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HEIQ VIROBLOCK

HeiQ Viroblock NPJ03 *powered by CHT*

CHT Group cooperates with HeiQ

Leaders, even when competitors, unite in times of crisis for the greater good

OVERVIEW

1. What is the issue?
2. What is the solution?
3. How can HeiQ Viroblock be tested?
4. Application fields
5. Product information and application technique
6. Consumer benefits
7. Regulary coverage of HeiQ Viroblock NPJ03

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COLLABORATION

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WHAT IS THE ISSUE?

TEXTILES: INFECTION & TRANSMISSION

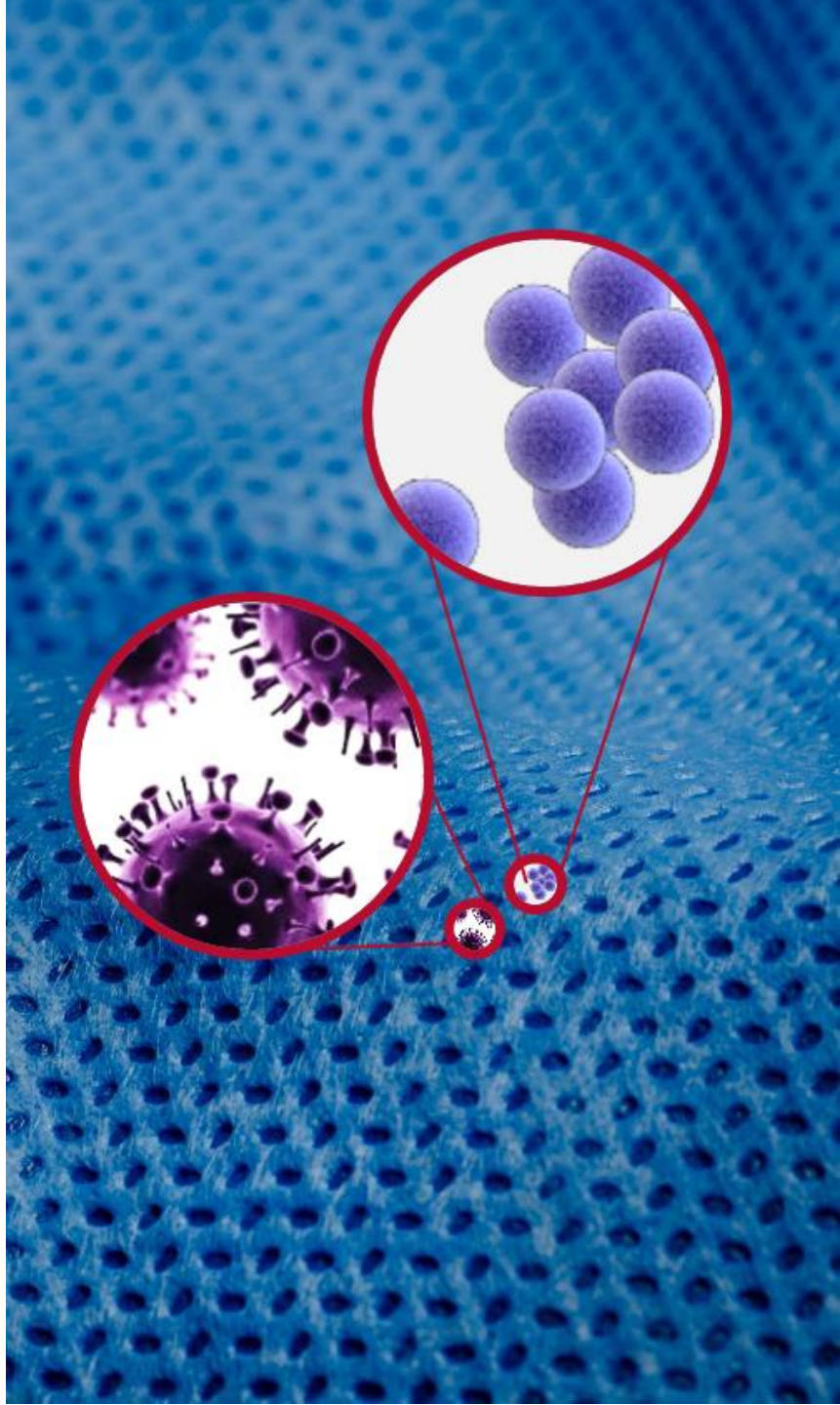
Textiles provide a large hosting surface area for bacteria and viruses, benefiting their carryover

Many viruses and bacteria are pathogens that can lead to severe sickness and mortality

Thousands of deaths every year can result from transmission of pathogens [1]

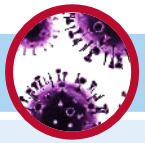
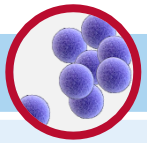
Viruses and bacteria can remain active on textile surfaces from days to months [2]

E.g. Research has shown that the human coronavirus (SARS-CoV) can persist for up to 2 days on surgical gowns at room temperature.[3]

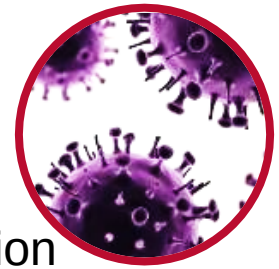


1) K.Sack “Hospital Infection Problem Persists”, New York Times (April 13, 2010).
2) A.Kramer, I.Schwebke, G.Kampf (2006) "How long do nosocomial pathogens persist on inanimate surfaces? A systematic review", BMC Infectious Diseases, 6(130).
3) Kampf, G., Todt, D., Pfaender, S. and Steinmann, E., 2020. Persistence of coronaviruses on inanimate surfaces and its inactivation with biocidal agents. Journal of Hospital Infection.

WHAT ARE VIRUSUS AND BACTERIA?

	Viruses 	Bacteria 
Definition	▪ Infectious substances (DNA or RNA) ▪ Usually infect specific cell types (of plants, animals, humans) ▪ Mostly harmful and can cause diseases	▪ Single cell organisms ▪ Natural part of environment, and present in large numbers inside and on the outside of the human body ▪ Mostly harmless, but some bacteria can cause harmful diseases
Types	▪ Enveloped (by a lipid, fatty, cholesterol rich membrane), more than 60% of all existing pathogenic viruses ▪ Non-enveloped	▪ Gram positive ▪ Gram negative
Size*	20-300 nm	About 1‘000 nm
Replication	By invading a living host cell which replicates and releases the new virions	Rapidly by cell division
Examples	Coronavirus, Human and avian influenza virus (H1N1, H5N1), Herpes simplex virus, Hepatitis virus, HIV	Gram pos.: Staphylococcus aureus, MRSA ("golden staph"), MSSA; Gram neg.: Escherichia coli, Klebsiella pneumoniae, Salmonella typhimurium
Diseases	COVID-19, Influenza, Chickenpox, SARS, HIV	Food poisoning, Meningitis, Pneumonia

KEY STEPS IN THE VIRUS REPLICATION CYCLE



- All viruses depend upon a host cell (e.g. from human) for their protein synthesis and replication
- Viral infections are governed by complex interactions between the (negatively charged, enveloped) virus and (positively charged) human cells

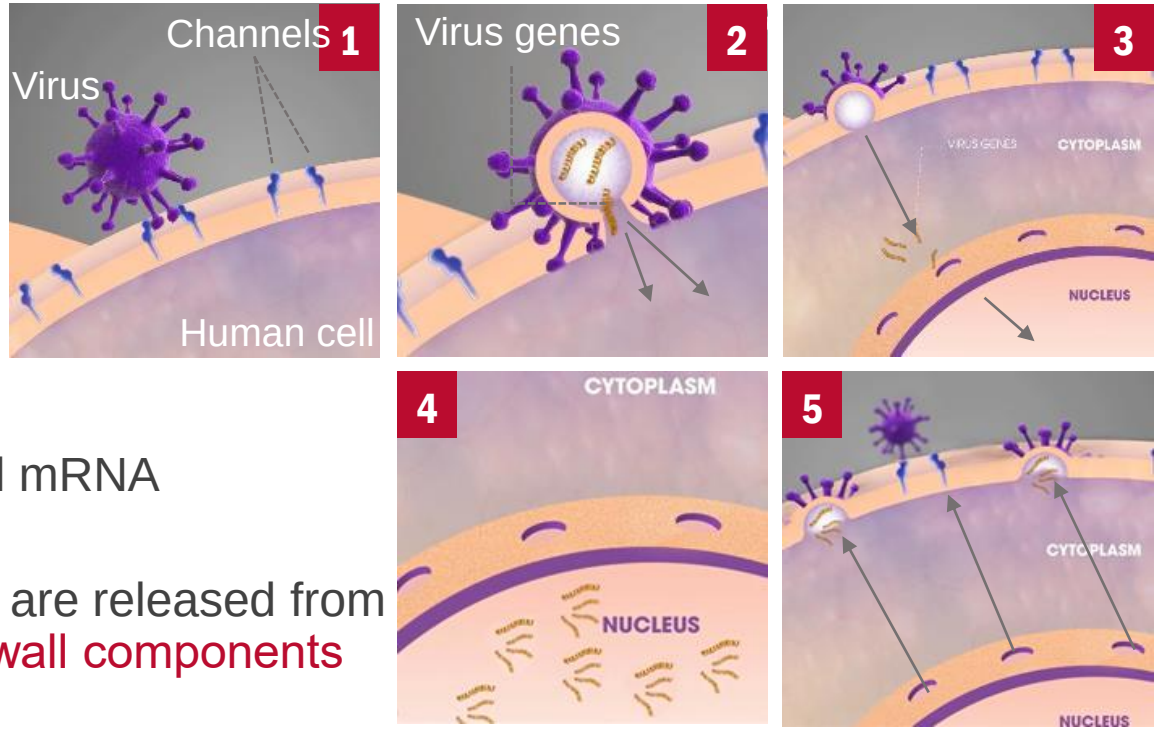
1 Binding: Virus binds to the preferential pore channels of the human cell

2 Entry: Virus or its genome enters in the human cell

3 Uncoating: Genome leaves its protective capsid (membrane)

4 Replication: Genome is transcribed and viral mRNA (Messenger RNA) directs protein synthesis

5 Release: Through the channels, new virions are released from the cell and being “coated” with human cell wall components (cholesterol rich membrane)



* Galdiero, S. et.al.., 2011. Silver nanoparticles as potential antiviral agents. Molecules, 16(10), pp.8894-8918.

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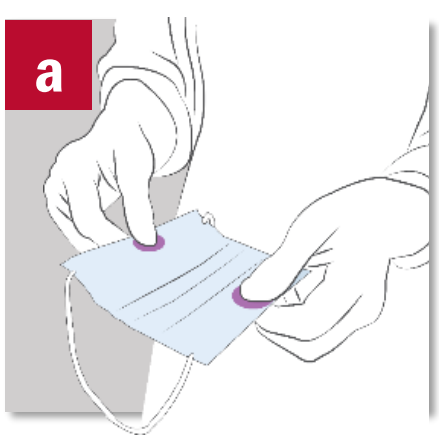
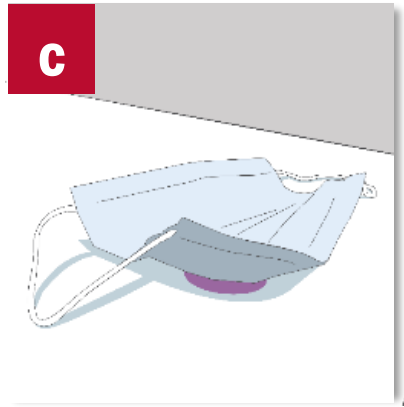
FACE MASK: A POTENTIAL VECTOR FOR CROSS-CONTAMINATION





Face masks are supposed to protect the wearer and others yet they can also be a potential vector for viruses and bacteria!

There is a risk of transferring pathogens to and from the surface of the face masks during, before or after use:

- a When picking it up
- b When putting it on or taking off
- c When disposing it unsafely or leaving it laying around
- d When touching it while wearing or for adjustment

! There is always the risk to contract the virus through touching the face after touching the contaminated surface of the mask or other contaminated surfaces!

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WHAT IS THE SOLUTION?

HEIQ VIROBLOCK NPJ03 – ANTIVIRAL TEXTILE TECHNOLOGY

- Breakthrough combination of two synergistic HeiQ technologies:
  - **A** HeiQ's patented and registered silver technology for antiviral and antibacterial effect
  - **B** HeiQ's patent pending fatty vesicle technology as a booster that mechanically destroys viruses
- HeiQ Viroblock NPJ03 kills bacteria and destroys common harmful viruses (such as influenza and coronavirus) in minutes
- Effective protection against contamination and transmission of viruses and bacteria that use textiles as a hosting surface

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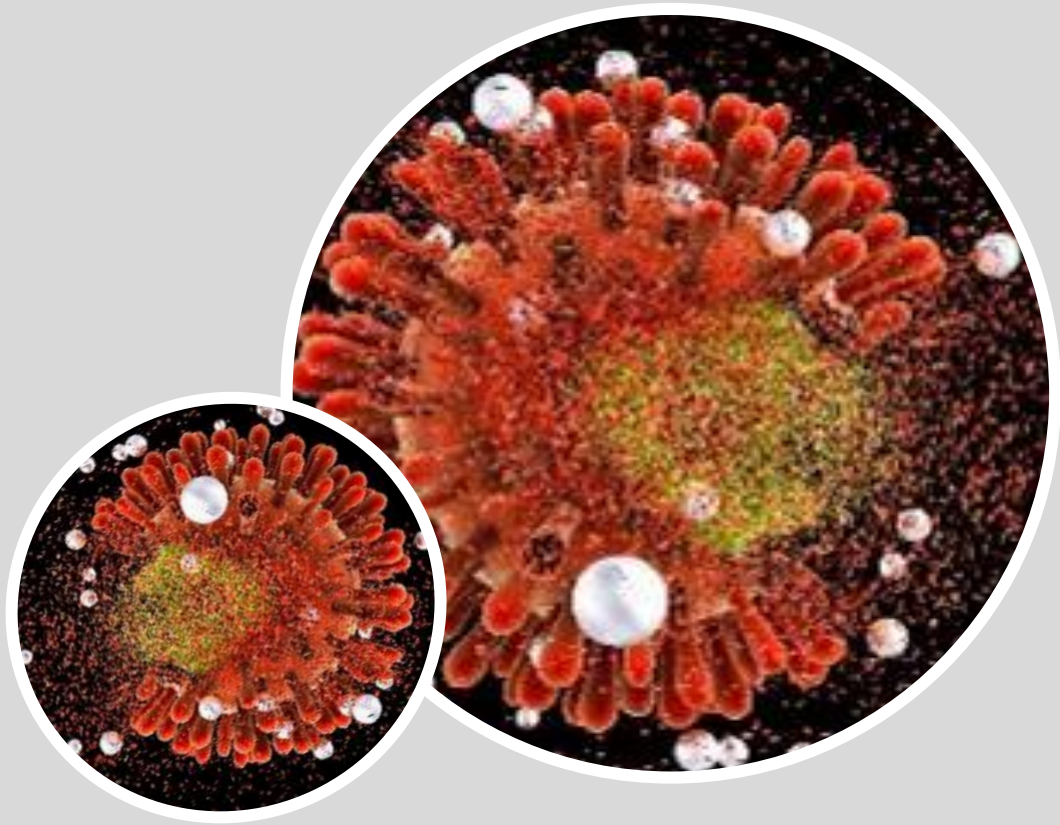
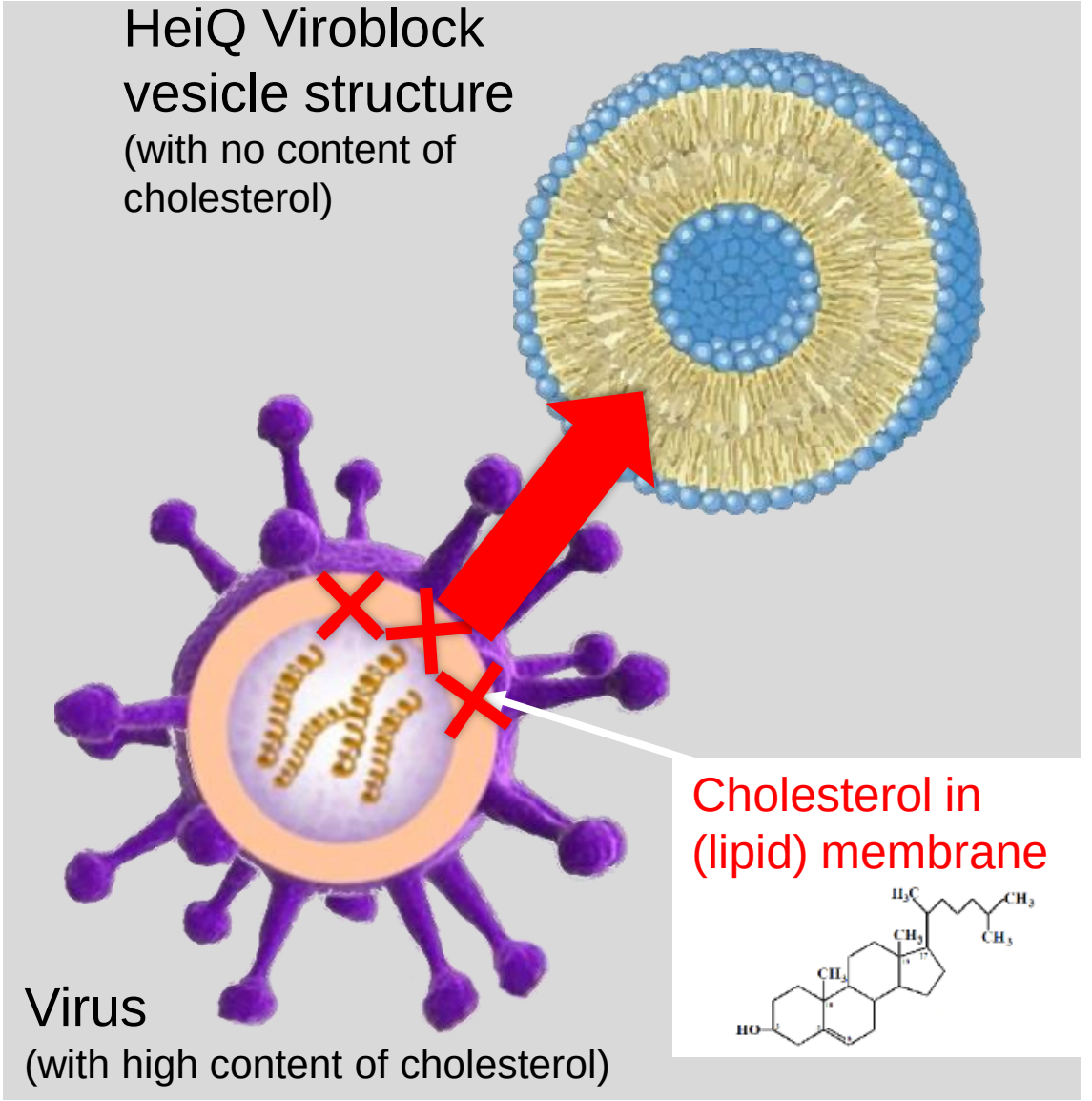
A SILVER COMPONENT ATTRACTS AND DEACTIVATE THE VIRUS

- Silver salt particles are known for their growth-limiting effects against microorganisms. The disinfectant effect of silver ions is based on interaction between cell wall proteins and the blocking of essential enzymes for metabolism.
- In case of viruses, the efficacy is based of electrostatic interaction:
  Like a magnet, silver ions attracts the oppositely charged viruses and binds them permanently to their sulfur groups (forming silver sulfide).
- → The virus is not only immobilized, moreover the virus is inactivated by the strong bonding to sulfur groups.

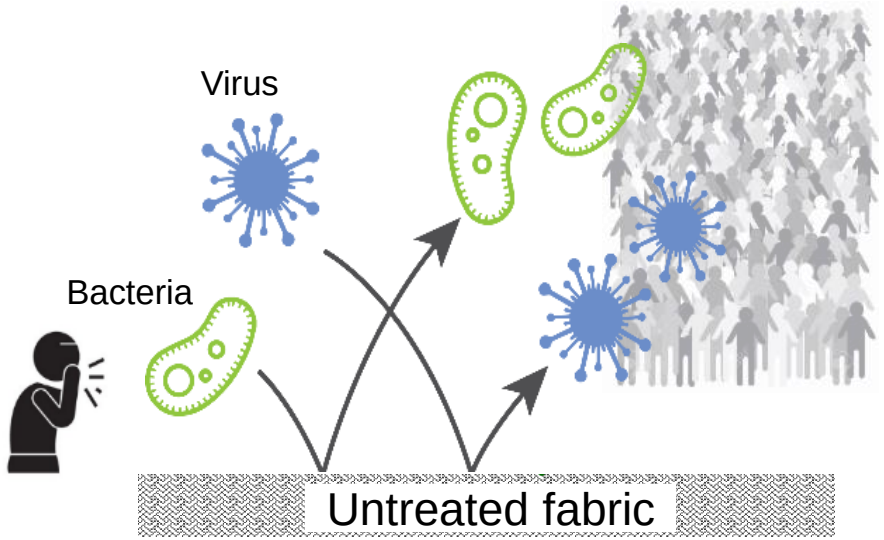


B VESICLE COMPONENT DESTROYS THE VIRUS

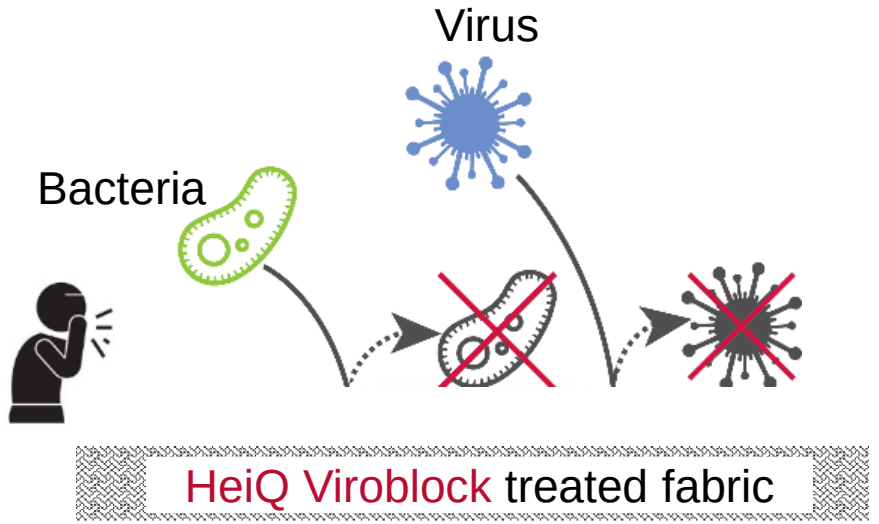
- HeiQ Viroblock vesicle technology (Liposomes) works as a booster
- The fatty spherical vesicle technology functions by directly targeting the lipid envelope (membrane) surrounding the virus
- The vesicle technology helps to deplete the viral membrane of its cholesterol content thereby destroying the virus
- The vesicles rapidly destroy the virus through a physical contact mechanism (cholesterol sink)



HOW DOES IT WORK?



- Textiles provide an ideal surface for harboring viruses and bacteria
- Viruses and bacteria are re-transmitted from the textile (eg. contact with other surfaces)



- Textiles treated with HeiQ Viroblock actively inhibit viruses and kill bacteria upon contact on the surface
- By keeping the textile free of viable viruses and bacteria, **HeiQ Viroblock** treated textiles **help to minimize the potential for re-transmission of pathogens from textiles**

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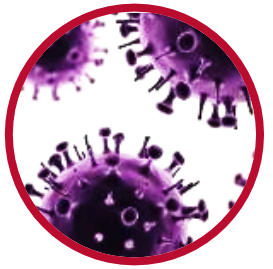
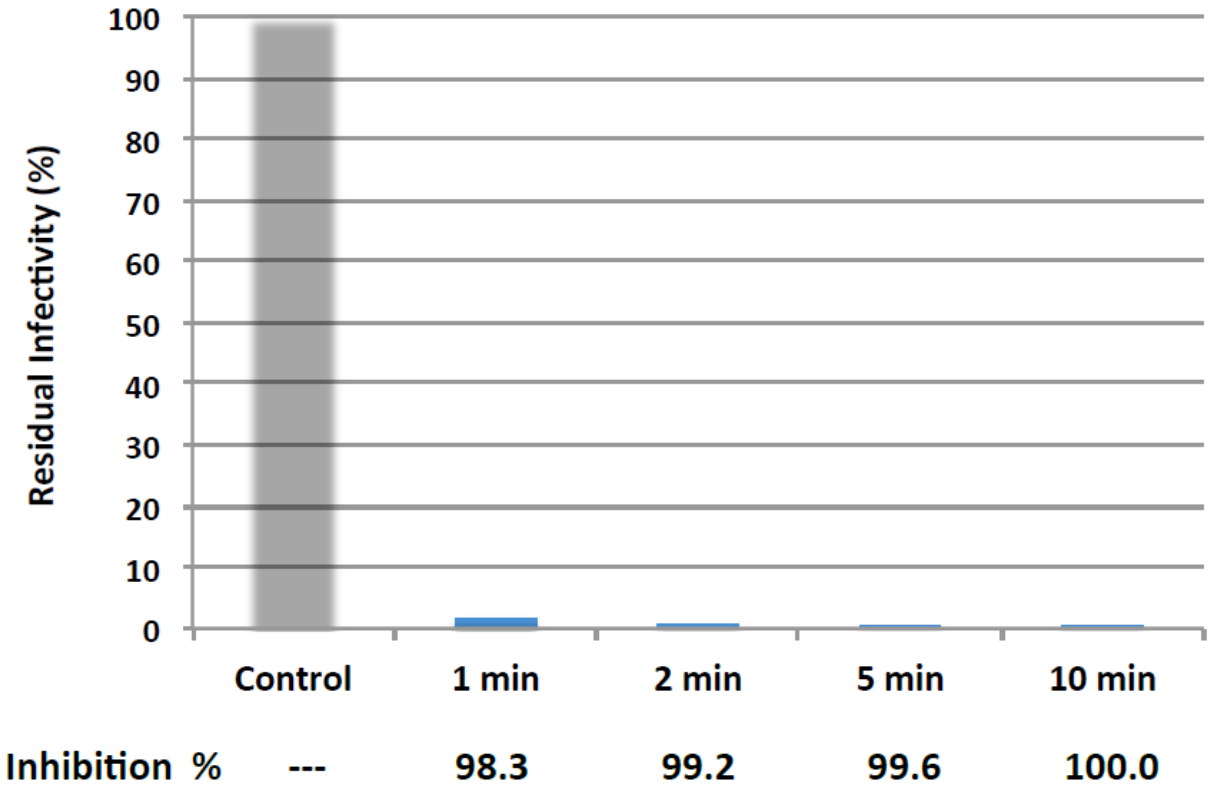
INSTANTANEOUS ANTIVIRAL EFFECT ON SENDAI VIRUS

- Nonwoven fabric treated with HeiQ Viroblock NPJ03
- The residual virus infectivity tested according to the modified ISO 20743 method (Sendai)





Inhibition %	---	98.3	99.2	99.6	100.0

RAPID ANTIVIRAL effect demonstrated within 2 to 5 minutes

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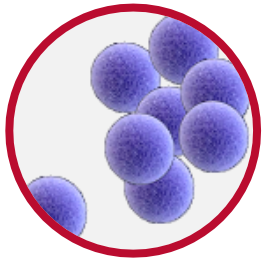
ANTIBACTERIAL EFFECT OF SILVER ON STAPHYLOCOCCUS AUREUS

- Polyester fabric treated with HeiQ Viroblock NPJ03
- Time series effectiveness based on the modified ISO 20743 test method
- >99,5% effect against staphylococcus aureus within 20 min



Kill rate for Staphylococcus aureus over time:

Sample # 326-1-1					
Contact time [min]	0	15	20	30	60
cfu control	4.35×10^5				5.17×10^5
cfu sample		6.63×10^4	2.23×10^3	6.93×10^2	$\leq 9.9 \times 10^1$
log reduction		0.8	2.3	2.8	3.6
% reduction		84.74%	99.5%	99.84%	99.98%

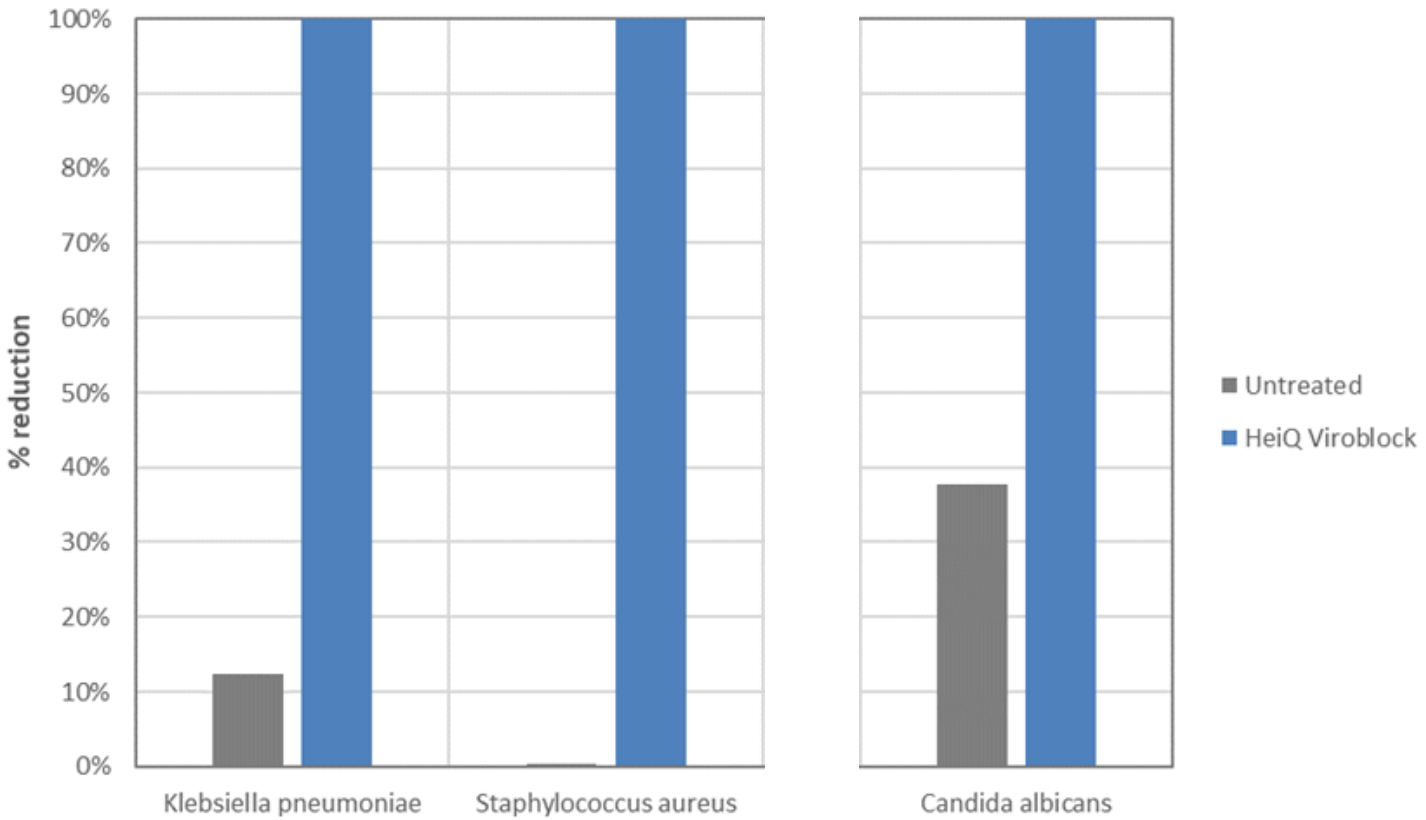
ANTIBACTERIAL effect demonstrated within 20 to 30 minutes

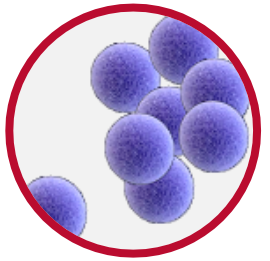
Effective against *gram pos.* and *neg.* bacteria such as: MRSA, Clostridium difficile, Staphylococcus aureus, Klebsiella pneumoniae, etc.

The theoretical limit of detection is 100 CFU (Colony Forming Unit)

ANTIMICROBIAL EFFECT ON BACTERIA AND YEAST

- Nonwoven fabric treated with HeiQ Viroblock NPJ03
- Antibacterial activity tested according to ISO 20743





Broad spectrum activity **against** *gram negative* and *gram positive* **BACTERIA**, and **YEAST**

*Infective yeasts such as candida auris are a huge problem for hospitals**

*R. Sabino et. Al. (2020) “Candida auris, an Agent of Hospital-Associated Outbreaks: Which Challenging Issues Do We Need to Have in Mind?”

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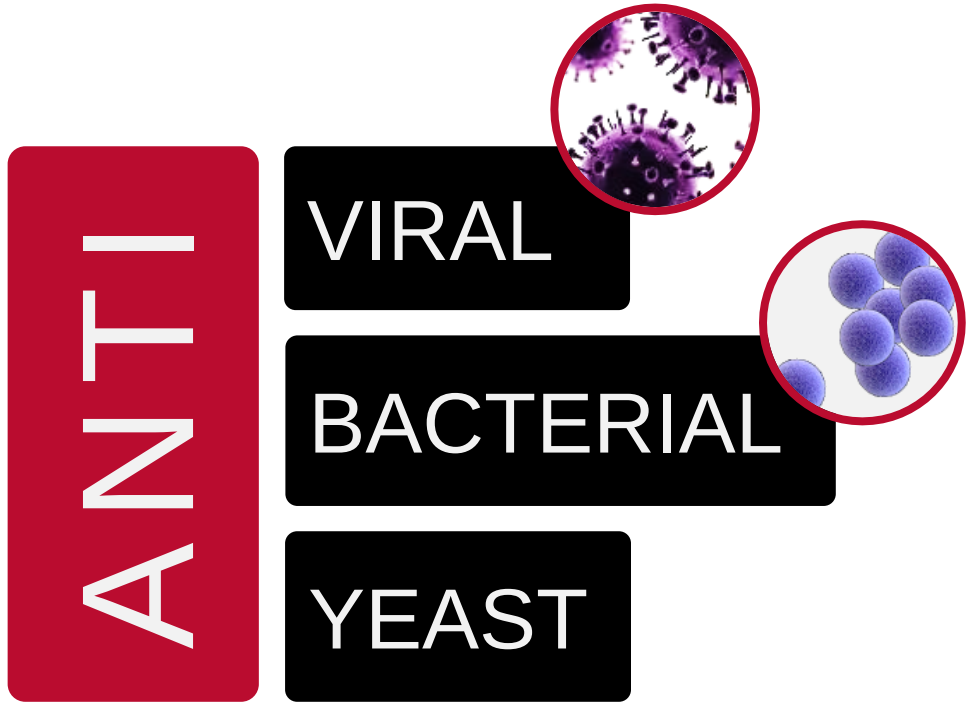
HEIQ VIROBLOCK NPJ03 ANTIVIRAL TEXTILE TECHNOLOGY

HeiQ Viroblock NPJ03 is effective against common harmful enveloped viruses, bacteria and yeast

Technical USPs:

- Can be applied to all types of fabrics and nonwovens
- Standard continuous wet-processing applications (padding, kiss-roll etc.)
- Application 5% to 20% w.o.f.
- Non-dangerous good: logistics and storage convenient



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HOW CAN HeiQ Viroblock BE TESTED

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HeiQ Viroblock TEST METHODS & GUIDELINES

- CHT / HeiQ has evaluated the following test routine
- Antibacterial efficacy is validated through antibacterial tests
- For validation of the antiviral efficacy of treated articles HeiQ has established the following procedure:

Step 1	**Silver content analysis**	AAS Industry standard method (amount of silver content on the finished textiles is analyzed)	CHT performs service *„pre-check“*
Step 2	**Antibacterial test**	HeiQ Yogurt Bac test (qualitative test) *If passed, then:* ISO 20743 antimicrobial test with Staphylococcus aureus	CHT performs service *„pre-check“* External testing lab *„validation test“*
Step 3	**Antiviral test**	ISO 18184	External testing class 4 laboratory (CHT/HeiQ does not perform this antiviral test*)

*Contact CHT Germany/HeiQ for recommended testing laboratories performing the ISO18184 test method!

ANTIVIRAL EFFICACY TEST RESULT (ISO 18184)

Nonwoven* material for disposable masks treated with HeiQ Viroblock NPJ03:

ID	Agent	Log reduction	% reduction
LS20-00319-6	H3N2 (Human Influenza A)	4.72	99.99%

The HeiQ ViroblockNPJ03 treated nonwoven material shows **excellent antiviral efficacy!**

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APPLICATION FIELDS

FACE MASKS PUT INTO THE TEST

FFP2 control face mask vs. FFP2 HeiQ Viroblock treated

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DROPLET BREAKTHROUGH SIMULATION

- A cough can release around 100,000 droplets into the air [1]

- scenario of a mask exposed to all 100,000 droplets yields different resulting numbers of viable virus droplets passing through:

Mask	Log reduction [2]	% reduction	Viable droplets passing through mask
FFP2 control	3.63	99.9766%	>23
FFP2 & HeiQ Viroblock	5.38	99.9996%	<1

! *One viral particle is sufficient to get infected!*

HeiQ Viroblock treatment enhances the level of **virus protection for masks by >20 times**

[1] Gerone, P.J., Couch, R.B., Keefer, G.V., Douglas, R.G., Derrenbacher, E.B. and Knight, V., 1966. Assessment of experimental and natural viral aerosols. Bacteriological reviews, 30(3), p.576.
[2] Viroblock, Aerosol study 798-110

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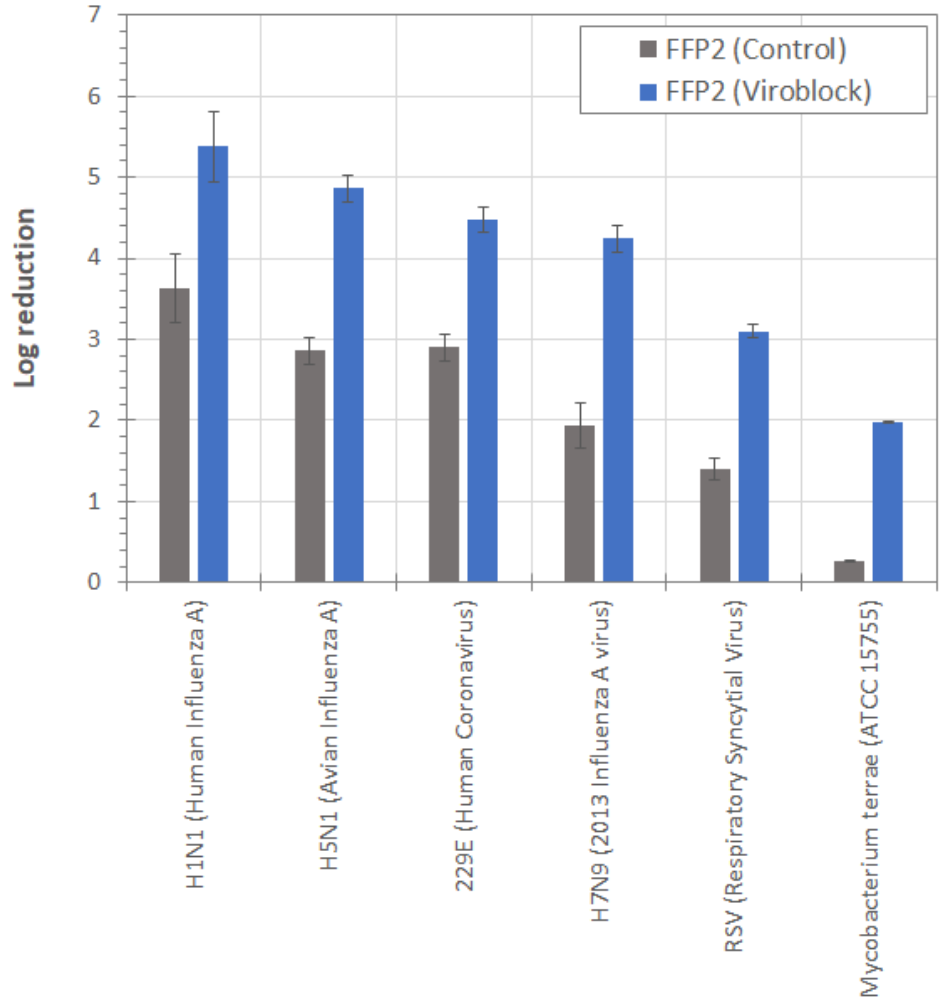
AEROSOL CHALLENGE TEST

HeiQ Viroblock FFP2 face masks (untreated control vs. treated)

		Log reduction			% reduction	
Study ID	Agent	**Control**	**HeiQ Viroblock**	Δ *	**Control**	**HeiQ Viroblock**
798-110	H1N1 (Human Influenza A)	3.63	**5.38**	**>50x**	99.9766%	99.9996%
798-111	H5N1 (Avian Influenza A)	2.86	**4.86**	**100x**	99.862%	99.999%
798-112	229E (Human Coronavirus)	2.90	**4.48**	**>30x**	99.874%	99.997%
798-114	H7N9 (2013 Influenza A)	1.93	**4.24**	**>200x**	98.825%	99.994%
798-115	RSV (Respiratory Syncytial Virus)	1.40	**3.10**	**>50x**	96.02%	99.92%
798-116	Mycobacterium terrae (ATCC 15755)	0.26	**1.98**	**>50x**	45.05%	98.95%



HeiQ Viroblock FFP2 masks* show **significantly (>30 times) improved reduction** in virus infectivity.

Effective against key virus types: H1N1, H5N1, H7N9, Coronavirus (229E), and RSV

* Delta improvement: Difference in log reduction of Δ = 1 indicates 10x; Δ = 2 indicates 100x

MISTING SPRAY CONTACT TEST: AATCC 100

For the evaluation of virucidal effectiveness of the treated face mask fabric via direct contact with the test virus. It determines the potential of the HeiQ Viroblock test fabric or face mask to inactivate virus on direct contact

Method summary

- Based on AATCC Test Method 100 with customization for virus testing
- Spray mist of the target virus inoculum applied evenly onto the surface of the fabric (2 x 2 in. area) from a distance of 3 to 6 in
- Let sample stand for the contact time of interest
- Recover residues into a recovery medium (stomacher)
- Evaluate residual infectivity of recovered residues
- The reduction in infectivity compared to the starting inoculum treated vs. untreated is calculated as an indicator of effectiveness

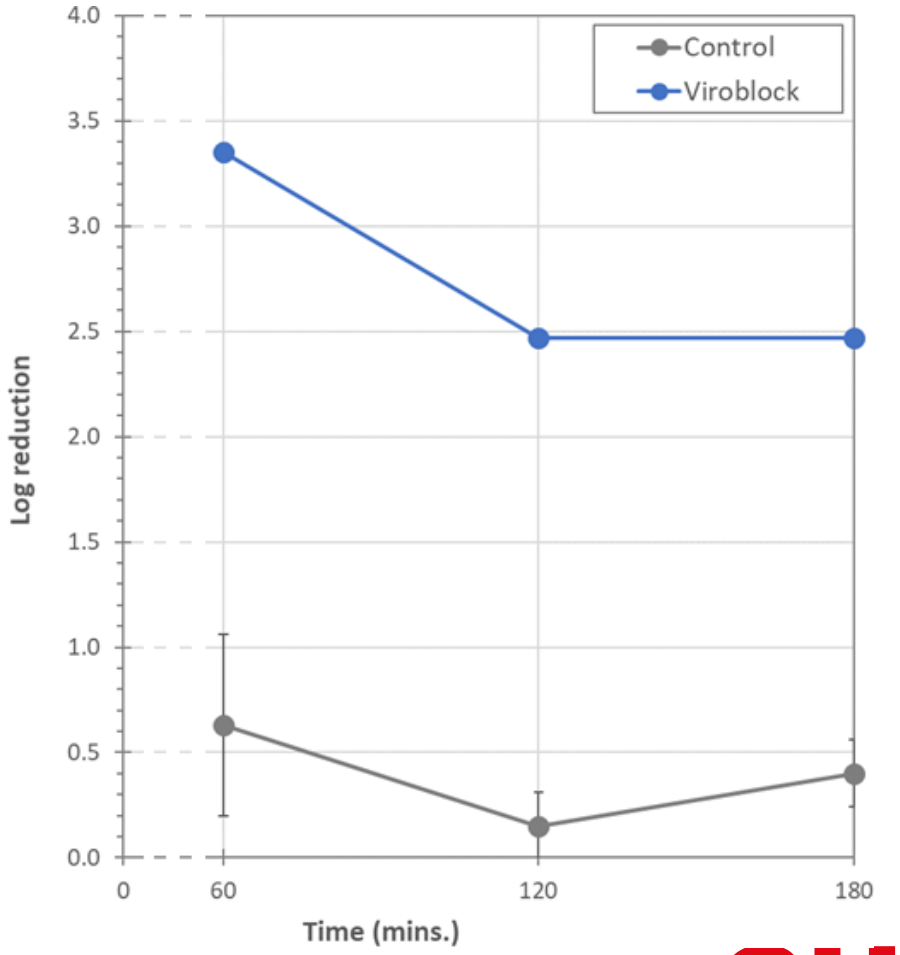
[2] AATCC Test Method 100, Antibacterial Finishes on Textile Materials: Assessment of", American Association of Textile Chemists and Colorists, AATCC Technical Manual (2019).

MISTING STUDY RESULTS – TIME SERIES

- Cotton fabric of HeiQ Viroblock face mask (Untreated control vs. treated)
- Exposure to Human influenza A (H1N1)

			Log reduction	
Study	Agent	Time (mins)	Control	HeiQ Viroblock
798-119	H1N1 (Human Influenza A)	60	0.63	3.35
		120	0.15	2.47
		180	0.40	2.47

HeiQ Viroblock treated fabric shows **dramatically improved reduction (>100 times)** in virus infectivity over a 3 hour period



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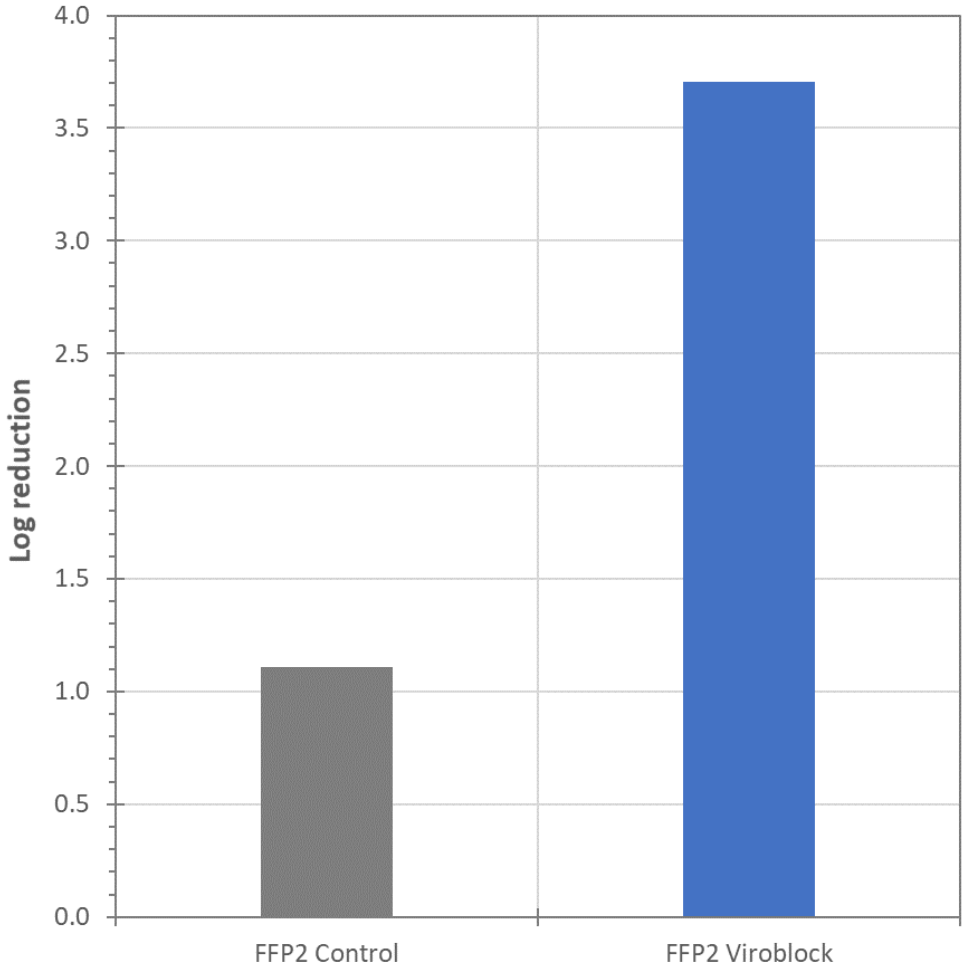
MISTING STUDY RESULTS – TIME SERIES

FFP2 HeiQ Viroblock face masks
(Untreated control vs treated)

		Log reduction			% reduction	
Study ID	Agent	Control	HeiQ Viroblock	Δ *	Control	HeiQ Viroblock
798-126	H1N1 (Human Influenza A)	1.11	3.71	>300x	92.2375%	99.9804%

HeiQ Viroblock treated washable FFP2 mask shows significantly (>300 times) improved reduction in virus infectivity (mist contact)



* Delta improvement: Difference in log reduction of Δ = 1 indicates 10x; Δ = 2 indicates 100x

FACE MASK PERFORMACE COMPARISION

- FFP3 masks have a higher resistance to breathing than FFP2 masks leading to higher metabolic cost. Higher resistance can lead to greater fatigue and exertion for prolonged periods of mask wearing. [1, 2)]
- **FFP2** mask material treated **with HeiQ Viroblock** showed similar virus reduction to FFP3 mask material [3)]
- Masks treated with HeiQ Viroblock provide significantly greater protection against surface contamination of the mask material [4)]

			Log reduction (H1N1 human influenza)			
			Aerosol protection [3]		Surface protection [4]	
Mask type	Metabolic cost (W/m2) [1]	Max breathing resistance (Pa) [2]	Control	HeiQ Viroblock	Control	HeiQ Viroblock
FFP2 (eqv. N95 / KN95)	20	70		5.22	1.11	3.71
FFP3 (eqv. N100/ NK100)	40	100	5.11			

[1] Roberge, R.J., Kim, J.H. and Coca, A., 2012. Protective facemask impact on human thermoregulation: an overview. Annals of occupational hygiene, 56(1), pp.102-112.
[2] Senić, Ž., Ilić, M., Radojković, A., Rajić, D. And Karkalić, R., Efficiency of Respiratory Protection Devices Against Bird Flu Virus. 4th International Conference on Defensive Technologies, OTEH 2011, 2011 Oct 6-7th.
[3] Viroblock, Aerosol study 798-121
[4] Viroblock, Misting study 798-126

HeiQ Viroblock: SUMMARY APPLICATION AREA

All fiber types

HeiQ Viroblock NPJ03 is ideal for nonwoven products:

- Face masks
  - esp. Respirators like N95, FFP2 or equivalent
- Air filters
- Medical nonwovens (e.g. surgical gowns, scrubs, drapes, curtains etc.)
- Workwear, bed linen etc. in the health care sector
- Common textiles in daily use (e.g. terry towels, bed sheets, apparel)

PRODUCT INFORMATION & APPLICATION TECHNIQUE

HEIQ Viroblock NPJ03

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HeiQ Viroblock NPJ03 by CHT (TL)

HeiQ Viroblock NPJ03 is an antiviral and antibacterial agent for all fiber types, especially suitable for non-woven textiles for medical use such as protective face masks and surgical gowns.

Chemical character:	Combination of HeiQ silver salt and lipid vesicle technologies
Appearance:	Viscous, milky-white to pale-brownish liquid
Ionic character:	Cationic
Specific weight at 20°C:	Ca. 0.8 to 1 g/cm^3
pH value:	6 – 8
Solubility:	Readily mixable in water
Compatibility:	Product stability and compatibility with other finishing agents to be checked in advance, not compatible with anionic products

Before applying HeiQ Viroblock NPJ03 make sure the textile is properly cleaned, washed and acidified and disturbing residues are removed such as sizes and anionic substances which may cause liquor instabilities.

FORCED APPLICATION (PADDING, LICK-ROLL…)

Recipe recommendation:

50 - 250 g/l HeiQ Viroblock NPJ03 (calculated acc. to pick up and fabric weight

0.5 - 1.0 g/l KOLLASOL CDO (optional)

- *Pick up dry-on-wet*
- *pH 4 to 5 with acetic acid or citric acid*
- *Dry at 120 to max. 140°*

FORCED APPLICATION (PADDING, LICK-ROLL…)

- The bath concentration of **HeiQ Viroblock NPJ03** has to be calculated according to the intended product add-on and the pick-up of the fabric as indicated in the following table:

	Pick up [%]		
Add-on [%]	40	60	80
5	125	83	63
8	200	123	100
10	250	167	125
15	375	250	188
20	500	333	250

EXHAUST APPLICATION

Recipe recommendation:

5.0 – 20.0 % (owf) HeiQ Viroblock NPJ03

0.1 – 0.5 g/l KOLLASOL CDO (optional)

- *LR 1:10*
- *pH 4.5 to 5.5 with acetic acid or citric acid*
- *Treat 30 min at 40°C*
- *No rinsing after application*
- *Dry at usual conditions (max. 140°C)*

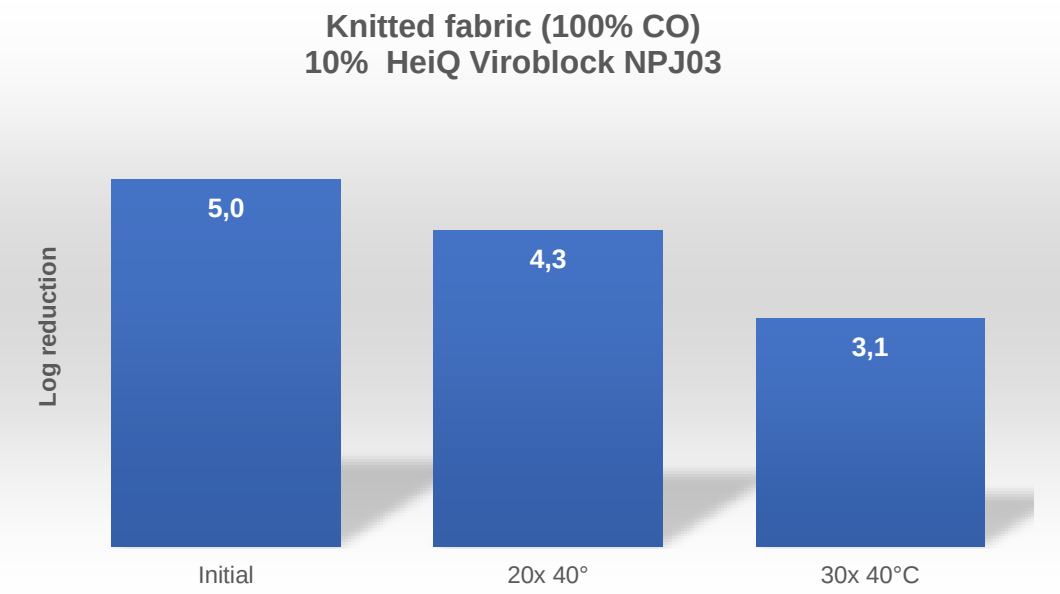
EXHAUST APPLICATION

- The bath concentration of **HeiQ Viroblock NPJ03** has to be adjusted according to the intended product add-on and liquor ratio as indicated in the following table:

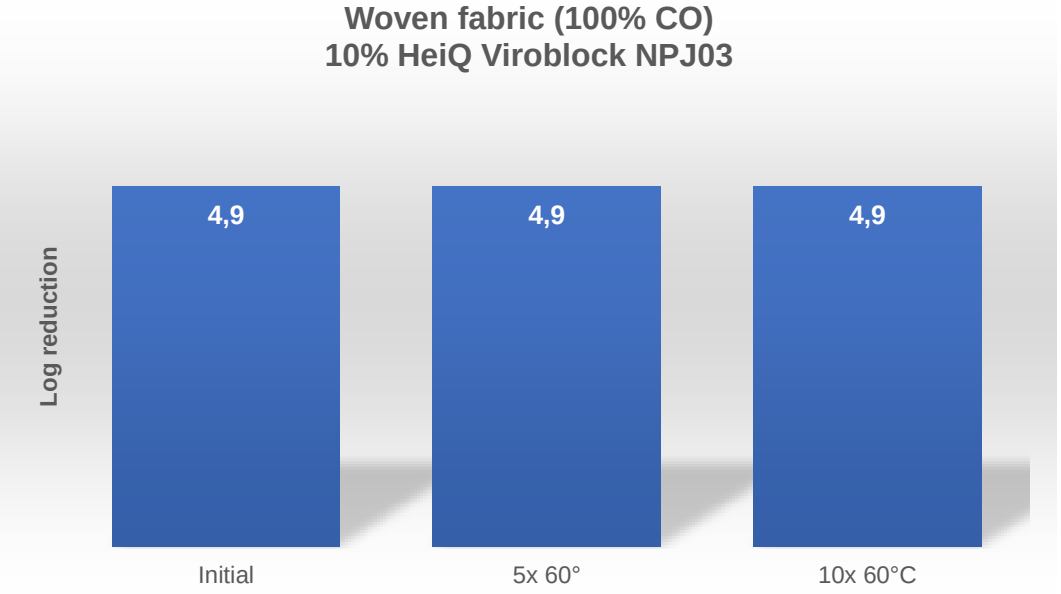
	Liquor ratio 1:X (textil : bath)			
Add-on [%]	4	6	8	12
5	12,5 g/l	8,3 g/l	6,3 g/l	4,2 g/l
8	20,0 g/l	12,3 g/l	10,0 g/l	6,7 g/l
10	25,0 g/l	16,7 g/l	12,5 g/l	8,3 g/l

DURABILITY STUDIES OF HeiQ Viroblock NPJ03

- Washing method: ISO 6330 / 4G
- Test method efficacy: ISO 20743
  (staphylococcus aureus)



- Washing method: ISO 6330 / 6N
- Test method efficacy: ISO 20743
  (staphylococcus aureus)



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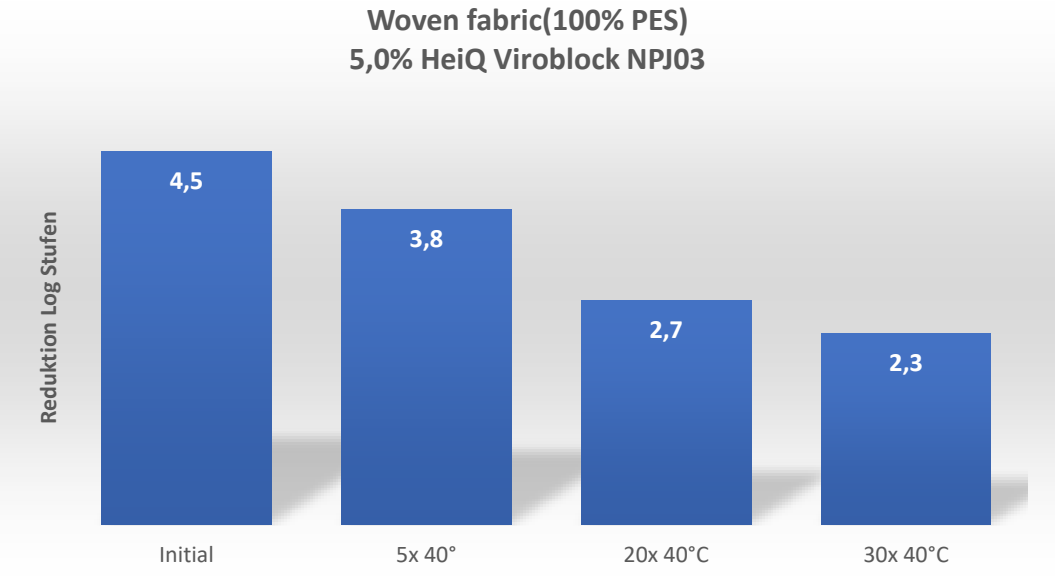
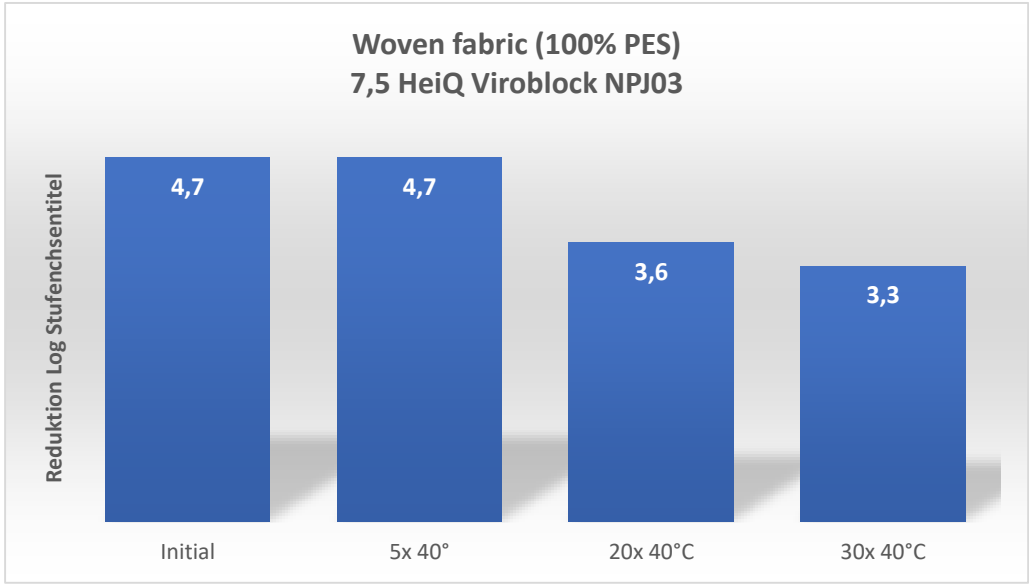
SMART CHEMISTRY WITH CHARACTER.

DURABILITY STUDIES OF HeiQ Viroblock NPJ03

- Washing method: ISO 6330 / 4G
- Test method efficacy: ISO 20743
  (staphylococcus aureus)



- Washing method: ISO 6330 / 4G
- Test method efficacy: ISO 20743
  (staphylococcus aureus)



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CONSUMER BENEFITS

HeiQ Viroblock INGREDIENT BRAND AND HANGTAG

HeiQ Viroblock logo

SWISS TECH INSIDE logo
Sewn-in label

HeiQ Viroblock hangtag

Requirements to use HeiQ Ingredient Brand elements:

- Fabric testing: The HeiQ treated fabric has to be tested **prior** to the hangtag application.
  - A test report needs to be submitted for HeiQ's review.
  - Acceptable tests for HeiQ Viroblock treated fabrics: ISO 20743
- Trademark license agreement: Use of the hangtags requires adherence to HeiQ's standard license agreement. Providing the brand company name and contact person is mandatory.
- **Strict product label claim approval by HeiQ required** (no direct or implied healthcare claims allowed!)

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REGULATORY COVERAGE OF HeiQ Viroblock NPJ03

REGULATION AND LABELS

HeiQ Viroblock NPJ03 is thoroughly tested for Safety, Sustainability and Environment

- Harmless to skin and body
- Uses a minimum of active ingredient

HeiQ Viroblock NPJ03 is US EPA registered, EU BPR and EU REACH compliant. *Check with HeiQ for your target market!*

The commercialization of the HeiQ Viroblock NPJ03 treated article might be subject to further local registrations. Consult HeiQ for Labelling Requirements and Permitted Claims on HeiQ Viroblock NPJ03 Treated Articles!

Zero Discharge of Hazardous Chemicals

Oekotex, Bluesign, ZDHC: pending for approval

SMART CHEMISTRY WITH CHARACTER.

Appendix

HUMAN PATCH TEST RESULT

Farcoderm TESTED WELLNESS

In collaboration with:
University of Pavia
Prof. FULVIO MARZATICO
Laboratory of Pharmacobiochemistry
Pharmacology and Toxicology Division

REPORT ON A HUMAN PATCH TEST

48 hour closed patch test under occlusion

Skin test to evaluate potential skin irritation after contact with a non-woven fabric

HEIQ MATERIALS AG

FABRIC SAMPLE "8"

Farcoderm srl
Head Office address: Via Angelini, 21 - 27028 San Martino Siccomario (PV) - Italy
Legal Office: Via Don Natale Fedeli 3 - 20020 Arese (MI) - Italy - VAT n. 03893350961
Tel. +39-0382 25504 - Fax +39-0382 536006 - Mail: information@farcoderm.com - www.farcoderm.com
Company with certified UNI EN ISO 9001:2008 quality management system

HEIQ MATERIALS AG — Farcoderm — SI.01.C_2011/1778 — 30/09/2011

RESULTS

Summary of the data obtained and evaluation of the product irritation potential

OEDEMA AND ERYTHEMA REACTIONS

Panelist name	Sex	ERYTHEMA 15'	OEDEMA 15'	ERYTHEMA 1h	OEDEMA 1h	ERYTHEMA 24h	OEDEMA 24h
1 D046G	M	0	0	0	0	0	0

0,00	0,00	0,00	0,00	0,00	0,00

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HeiQ Viroblock is dermatologically tested as **Non-irritating**

HEIQ MATERIALS AG — Farcoderm — SI.01.C_2011/1778 — 30/09/2011

CONCLUSIONS

The table and the graphs listed above contain the values of the erythema and oedema indices recorded for each of the 10 volunteers. Potential skin irritation of the product has been assessed according to the amended Draize classification.

On the basis of the data obtained we deem the non woven fabric:

HEIQ MATERIALS AG

FABRIC SAMPLE"8"

NON IRRITATING

"DERMATOLOGICALLY TESTED"

Siccomario – 30th September 2011

Experimenter — Dr. Enza Cestone

Quality control — Dr. Carmen Palumbo

Scientific supervisor — Prof. Fulvio Marzatico

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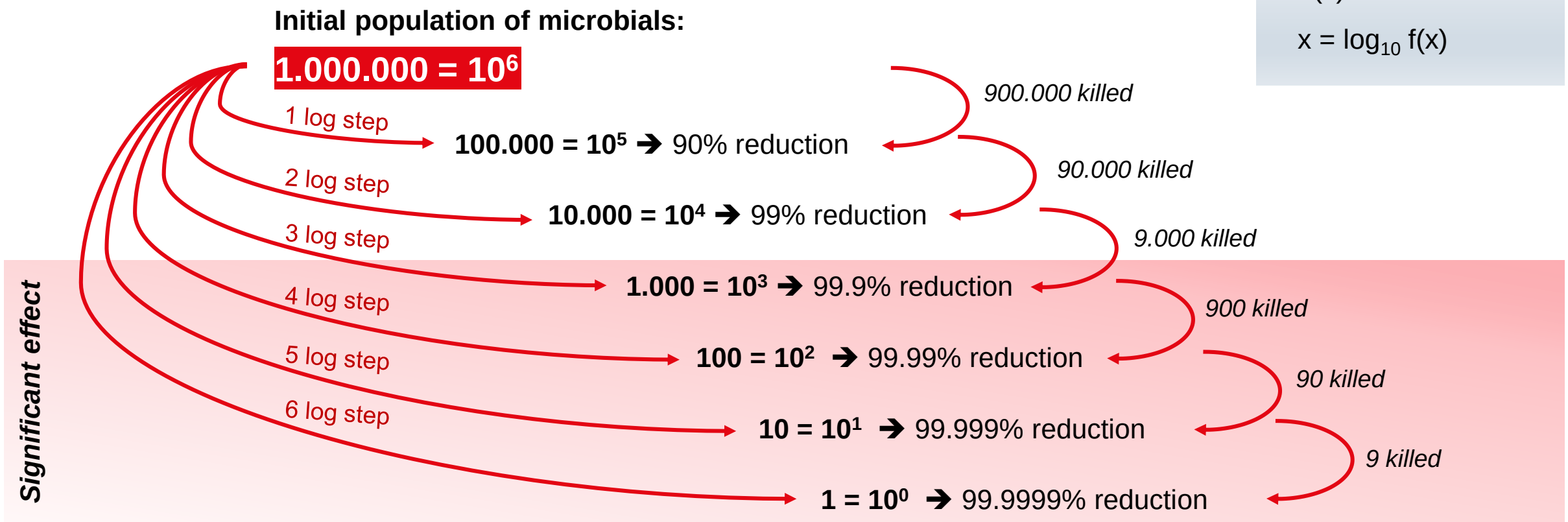
LOG* REDUCTION – WHAT DOES IT MEAN?

Exponential function:

$f(x) = 10^x$

$x = \log_{10} f(x)$

Example how to calculate



*Log = Logarithem to the base of 10

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