

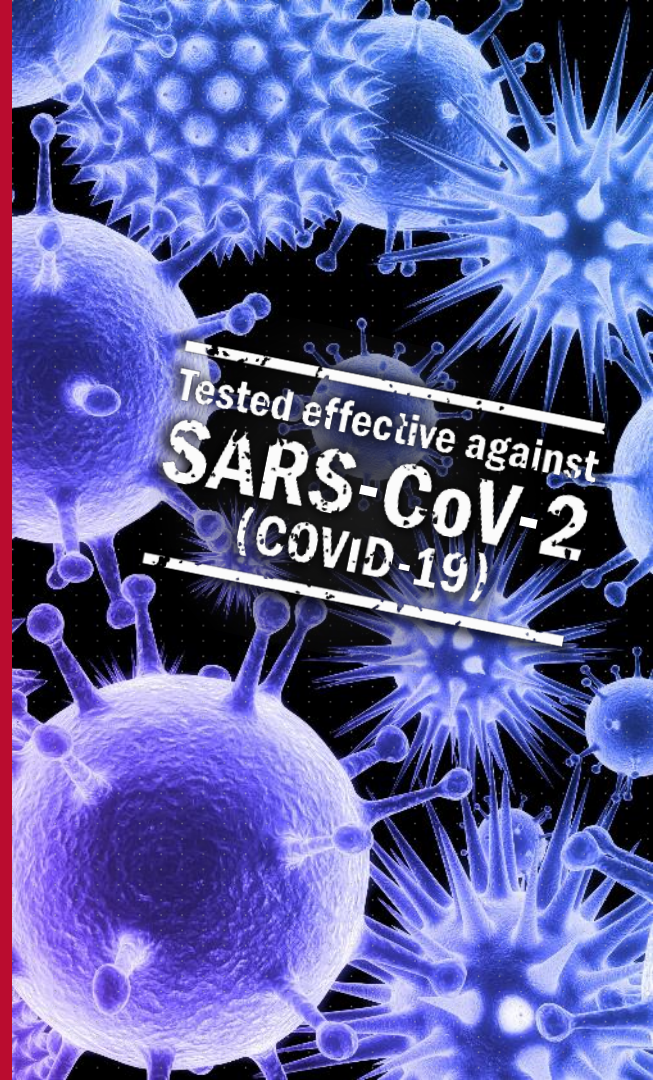
HEIQ  
**VIROBLOCK**

# Antiviral & Antibacterial protection

14 August 2020

SWISS  
TECH  
INSIDE

HeiQ Viroblock NPJ03





### ***Trademarks:***

*HeiQ, HeiQ Viroblock and Viroblock are trademarks or registered trademarks owned by HeiQ Materials AG. The use of such trademark(s) is subject to trademark licensing, review of test report and approval of claims by HeiQ. No unauthorized use permitted.*

### ***Use of content (specifically test data):***

*The use of this this presentation's content is subject to trademark licensing and review of test report. No unauthorized use of this content is permitted.*

Please contact [marketing@heiq.com](mailto:marketing@heiq.com) for more information.

# Differentiate. Innovate.

HeiQ is a three-in-one company:  
**Scientific research,**  
**Specialty materials manufacturing**  
**& Consumer ingredient branding.**

Our purpose is to improve the lives of billions of people by perfecting an every day product: Textiles.

SWISS  
TECH  
INSIDE

[HeiQ corporate video](#)





# HeiQ – Your innovation partner

HeiQ is a leader in textile innovation creating some of the most **effective, durable and high-performance textile technologies** on the market today

HeiQ engages with textile brands along the entire value chain to **innovate, differentiate products** and **capture the added value** at the point of sale



Founded in 2005  
by Carlo Centonze &  
Dr Murray Height



Swiss Federal Institute of  
Technology Zurich (ETH)  
spin-off



+90 professionals of  
20 nationalities in  
12 countries on  
5 continents

# Sustainability is at the core of our business.

For HeiQ, sustainability encompasses not only economic, environmental and social principles, but also product quality. Our purpose is to help make **textiles better.**

PFC-free  
water repellent:  
HeiQ Eco Dry



Destroys  
Coronavirus in  
minutes:  
HeiQ Viroblock

50% less  
insulation yet  
100% warmth:  
HeiQ XReflex

Rapid  
polyester dyeing:  
Award-winning  
HeiQ Clean Tech



Silver-free  
bio-based odor  
control:  
HeiQ Fresh  
FFL



HeiQ is bluesign  
partner since  
2011

**OEKO-TEX®**  
CONFIDENCE IN TEXTILES

Oeko-tex conform  
products



# HeiQ global network




▶ [Get to know our local technical mill support teams](#)



# HeiQ: All-in-one support

Aligned with your brand, HeiQ helps you realize the added value of innovations and provides the tailored tools and services you need for impact:



*hei q it!* – Fast fabric sampling tool [more...](#)


Partner mill recommendations

Local technical application services worldwide [more...](#)

Global supply chain solution provider

EHS & sustainability services [more...](#)

HeiQ Research and Development Lab

B2B2C Marketing services 

Consumer ingredient branding [more...](#)

International testing services [more...](#)

Legal compliance services [more...](#)



# Innovation partner of over 200 brands – Examples:

Sports & outdoor	
Intimate & hosiery	
Fashion & athleisure	
Home fashion	
Footwear	
Workwear	





# 17 major recognitions in 15 years

- 2020** Swiss Venture Club / Credit Suisse award
- 2019** Swiss Environmental Award
- 2018** Finalist E&Y Entrepreneur of the Year
- 2017** Top 30 Swiss Growth Champions
- 2016** Swiss Technology Fund Award
- 2015** Swiss Top 10 McKinsey Venture Graduate
- 2013** Finalist Swiss of the Year
- 2011** European Environmental Press Award
- 2010** Swiss Technology Award
- 2010** Swiss Equity Fair Winner
- 2009** Finalist E&Y Entrepreneur Of the Year
- 2008** KTI Technology Entrepreneur
- 2007** McKinsey / ETH Venture Prize
- 2007** Venture Leaders Award
- 2006** W.A. DeVigier Foundation Award
- 2006** IMD Startup Award
- 2005** Siska-Heuberger Prize



**KTI/CTI**

DIE FÖRDERAGENTUR FÜR INNOVATION  
L'AGENCE POUR LA PROMOTION DE L'INNOVATION  
L'AGENZIA PER LA PROMOZIONE DELL'INNOVAZIONE  
THE INNOVATION PROMOTION AGENCY



venturelab

# HeiQ manufacturing capability

## Bad Zurzach, Switzerland

- Microcomposites plant – 2 tpa
- Textile formulation plant – 5'000 tpa
- Masterbatch plant – JV with Sukano AG

## Concord(NC) & Calhoun(GA), USA

- Textile formulation plant – 13'000 tpa
- Polymer synthesis plant – 12'000 tpa

## Geelong, Australia

- Short polymer fiber plant – 10 tpa
- Textile formulation plant – 5'000 tpa



**Expertise in scale-up of unique materials  
manufacturing process from lab through  
industrial scale production**





# HeiQ development laboratories

## Zürich, Switzerland & Concord, North Carolina USA

- State-of-the-art textile testing & development laboratories
- Our dedicated team of textile chemists offers product development, customized solutions & testing services



## Laboratory capabilities

- Chemical reactions
- Polymer synthesis
- Chemical formulations
- Particle milling
- Analytics
- QC
- Recipe development
- Textile application
- Textile testing
- Membrane testing
- Antimicrobial testing
- VOC testing
- Pilot plant textile application
- *heiQ it!* fabric library



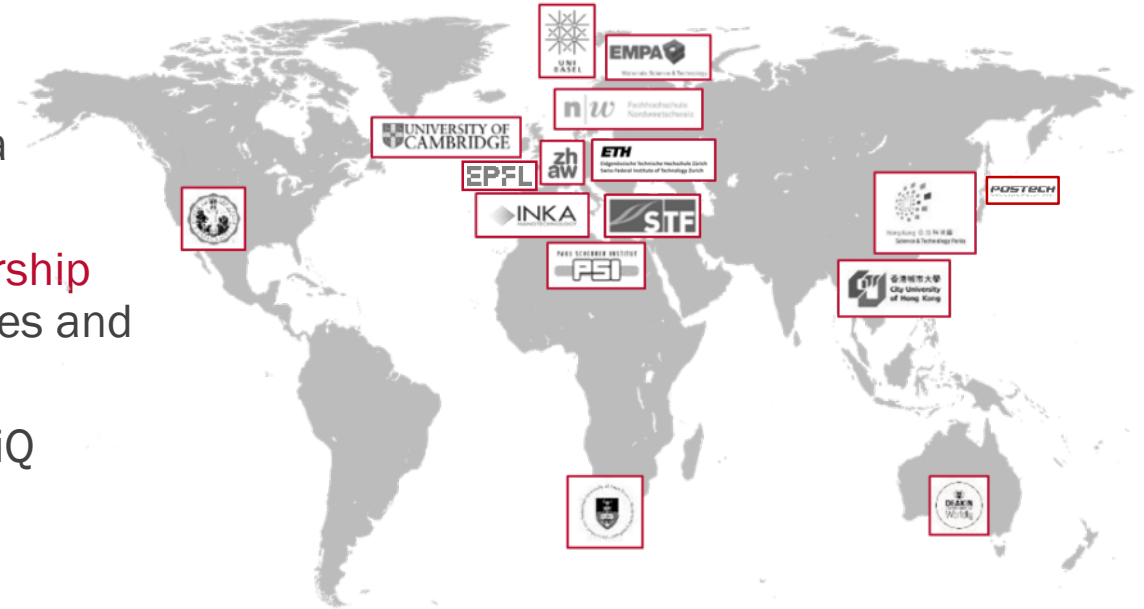
# HeiQ research network

HeiQ internal product development team of 12 chemists

HeiQ achieves its research objectives primarily through a **boundless research network**

HeiQ **sparks engaged partnership** with researchers at universities and institutes around the world

Today 40+ PhD's work on HeiQ projects





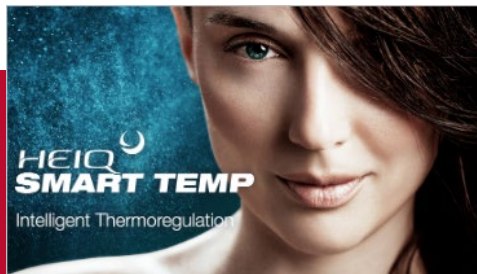
# HeiQ scientific board

<b>Martin Loessner</b> Prof. Dr.	ETH Zürich Switzerland	Microbiology & food sciences
<b>Clemens Holzer</b> Univ. Prof. Dipl. Eng. Dr. mont.	Montanuniversitaet Leoben Austria	Polymer science & processing
<b>Hyung Gyu Park</b> Prof. Dr.	POSTECH South Korea	Nanotechnology & process engineering
<b>Thierry Pelet</b> Dr.	EPFL Lausanne Switzerland	Molecular biology & virology
<b>Wey Yang Teoh</b> Dr.	Australia	Nanotechnology & Photocatalysis
<b>Hendrik Tevæarai</b> Prof. Dr. med., EMBA HSG	Switzerland	Cardiology & medical sciences
<b>Paul Collins</b> Assoc. Prof. Dr.	Deakin University Australia	Engineering & sports physiology
<b>Alessandra Sutti</b> Assoc. Prof. Dr.	Deakin University Australia	Biomaterials & materials science





# HeiQ key innovation families



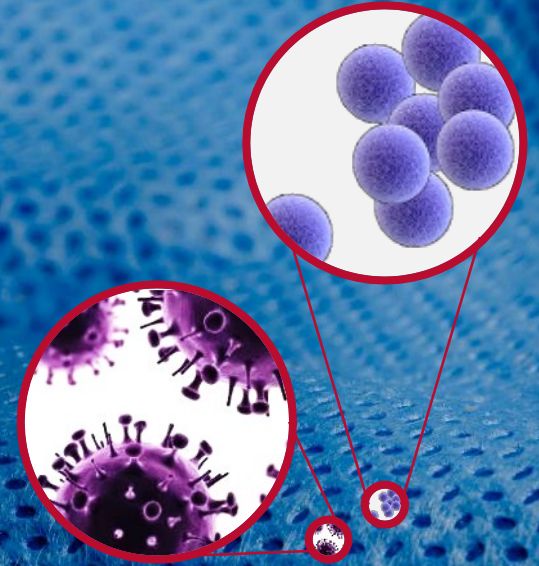


# What is the issue?



# 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** <sup>[1]</sup>
- Viruses and bacteria can **remain active on textile surfaces from days to months** <sup>[2]</sup>
- E.g. Research has shown that the **human coronavirus (SARS-CoV)** can persist for **up to 2 days** on surgical gowns at room temperature.<sup>[3]</sup>



[1] K.Sack "Hospital Infection Problem Persists", New York Times (April 13, 2010).

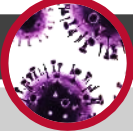
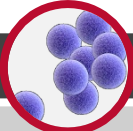
[2] A.Kramer, I.Schwebke, G.Kampf (2006) "How long do nosocomial pathogens persist on inanimate surfaces? A systematic review", BMC Infectious Diseases, 6(130).

[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.

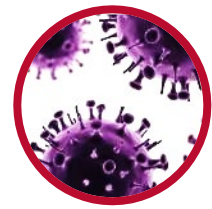




# What are viruses and bacteria?

	Viruses 	Bacteria 
<i>Definition</i>	<ul style="list-style-type: none"> <li>▪ Infectious substances (DNA or RNA)</li> <li>▪ Usually infect specific cell types (of plants, animals, humans)</li> <li>▪ Mostly harmful and can cause diseases</li> </ul>	<ul style="list-style-type: none"> <li>▪ Single cell organisms</li> <li>▪ Natural part of environment, and present in large numbers inside and on the outside of the human body</li> <li>▪ Mostly harmless, but some bacteria can cause harmful diseases</li> </ul>
<i>Types</i>	<ul style="list-style-type: none"> <li>▪ <b>Enveloped</b> (by a lipid, fatty, cholesterol rich membrane), more than 60% of all existing pathogenic viruses</li> <li>▪ <b>Non-enveloped</b></li> </ul>	<ul style="list-style-type: none"> <li>▪ Gram positive</li> <li>▪ Gram negative</li> </ul>
<i>Size*</i>	20-300 nm	About 1'000 nm
<i>Replication</i>	By invading a living host cell which replicates and releases the new virions	Rapidly by cell division
<i>Examples</i>	<b>Coronavirus</b> (e.g. <b>SARS-CoV-2</b> ), Human and avian influenza virus (H1N1, H5N1), Herpes simplex virus, Hepatitis virus, HIV	<i>Gram pos.:</i> Staphylococcus aureus, MRSA ("golden staph"), MSSA; <i>Gram neg.:</i> Escherichia coli, Klebsiella pneumoniae, Salmonella typhimurium
<i>Diseases</i>	<b>COVID-19</b> , Influenza, Chickenpox, SARS, HIV	Food poisoning, Meningitis, Pneumonia

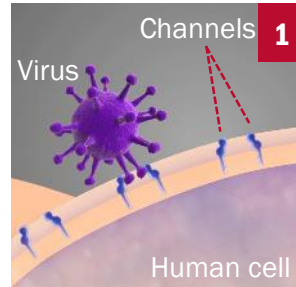
\* Lakna, «Difference Between Bacteria and Virus», 2017, Pediaa



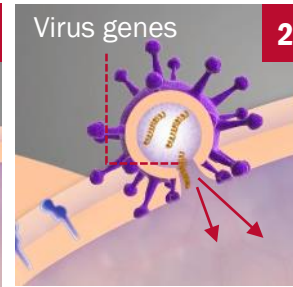
# Key steps in the virus replication cycle

- 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**

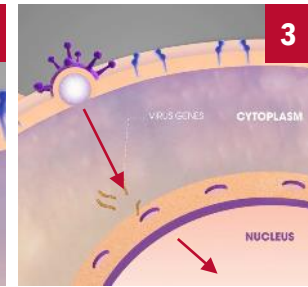
**1** Binding: Virus binds to the preferential pore channels of the human cell



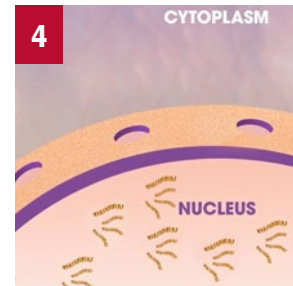
**2** Entry: Virus or its genome enters in the human cell



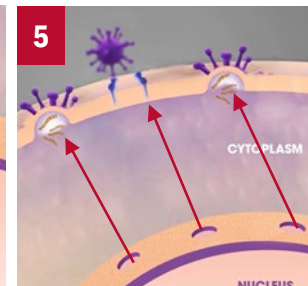
**3** Uncoating: Genome leaves its protective capsid (membrane)



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



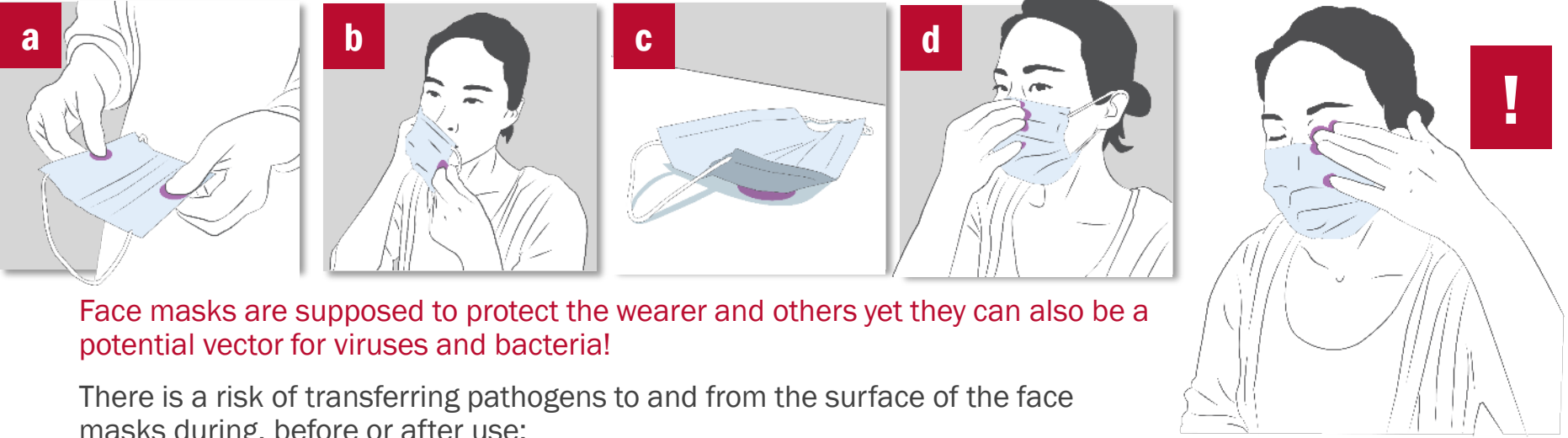
**5** Release: Through the channels, new virions are released from the cell and being “coated” with human cell wall components (cholesterol rich membrane)



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



# 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!



# What is the solution?



# HeiQ Viroblock NPJ03 – Antiviral textile technology

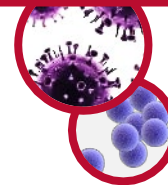
- Breakthrough, patent-pending combination of two synergistic HeiQ technologies:

- A** HeiQ's **registered silver technology** for antiviral and antibacterial effect (non-nano)
- B** HeiQ's fatty **vesicle technology** as a **booster**

- HeiQ Viroblock NPJ03 **kills bacteria & destroys harmful enveloped viruses** (such as influenza & coronavirus) **in minutes**
- Effective **protection against contamination and transmission** of viruses and bacteria that may be hosted in textiles
- High performance up to 30 gentle washings at 60°C (140°F)
- Certified as safe and sustainable as all its ingredients are cosmetic grade (INCI), bio-based and recycled



Tested effective against  
**SARS-CoV-2 (COVID-19):**  
**99.99% reduction**



**HEIQ**  
**VIROBLOCK**

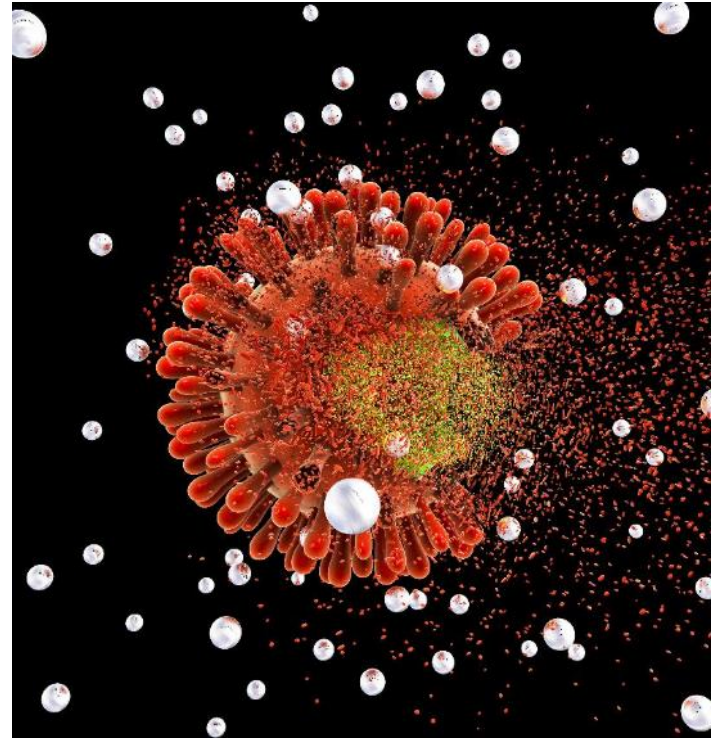




# A Silver component binds and destroys the virus

Silver binds permanently to sulfur groups within the virus structure and disrupts biochemical pathways [1]

- Silver is a potent antibacterial and antiviral substance due to its unique chemical and physical properties [1, 2]
- **Silver is effective at destroying viruses** following short exposure of isolated viruses [2]
- HeiQ's non-nano silver material contributes to a broad-spectrum of antiviral mechanisms that are not prone to inducing resistance



[1] Rogers, J.V. et al., (2008) Nanoscale Research Letters, 3(4), pp.129-133.

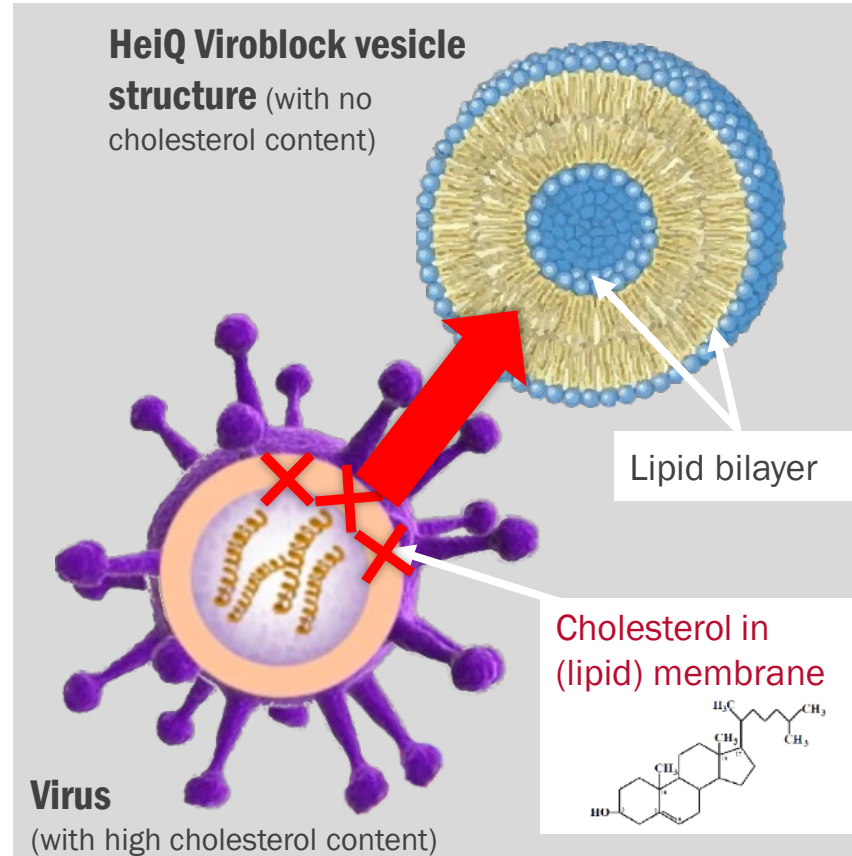
[2] Galdiero, S. et. al. (2011) Molecules, 16(10), pp.8894-8918.



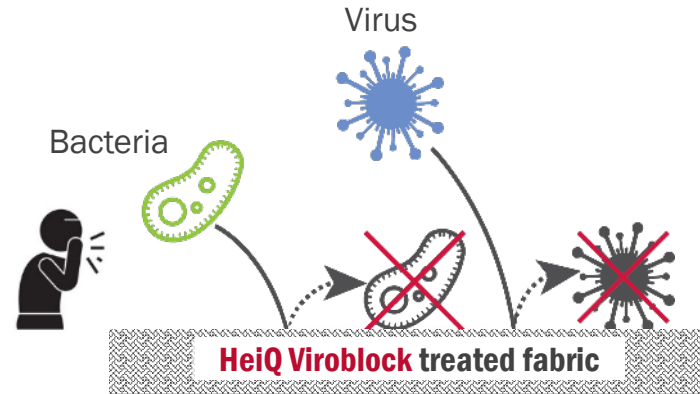
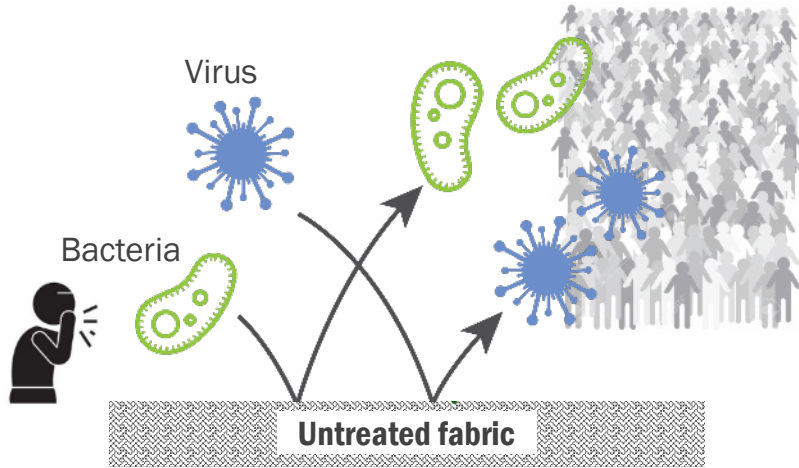
# B Vesicle component destroys the viral membrane

The fatty spherical vesicle technology helps to deplete the viral membrane of its cholesterol content in minutes → aiding the silver to rapidly destroy the virus

- HeiQ Viroblock vesicle technology (Liposomes) works as a **booster**
- The vesicle technology functions by **directly targeting the lipid envelope** (membrane) surrounding the enveloped viruses
- The vesicle components (without any cholesterol) deplete the cholesterol from the virus envelope



# 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)

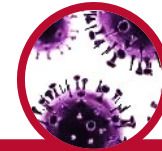
- Textiles treated with HeiQ Viroblock actively inhibit viruses and kill bacteria upon contact on the surface
- By keeping the textile free of viable viruses and bacteria, HeiQ Viroblock treated textiles help to minimize the potential for re-transmission of pathogens from textiles



# Strong antiviral effect on SARS-CoV-2 (COVID-19)

- 100% polyester woven treated with **HeiQ Viroblock NPJ03**
- Testing against SARS-CoV-2, an enveloped virus from the coronavirus family that causes COVID-19
- Two laboratory test methods were used to assess the residual infectivity of virus remaining on inoculated fabric samples after a contact time of 30 minutes:

*One of the **first** textile technologies in the world to be proven effective against SARS-CoV-2 in the laboratory*



Test A	Sample	Avg. Log TCID <sub>50</sub> /ml	Log reduction *	% reduction *
	Inoculum	5.9		
	HeiQ Viroblock treated sample	0.0	5.9	>99.99%

Test B	Sample	Avg. Log TCID <sub>50</sub> /ml	Log reduction *	% reduction *
	Inoculum	5.0		
	HeiQ Viroblock treated sample	1.0	4.0	99.99%

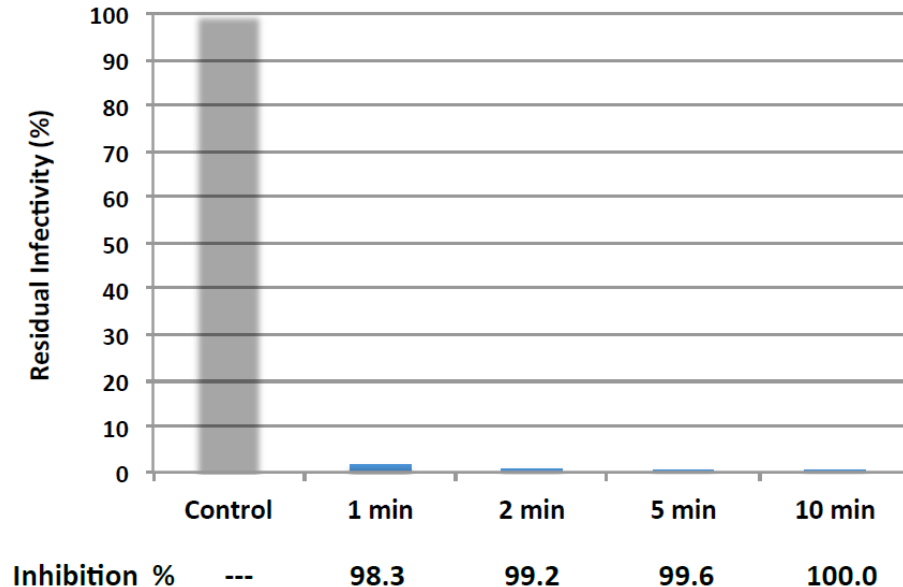
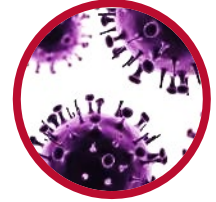
**ANTIVIRAL** effect demonstrated against **SARS-CoV-2** within **30 minutes**

\* Reduction relative to inoculum values after 30 minutes



# 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)

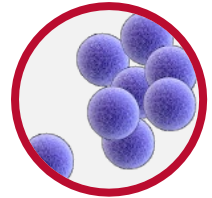


**RAPID ANTIVIRAL** effect demonstrated within 2 to 5 minutes



# 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 x 10 <sup>5</sup>				5.17 x 10 <sup>5</sup>
cfu sample		6.63 x 10 <sup>4</sup>	2.23 x 10 <sup>3</sup>	6.93 x 10 <sup>2</sup>	≤ 9.9 x 10 <sup>1</sup>
log reduction		0.8	2.3	2.8	3.6
% reduction		84.74%	99.5%	99.84%	99.98%

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

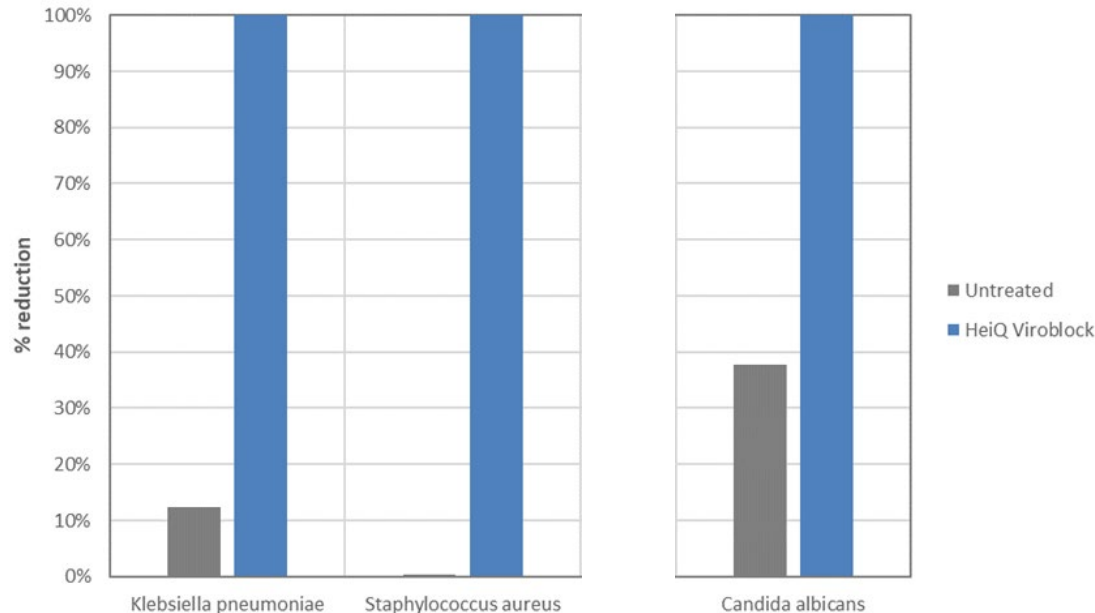
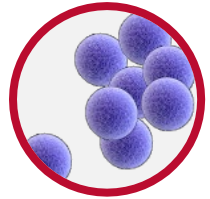
**ANTIBACTERIAL** effect demonstrated within 20 to 30 minutes

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



# Antibacterial effect on bacteria

- 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?"

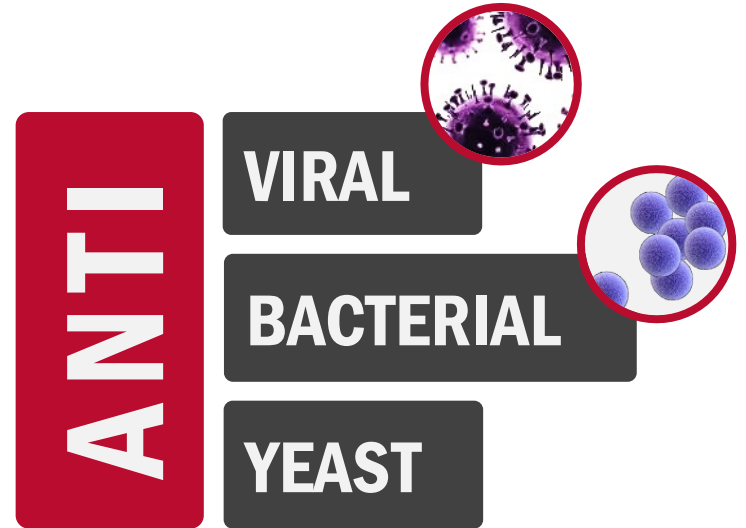


# HeiQ Viroblock NPJ03 Antiviral textile technology

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 10% w.o.f.
- Non-dangerous good: logistics and storage convenient





# How can HeiQ Viroblock be tested?



# HeiQ Viroblock – Quality Validation tests

- HeiQ has empirically correlated the antiviral textile test ISO 18184 to the antibacterial textile test ISO 20743 (for **hydrophilic** fabrics), and the antiviral textile test ISO 21702 to the antibacterial textile test ASTM E2149 (for **hydrophobic** fabrics)
- **Quality Validation (QV)** for a new HeiQ Viroblock treated textile is free of charge
- To correlate and validate a HeiQ Viroblock NPJ03 treated textile, one of the following antibacterial tests need to be performed at the Swiss contract lab Microbe Investigations AG (MIS) or its subsidiary in China:
  - **ISO 20743** quantitative antimicrobial test with *Staphylococcus aureus* for **hydrophilic** fabrics, or
  - **ASTM E2149** quantitative antimicrobial test with *Staphylococcus aureus* for **hydrophobic** fabrics
- With a positive QV result, HeiQ will validate the Mill and onboard the customer for HeiQ Viroblock trademark license agreement with an **antimicrobial claim**
- In case the customer wishes to **claim antiviral efficacy** on their products, HeiQ requires customer to **initiate** performance of an ISO 18184 (for **hydrophilic** fabrics) and ISO 21702 (for **hydrophobic** fabrics) antiviral test with one QV approved selected fabric sample prior to signing a trademark license agreement (with the **enveloped** virus H3N2 or H1N1 or a Coronavirus type), HeiQ can recommend testing laboratories, HeiQ does not perform antiviral tests internally.

**Passing criteria:**  
**Log reduction  $\geq 3$**   
initial, and (for washable items)  
**Log reduction  $\geq 2.2$**   
after 10 or more washes  
*acc. to ISO 6330 4G*



# HeiQ Viroblock – Quality Control tests

- **Quality Control (QC) at cost** at MIS or at a reputable 3rd party laboratory:
  - **HeiQ Viroblock Identifier Test Protocol**  
as qualitative test (Pass/Fail) at MIS at 50 US\$ per sample or done by mill, supported with test kit (Incoterms DDP: 150US\$ per kit and 50US\$ for renewables package)
  - **HeiQ Yogurt Bac test**  
as qualitative test (Pass/Fail) at MIS for 50 US\$ per sample
  - **ISO 20743 or ASTM E2149**  
quantitative antimicrobial test with *Staphylococcus aureus* at MIS for 150 US\$ per sample
  - **AATCC 147**  
as qualitative (Pass/Fail) antimicrobial test with *Staphylococcus aureus* at a reputable 3rd party lab
  - **ISO 20743 or JIS 1902 or ASTM E2149**  
quantitative antimicrobial test with *Staphylococcus aureus* at a reputable 3rd party lab





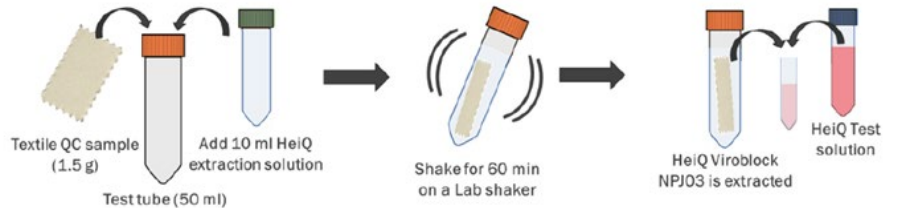
# HeiQ Viroblock Identifier Test Protocol

# HeiQ Viroblock Identifier Test Protocol

Analytical determination of the marker present in HeiQ Viroblock NPJ03 (detection right after padding application):

- (a) In-line *semi-quantitative* colorimetric method (visual comparison with positive and negative control), or
- (b) Off-line *quantitative* spectrophotometric method (measurement by spectrophotometric apparatus)

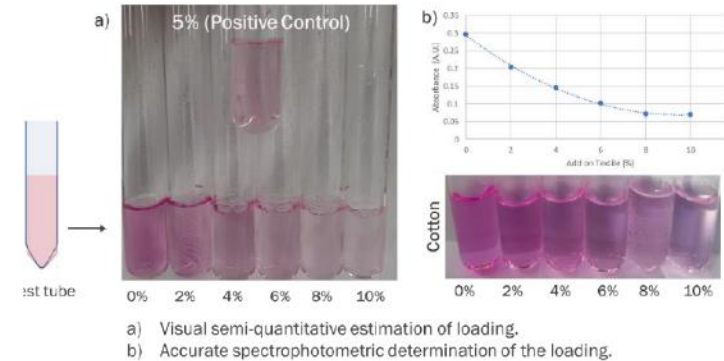
## Test procedure:



1) Sample preparation

2) Sample extraction

3) Sample transfer and color display



4) Determination of loading exemplified for Cotton

[Watch the video!](#)





# Antibacterial test methods

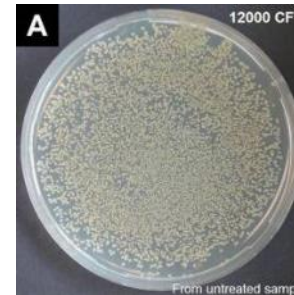
ISO 20743 & HeiQ Yogurt Bac test

# Bacteriostatic efficacy test: ISO 20743

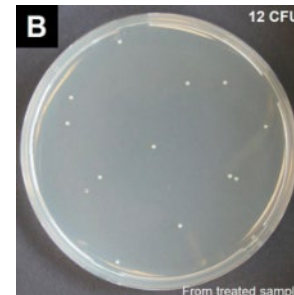
Quantitative test method for the determination of bacteriostatic activity on textiles including nonwovens



- This test method is applicable to **all textile products** including material for apparel, home textiles, cloth, wadding, thread etc.
- **Widely accepted** method for textile samples
- Specified organism:  
*Staphylococcus aureus*  
*Klebsiella pneumoniae*



Untreated



Treated with  
HeiQ Pure TAG



# HeiQ Yogurt Bac test – Qualitative method

Fast and simple test for quick proof of concept

## Procedure:

Adding diluted sterile UHT (Ultra High Temperature) milk and non-pathogenic blended (Yogurt/bifidus) bacteria sample onto fabric (incubation: 15 hours at 40°C)

## Evaluation:

pH-measurement for control purposes:

- Fail** ✘ pH < 5.5 (lactic acid present)
- Pass** ✔ pH > 6.5 (no noteworthy amount of lactic acid)

Qualitative olfactory evaluation:

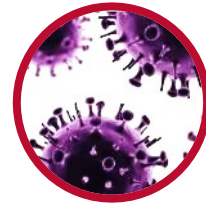
- Fail** ✘ Odor present
- Pass** ✔ Odor not present





# Antiviral efficacy test: ISO 18184

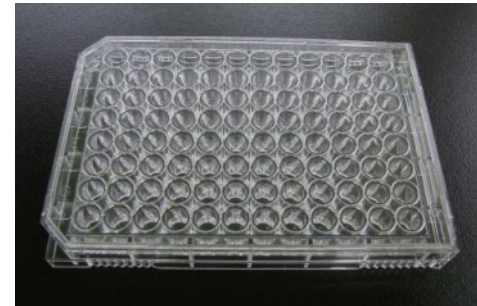
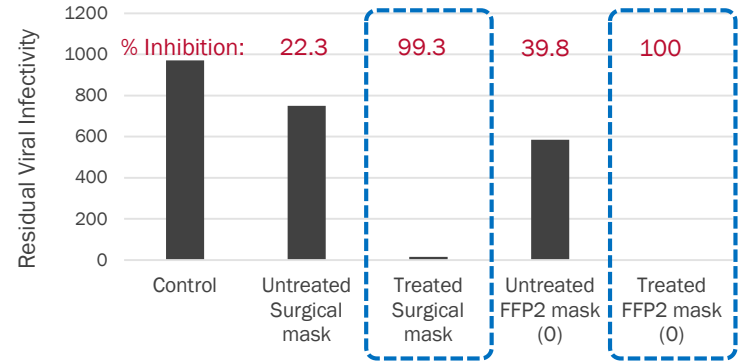
Testing for antiviral efficacy



# Antiviral efficacy test: ISO 18184

Quantitative test method to assess the antiviral performance of textile products against specified viruses

- Viruses are deposited onto the test fabric
- After specific contact time, the remaining infectious virus is counted
- The reduction rate is calculated by the comparison between the antiviral fabric and the control fabric by common logarithm
- The infectious virus titre is measured with the number of infectious viral particles present per unit volume in a cell lysate



96 wells microplate for TCID50 method



# Antiviral & antibacterial efficacy test results

65% Polyester / 35% Cotton woven treated with **HeiQ Viroblock NPJ03** tested against Influenza virus (H3N2) and its correlated test results against Staph. A.:

ISO 18184 method (Influenza virus H3N2)	Log reduction	% reduction
HeiQ Viroblock treated sample (10 x washes 40°C)	3.10	99.92%
HeiQ Viroblock treated sample (20 x washes 40°C)	2.20	99.37%

ISO 20743 method (Staph. A.)	Log reduction	% reduction
HeiQ Viroblock treated sample (10 x washes 40°C)	3.4	99.96%
HeiQ Viroblock treated sample (20 x washes 40°C)	2.4	99.61%

The HeiQ Viroblock NPJ03 treated PES/CO fabric shows **excellent antiviral and antibacterial efficacy!**





# HeiQ Viroblock face masks put to the test!





# FFP2 control face mask vs. FFP2 HeiQ Viroblock treated



VS.





# Droplet breakthrough simulation



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

- A 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



# **Aerosol challenge test: ASTM F2101**

Testing for antiviral efficacy specific to face masks

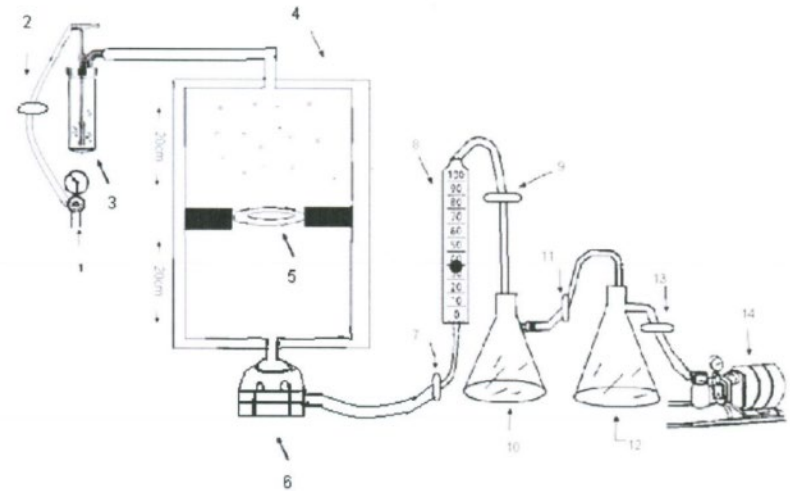


# Aerosol challenge test: ASTM F2101

For the evaluation of the virus filtration efficiency of treated face mask materials against viruses

## Method summary

- Based on ASTM Method F 2101.01 with modifications and customization to virus testing.
- Test mask is mounted and sealed within a test chamber
- A nebulizer delivers an aerosol of the target virus inoculum to the upstream side of the mask
- A vacuum draws air through the mask
- A collection dish placed below the mask downstream collects aerosol droplets and viruses that pass through the mask sample
- The reduction in infectivity of the virus with control and treated mask is calculated as an indicator of effectiveness



Key

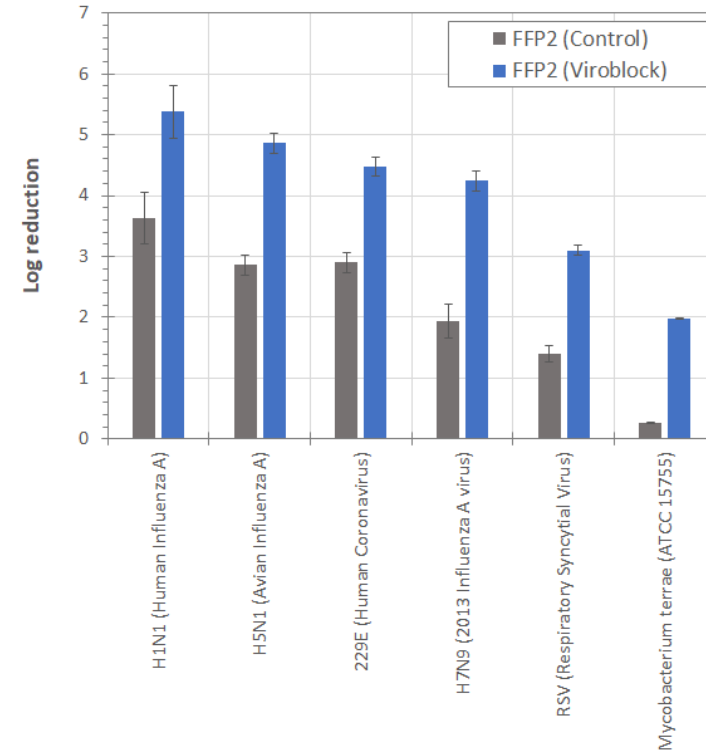
- |                             |                                |                 |
|-----------------------------|--------------------------------|-----------------|
| 1. High pressure air source | 7. Filter #2                   | 13. Filter #5   |
| 2. Filter #1                | 8. Calibrated Flowmeter, L/min | 14. Vacuum pump |
| 3. Nebulizer                | 9. Filter #3                   |                 |
| 4. Mask chamber             | 10. 4L Vacuum flask #1         |                 |
| 5. Test material location   | 11. Filter #4                  |                 |
| 6. Anderson Impactor        | 12. 4L Vacuum flask #2         |                 |



# Aerosol challenge test

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

Study ID	Agent	Log reduction			% reduction	
		Control	HeiQ Viroblock	$\Delta$ *	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 **greatly (>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  $\Delta = 1$  indicates 10x;  $\Delta = 2$  indicates 100x



# Misting spray contact test: AATCC 100

Contact Kill testing for antiviral efficacy  
specific to face masks



# 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 inches
- 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



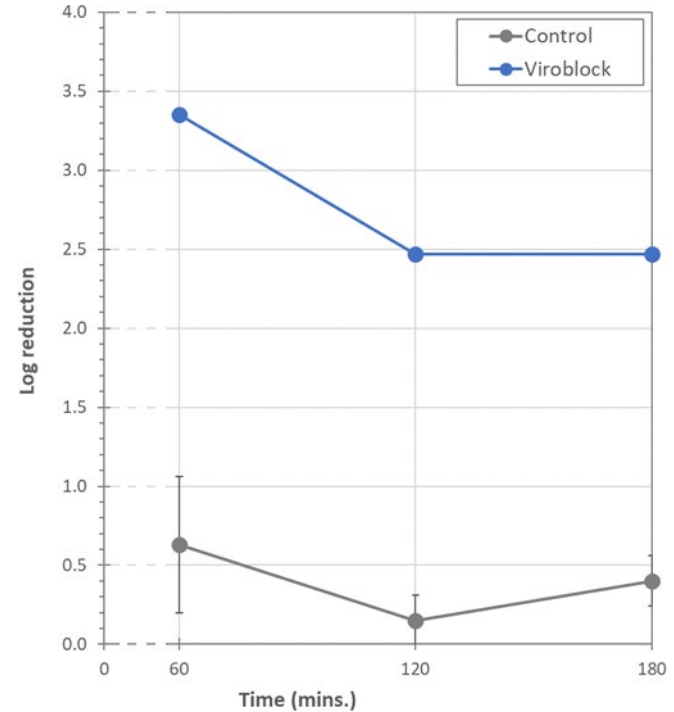


# Misting study results – time series

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

Study	Agent	Time (mins)	Log reduction	
			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



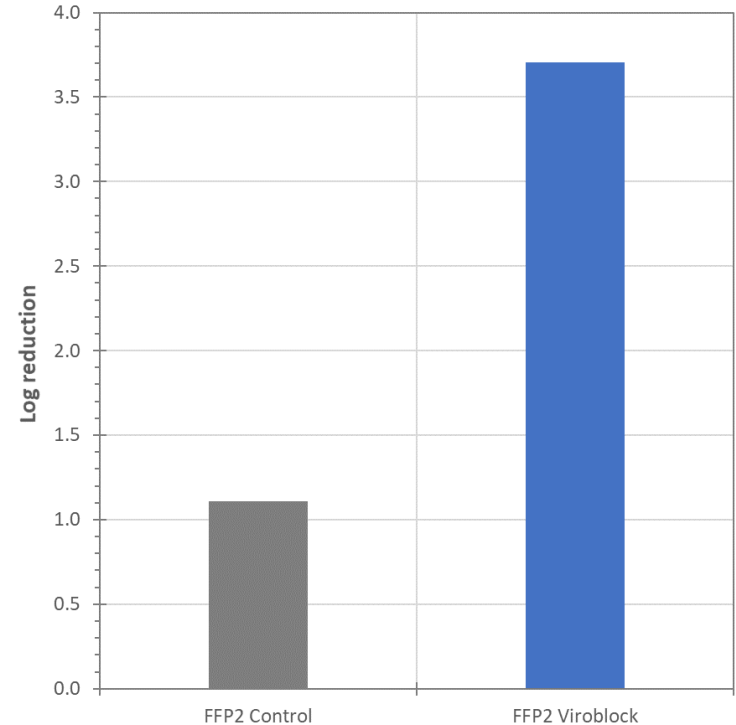


# Misting study results – time series

- FFP2 HeiQ Viroblock face masks (Untreated control vs treated)

Study ID	Agent	Log reduction			% reduction	
		Control	HeiQ Viroblock	$\Delta$ *	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  $\Delta = 1$  indicates 10x;  $\Delta = 2$  indicates 100x



# Face mask performance comparison

- 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. <sup>1, 2)</sup>
- FFP2 mask material treated with HeiQ Viroblock showed similar virus reduction to FFP3 mask material** <sup>3)</sup>
- Masks treated with HeiQ Viroblock provide significantly **greater protection against surface contamination** of the mask material <sup>4)</sup>

Mask type	Metabolic cost (W/m <sup>2</sup> ) <sup>1</sup>	Max breathing resistance (Pa) <sup>2</sup>	Log reduction (H1N1 human influenza)			
			Aerosol protection <sup>3</sup>		Surface protection <sup>4</sup>	
			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



# Where can HeiQ Viroblock be used?



# HeiQ Viroblock application areas

## All fiber types

HeiQ Viroblock NPJ03 is suitable for:

- Protective masks (esp. respirators like N95, FFP2 or equivalent)
- Medical nonwovens (eg. surgical gowns, scrubs, drapes, curtains etc.)
- Clothing, home textiles, public transport
- Air filters

*Antimicrobial efficacy of HeiQ Viroblock NPJ03 lasts at least 30x washes (60 °C/140 °F gentle washing).*





# HeiQ Viroblock makes the difference



# HeiQ Viroblock's unique selling points

- HeiQ Viroblock treated textiles help to **reduce the risk of viral and bacterial persistence on dry inanimate surfaces**, thereby lowering the potential for transmission
- HeiQ Viroblock confers **antiviral & antibacterial effect to textiles**
- HeiQ Viroblock is a **Swiss** technology
- HeiQ Viroblock technology's effectiveness has been **tried and tested as active** against viruses that commonly affect human health, including SARS-CoV-2 (COVID-19)



*Every few years, epidemics breakout globally or regionally causing disruption to lives, sometimes leading to social distress, financial market crashes and economic downturn.*

*Photo: Commuters wearing protective masks in a MTR station in Hong Kong on the 5th day after first confirmed case of novel coronavirus (Covid-19) in Hong Kong.*

*Photo from CNBC, Paul Yeung | Bloomberg*

**SWISS  
TECH  
INSIDE**



# HeiQ Viroblock Consumer Benefits





# HeiQ Viroblock ingredient brand and hangtag



HeiQ Viroblock logo



SWISS TECH INSIDE logo  
Sewn-in label

HeiQ Viroblock  
hangtag (different  
versions available  
for different  
countries)



## Requirements to use HeiQ Ingredient Brand elements:

1. **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, according to "HeiQ Viroblock treated fabric validation rules".)
2. **Trademark license agreement:** Adherence to HeiQ's standard license agreement is required. Providing the brand company name and contact person is mandatory.
3. **Strict product label claim approval by HeiQ required** (no direct or implied healthcare claims allowed!)

Consult HeiQ for Guidelines and Approval process documents!

Disclaimer: Active healthcare claims on treated articles such as *antiviral* are not permitted in the USA and require pesticidal device registration. *Antiviral* claims are permitted in Germany on most treated articles and can be evaluated on a case-by-case basis in other EU territory. Please contact HeiQ for all treated article claims approval prior to commercialization.



# Regulatory coverage of HeiQ Viroblock



# Regulations & 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 **EU BPR** and **EU REACH** compliant, and the main ingredient is registered with **US TSCA** and **US EPA**. *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!***



Oekotex approved; ZDHC and bluesign® homologized

# Human patch test results

**Farcoderm**  
TESTED WELLNESS

In collaboration with:  
University of Pavia  
Prof. FULVIO MARZATICO  
Laboratory of Pharmacobiotechnology  
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](mailto:information@farcoderm.com) - [www.farcoderm.com](http://www.farcoderm.com)  
Company with certified UNI EN ISO 9001:2008 quality management system

HEIQ MATERIALS AG

Far

Report n. SE 01 C  
Date: 2011

## RESULTS

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

### OEDEMA AND ERYTHEMA REACTIONS

Panelist name	Sex	ERYTHEMA 12h	OEDEMA 12h	ERYTHEMA 16h	OEDEMA 16h	ERYTHEMA 24h	OEDEMA 24h
1. DR480	M	0	0	0	0	0	0
2. DR040	F	0	0	0	0	0	0
3. GR02T	F	0	0	0	0	0	0
4. PR05C	F	0	0	0	0	0	0
5. SE08E	F	0	0	0	0	0	0
6. DR41E	F	0	0	0	0	0	0

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

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](mailto:information@farcoderm.com) - [www.farcoderm.com](http://www.farcoderm.com)  
Company with certified UNI EN ISO 9001:2008 quality management system

HEIQ MATERIALS AG

**Farcoderm**  
TESTED WELLNESS

Report n. SE 01 C\_2011/1778  
Date: 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"**

San Martino Siccomario - 30<sup>th</sup> September 2011

Experimenter  
Dr. Enza Cestone

Quality control  
Dr. Carmen Palumbo

Scientific supervisor  
Prof. Fulvio Marzatico

Page 10 out of 11

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](mailto:information@farcoderm.com) - [www.farcoderm.com](http://www.farcoderm.com)  
Company with certified UNI EN ISO 9001:2008 quality management system

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

For **antimicrobial & odor control** on textiles, please take a look at our **HeiQ Pure** products:

**HEIQ**   
**PURE**





# Differentiate. Innovate.

## HeiQ Switzerland

HeiQ Materials AG  
Ruetistrasse 12  
8952 Schlieren (Zurich)  
Switzerland

Phone: +41 56 250 68 50  
Fax: +41 56 250 68 41  
info@heiq.com

[www.heiq.com](http://www.heiq.com)

## HeiQ Australia

HeiQ Australia Pty. Ltd.  
P.O. Box 940  
Geelong VIC 3220  
Australia

## HeiQ Taiwan

HeiQ Company Limited  
No. 14, Ln. 50, Wufu 1st Rd.  
Luzhu District  
Taoyuan City 33850  
Taiwan (R.O.C.)

## HeiQ China

HeiQ Materials Company Limited  
Shanghai  
Room 2011, Xuhui Commercial  
Mansion, No. 168 Yude Road,  
Shanghai  
China

## HeiQ USA

HeiQ ChemTex Inc.  
P.O. Box 5228  
Concord, NC 28027  
USA

## HeiQ Portugal

c/o Idvance Consulting, LDA  
Rua Dr.Joaquim Nogueira dos  
Santos, n°852, 5  
4475-474 Maia  
Portugal

SWISS  
TECH  
INSIDE

Follow us:

