.d.
			15	tttt	tttt	tttt	4444	4444	4444	0440	n.d.	n.d.
			30	tttt	tttt	tttt	4444	4444	0030	0000	n.d.	n.d.
			60	tttt	tttt	tttt	3443	0000	0000	0000	n.d.	n.d.
formaldehyde cytotoxicity	0.7 % (m/V)	PBS	n.a.	tttt	tttt	tttt	0000	0000	n.d.	n.d.	n.d.	
virus control	n.a.	PBS	0	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	
			60	4444	4444	4444	4444	4444	4442	4040	0000	0000

n.a. = not applicable

0 = no virus present; t = cytotoxic

n.d. = not done

1 to 4 = virus present (degree of CPE in 8 cell culture units) (wells of microtitre plates)



Table 6: Raw data for control of efficacy for suppression of disinfectant's activity (80.0 %) (#5451)

Product	Interfering substance	dilutions (log ₁₀)								
		1	2	3	4	5	6	7	8	9
test product	clean conditions	n.d.	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4004 4004	0000 0000	n.d.
corresponding virus control	clean conditions	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4444 4444	4403 0444	0000 0000	0000 0000

n.a. = not applicable

0 = no virus present; t = cytotoxic

n.d. = not done

1 to 4 = virus present (degree of CPE in 8 cell culture units) (wells of microtitre plates)



Table 7: Raw data (MNV) for cell sensitivity (80.0 %) (#5451)

Product	Dilution	Dilutions (log ₁₀)								
		1	2	3	4	5	6	7	8	9
PBS	-	4444	4444	4444	4444	4444	4444	4443	4000	n.d.
		4444	4444	4444	4444	4444	4444	4004	0000	
test product	1:100	4444	4444	4444	4444	4444	4444	4433	0004	n.d.
		4444	4444	4444	4444	4444	4444	0444	0040	

n.a. = not applicable

0 = no virus present; t = cytotoxic

n.d. = not done

1 to 4 = virus present (degree of CPE in 8 cell culture units) (wells of microtitre plates)



Table 8a: Summary of results with Chemisept GEL and MNV

Product*	Con- centration	Interfering substance	Level of cytotoxicity	log ₁₀ TCID ₅₀ /ml after ...					> 4 log ₁₀ reduction after ...
				15 s	20 s	30 s	60 s	30 min	
test product (1)	80.0 %	clean conditions	2.50	n.d.	n.d.	3.75±0.35	≤ 3.00±0.38	n.d.	30 s (RF = 4.63±0.61)
test product (2)	80.0 %	clean conditions	2.50	n.d.	n.d.	≤ 3.38±0.25	n.d.	n.d.	30 s (RF ≥ 4.63±0.45)
test product (2)	50.0 %	clean conditions	2.50	n.d.	n.d.	8.00±0.38	n.d.	n.d.	> 30 s (RF = 0.00±0.53)
test product (2)	10.0 %	clean conditions	1.50	n.d.	n.d.	n.d.	n.d.	8.00±0.44	> 30 min (RF = 0.00±0.58)

*The number in brackets gives the number of the corresponding virus control, see table 8b

n.a. = not applicable n.d. = not done



Table 8b: Summary of results with Chemisept GEL and MNV

Product	Con- centration	Interfering substance	Level of cytotoxicity	log ₁₀ TCID ₅₀ /ml aftermin					> 4 log ₁₀ reduction after ... min
				0	5	15	30	60	
formaldehyde	0.7 % (w/v)	PBS	4.50	n.d.	7.75±0.33	7.25±0.44	6.88±0.37	5.88±0.37	> 60 (RF = 2.00±0.52)
virus control	n.a.	PBS	n.a.	n.d.	n.d.	n.d.	n.d.	7.88±0.57	n.a.
virus control (1)	n.a.	clean conditions	n.a.	n.d.	n.d.	n.d.	n.d.	8.38±0.49	n.a.
virus control (2)	n.a.	clean conditions	n.a.	7.63±0.25	n.d.	n.d.	n.d.	8.00±0.38	n.a.
virus control suppression	n.a.	clean conditions	n.a.	n.d.	n.d.	n.d.	n.d.	8.25±0.33	n.a.
suppression control	80.0 %	clean conditions	2.50	n.d.	n.d.	n.d.	8.00±0.38	n.d.	n.a.
sens. control PBS	n.a.	n.a.	n.a.	n.d.	n.d.	n.d.	n.d.	8.38±0.41	n.a.
sens. control test product	80.0 % → 1:100	n.a.	n.a.	n.d.	n.d.	n.d.	n.d.	8.50±0.35	n.a.

n.a. = not applicable n.d. = not done sens. = sensitivity



Figure 1: Virus-inactivating properties of Chemisept GEL (80.0 %)

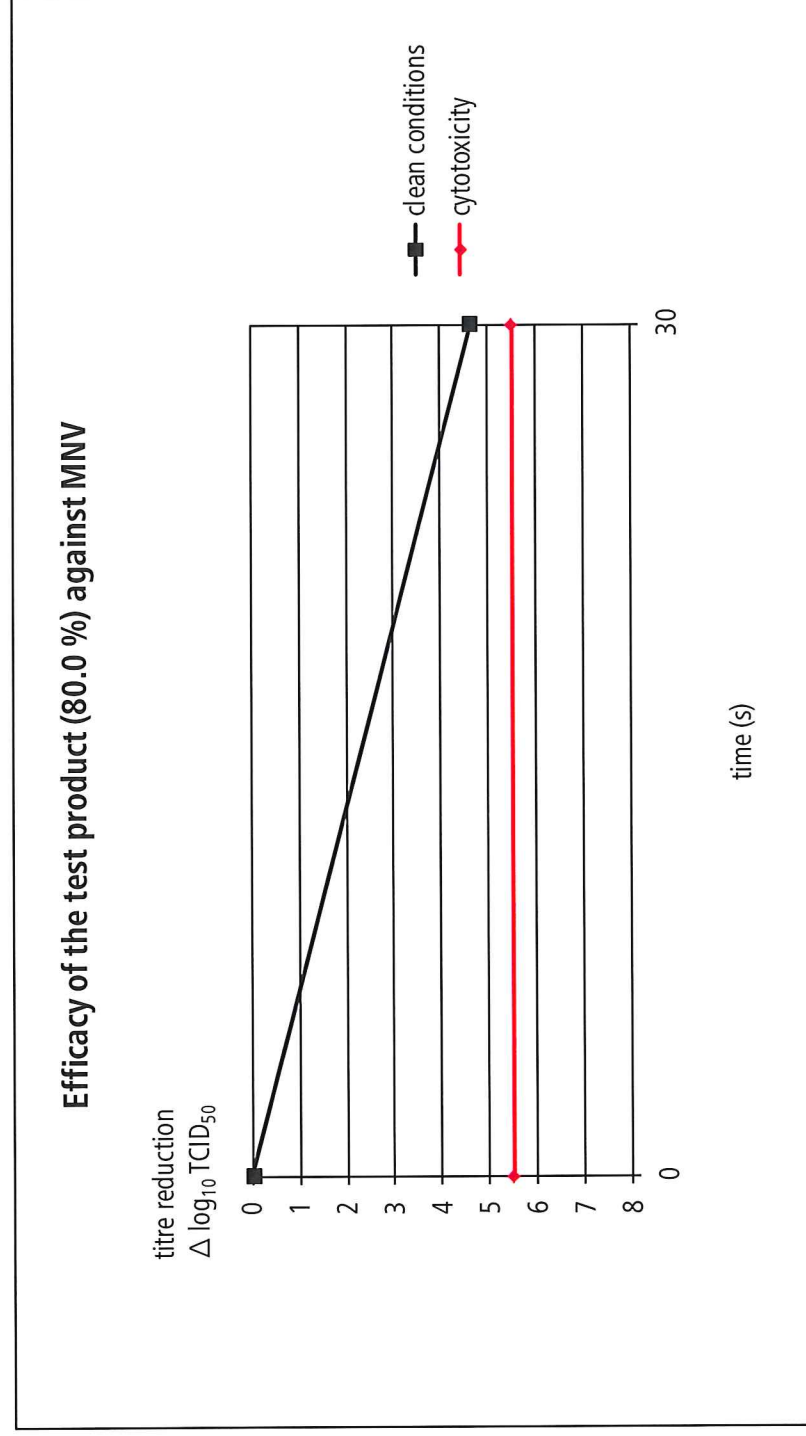




Figure 2: Virus-inactivating properties of formaldehyde (0.7 %)

