Building High Performance Filter

Challenges & Solutions

Robrecht Hendrikx
Market Manager for Venting & Filtration,
Nitto Belgium

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Host Introduction

Robrecht Hendrikx

Market Manager for Venting & Filtration, Nitto Belgium

Robrecht Hendrikx is the Market Manager for Venting & Filtration at Nitto Belgium. Robrecht has a master's in mechanical engineering and has worked in air filter/vent filter applications for over 30 years. In that time, he has developed various HEPA/ULPA air filtration systems in multiple different markets including clean rooms, respiratory equipment, appliances, transportation, and more.

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Agenda

01 Design Challenges

02 TEMISH™ (ePTFE filter) as a Solution

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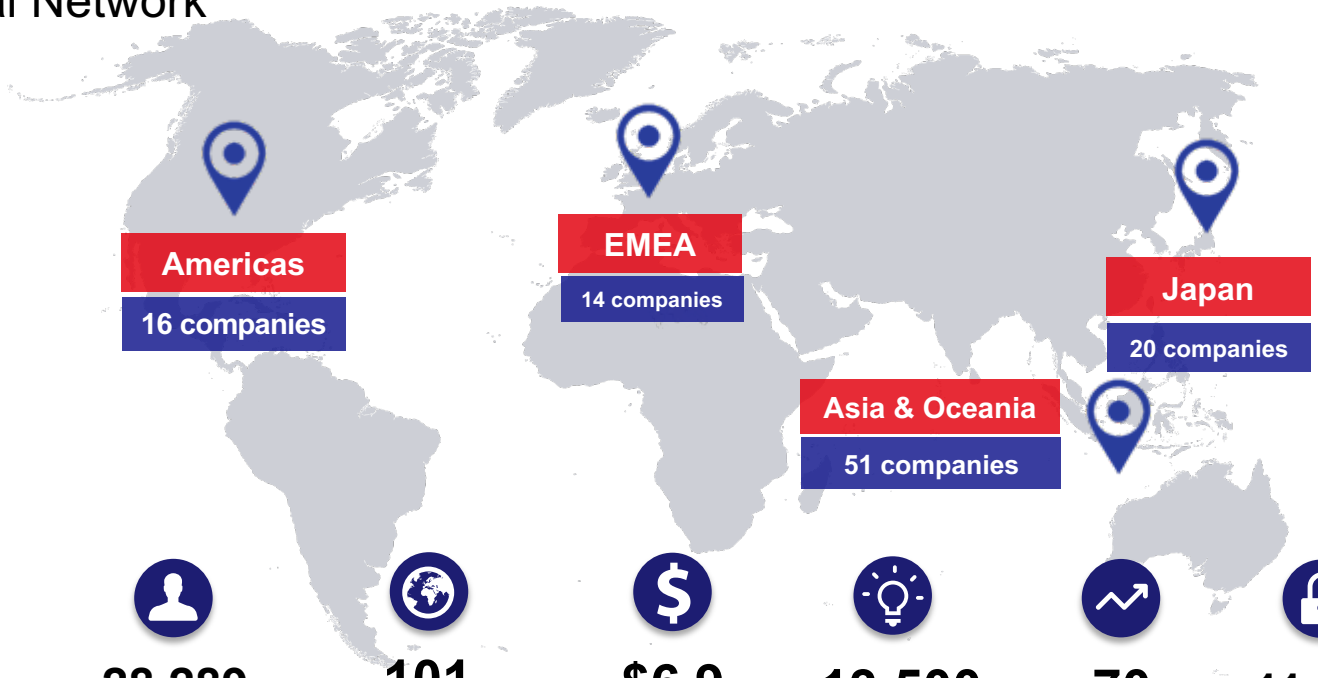
The Nitto Group

Global Network

*As of 2020 Group Report



1918
Year Founded

28,289
Employees Worldwide

101
Companies worldwide

$6.9
Revenue (Billion USD)

13,500
Products

70
Markets

11,200
Patent Families Granted or in Progress

Listed on the Tokyo Stock Exchange Market

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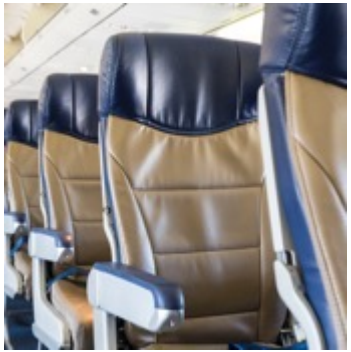
Design Challenges

The Challenge in Improving Air Quality





Customers' heightened awareness of air quality has increased demand for high-performance long-lasting filters. The need to create higher quality filters, or even retrofit existing systems for improved air purification, is creating new challenges for engineers needing to meet more difficult specifications.

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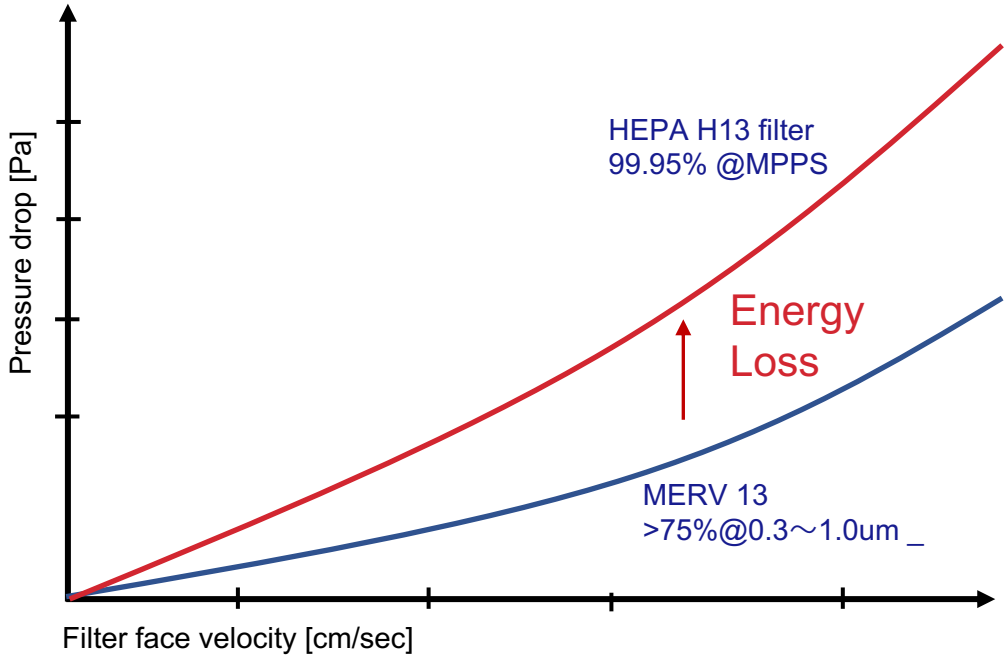
Balancing Collection Efficiency & Pressure Drop

Trade Off: Air Flow & Collection Efficiency



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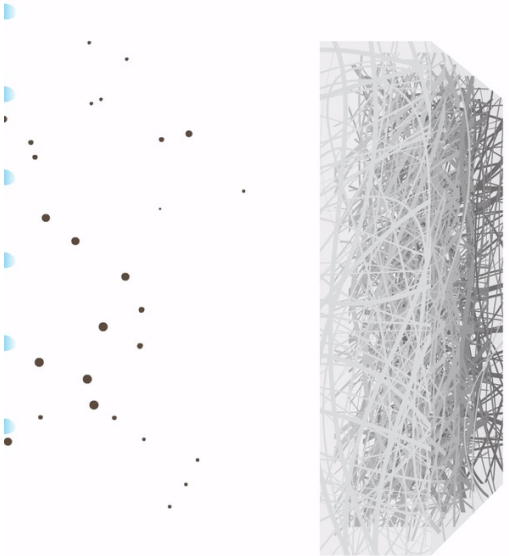
Filter Size/Pressure Drop

Traditional media requires more surface area to achieve pressure drop. The current industry trend is media with a smaller profile as to design smaller devices.



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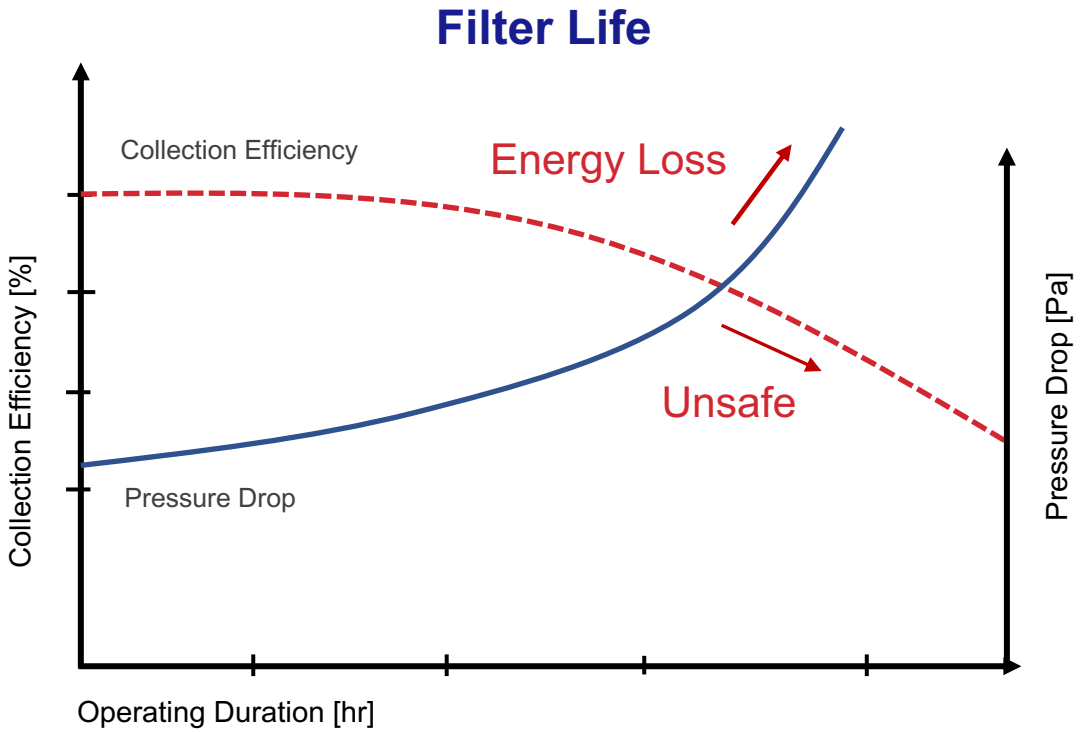
Longevity – Electret Charge



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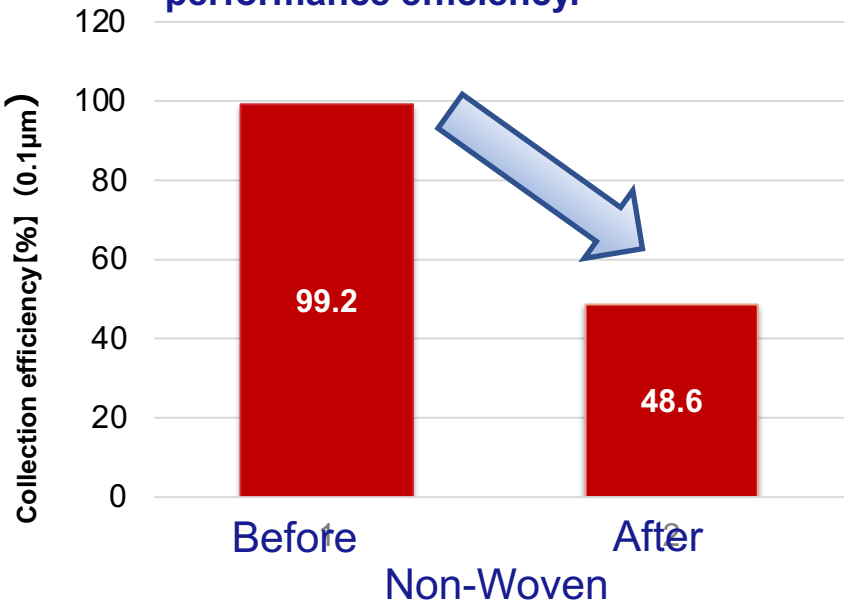
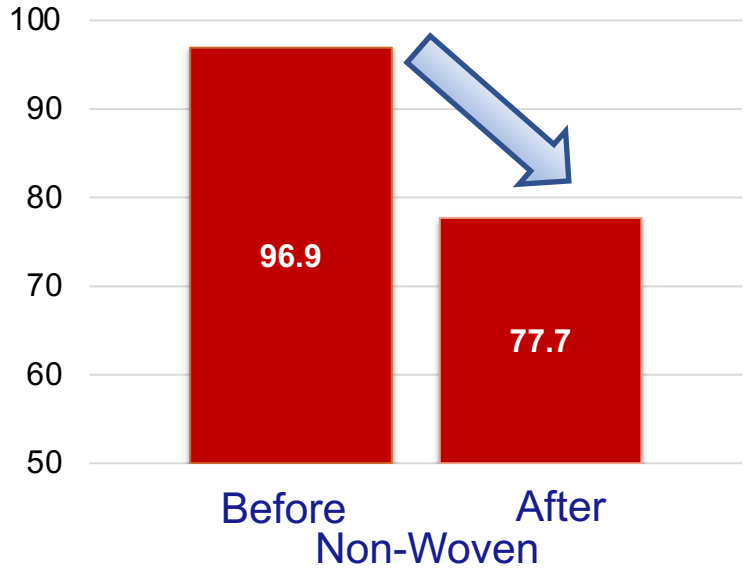
Longevity – Reusability

Alcohol cleaning can decrease performance efficiency.



*Filter sprayed with IPA 75%

Water/humidity can decrease performance efficiency.



*Immerse in detergent water → rinse with water → Dehydration for total 15min. Dry in the sun for 8hrs.

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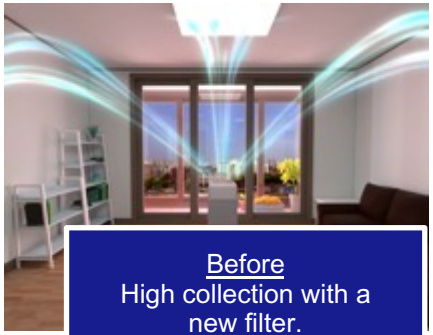
Decreased Performance Over Time

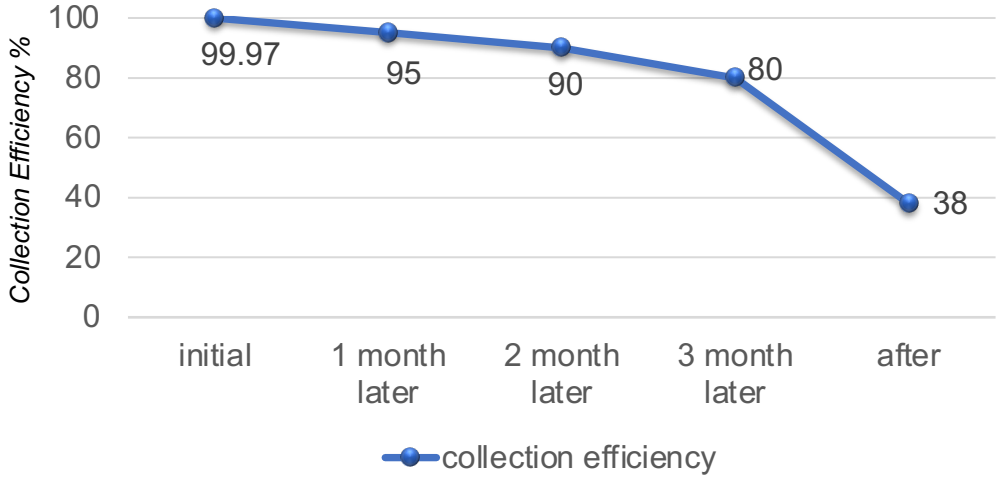
Non-Woven



Before
High collection with a new filter.

After
Less efficient cleaning over time.

Deterioration Over Time



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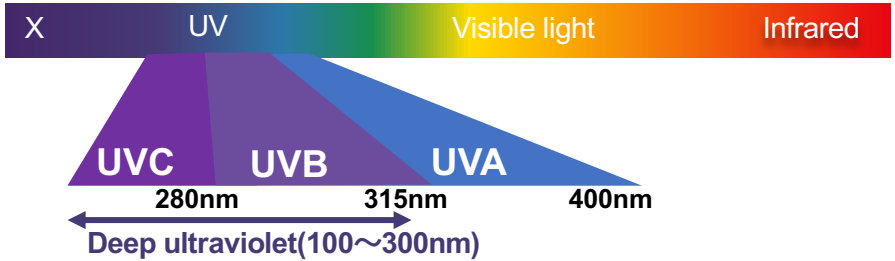
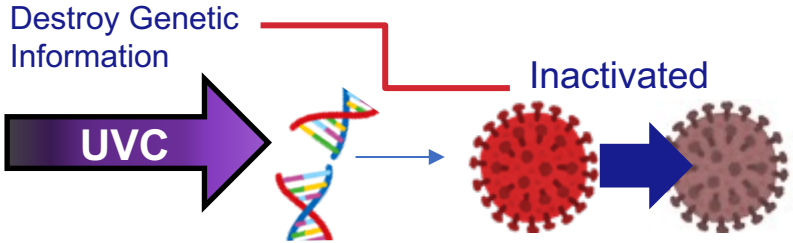
Challenge with UVC Light

UVC light can inactivate viruses, so filter media needs UV resistance.

UV Sterilization Mechanism





UVC irradiation destroys the genetic information of viruses and bacteria and prevents them from multiplying (inactivation).

Most media disintegrate under UVC light.

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TEMISH™ Solutions

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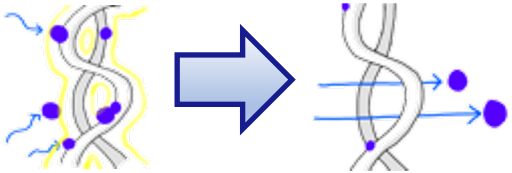
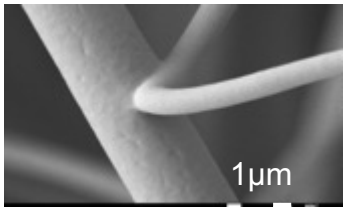
Media Collection Principles

Non-Woven*

An attraction force by charged fiber

A decrease in collection capacity when charge is lost.





Fiber diameter 2.0~5.0μm

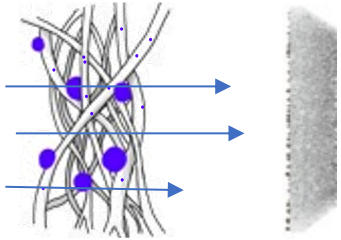
*A charged fiber

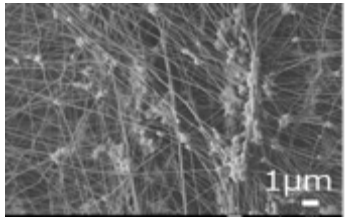
TEMISH ™ (ePTFE)

A collision of particles into fiber

Collection of fine particles

Lasting collection capacity



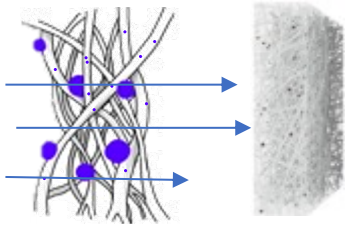


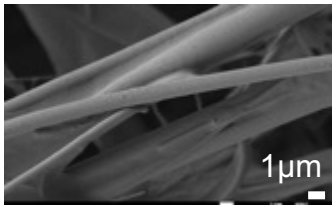
TEMISH™Enlarged view Fiber diameter 0.05~0.1μm

Glass Fiber

A collision of particles into fiber

Collection of fine particles by layer thickness





Fiber diameter 0.5~2.0μm

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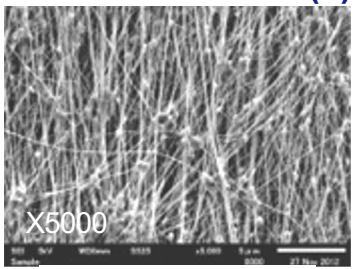
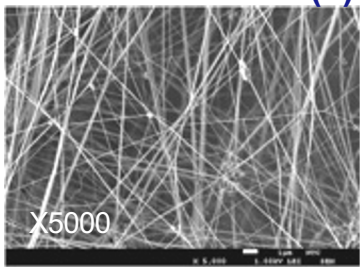
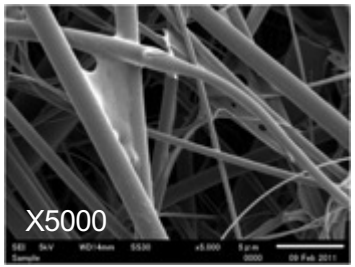
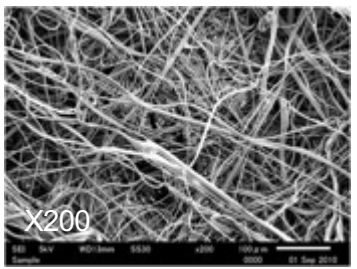
Fiber Diameter and PF Value

PF Value: Index representing the filter performance

$$PF = \frac{-\mathrm{Log}(\text{penetration})}{\text{Pressure drop [mmH}_2\text{0]}} \times 100$$

High PF ⇒ High Performance
Lower Pressure Drop
Higher Collection Efficiency

PTFE Membrane (1)	PTFE Membrane (2)	Glass Fiber	Melt Blown Non-Woven
			
measured value PF：25～35 D_f：55～100**nm**	PF：20～25 D_f：100～200**nm**	PF：10～12 D_f：500～2000**nm**	PF：5～15 D_f：1000～5000**nm**

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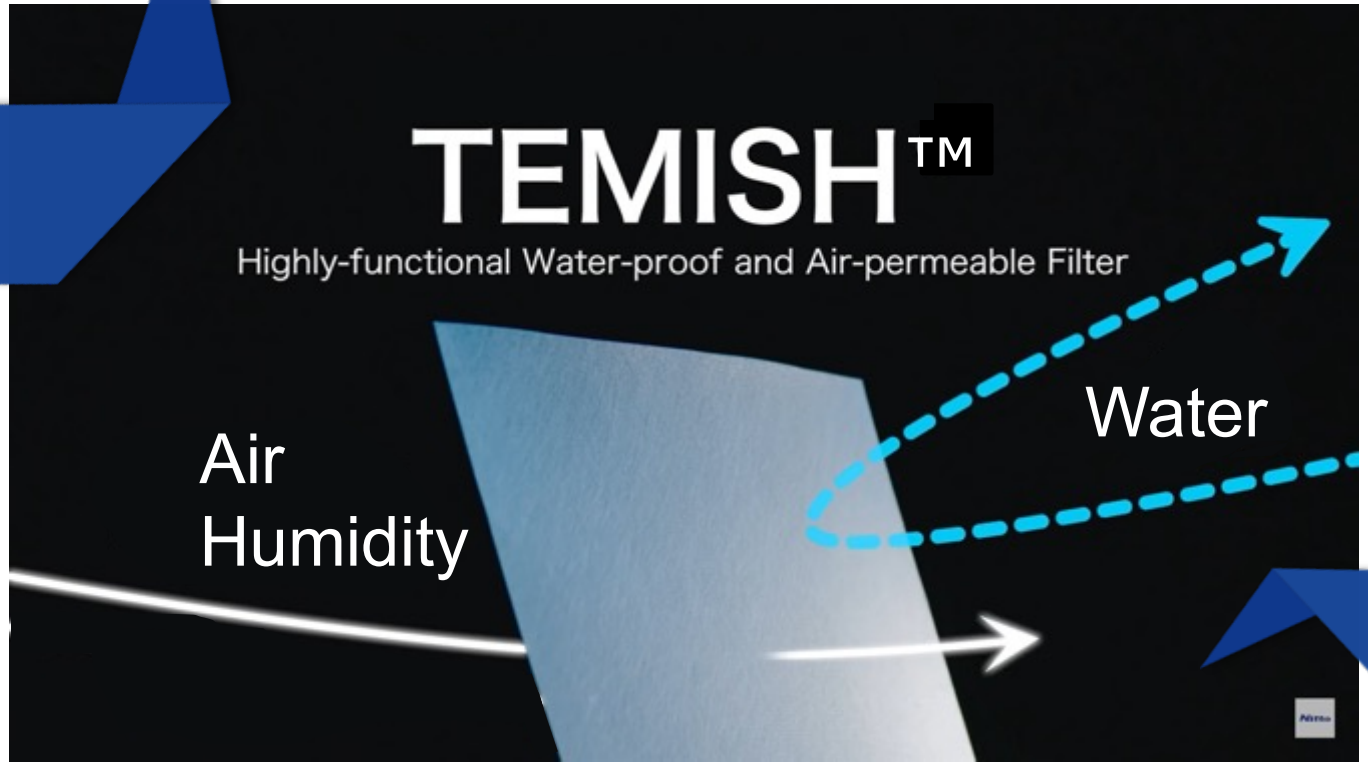
Media Performance

Media Type	Collection Principle	Initial Collection Efficiency	Initial Pressure Drop	Filter Thickness	Longevity - Efficiency	Longevity – Pressure Drop	UV resistance
NonWoven (PP/PE)	Charged Fiber	++	+++	Moderate	+	++	+
Glass	Depth filtration	+++	+	Thicker	+++	+++	+++
TEMISH PTFE	Micro Porous Structure	+++	++	Thinner	+++	++	+++



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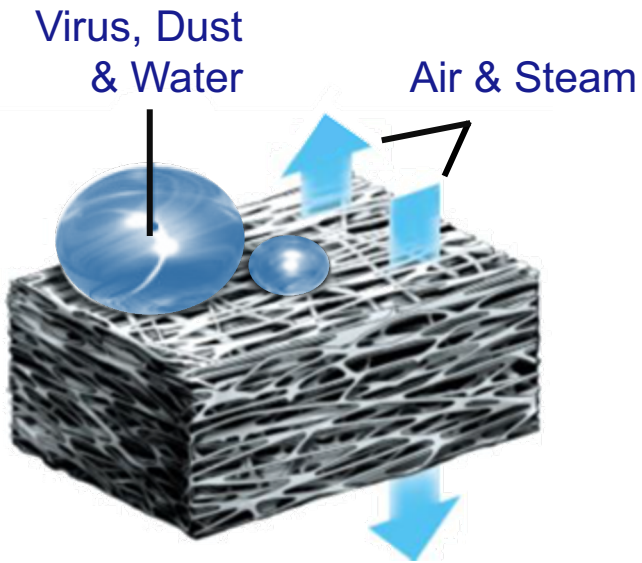
What is TEMISH™?

Allows air to pass through but not water.

PTFE

×

Porous Film



*Enlarged image of TEMISH™

Main Characteristics

- Fine Fibers
- Water Resistance
- Chemical Resistance
- UV resistance

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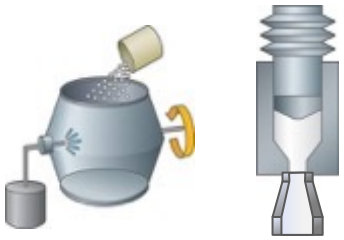
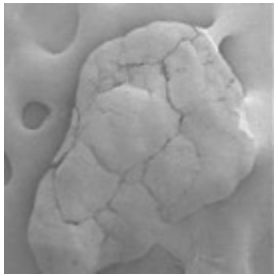
TEMISH™ Manufacturing Process

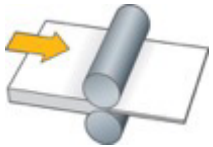
Blending & Extrusion



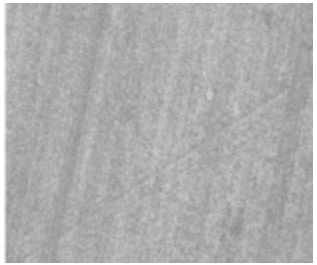
PTFE Fine Powder (Secondary Powder)



Rolling/Drying

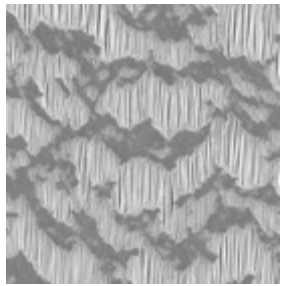


Rolling / Drying

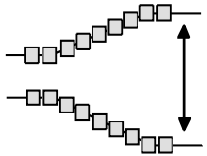


MD Stretching

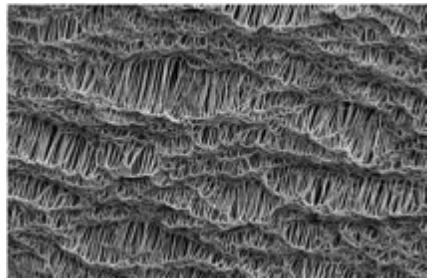
MD Stretching



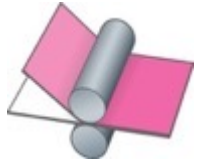
TD Stretching



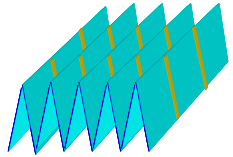
TD Stretching

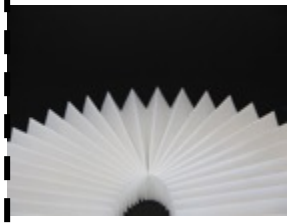


Laminating



Converting





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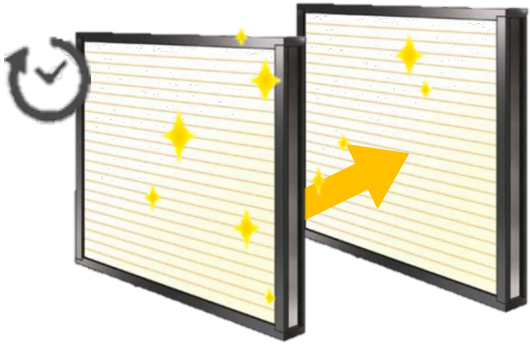
Balanced Collection Efficiency & Pressure Drop

Highly Balanced Performance

High collection and low pressure loss

Achieves both high collection and long-lasting performance with ePTFE filter characteristics.

Performance Sustainability



Maintains performance without losing efficiency

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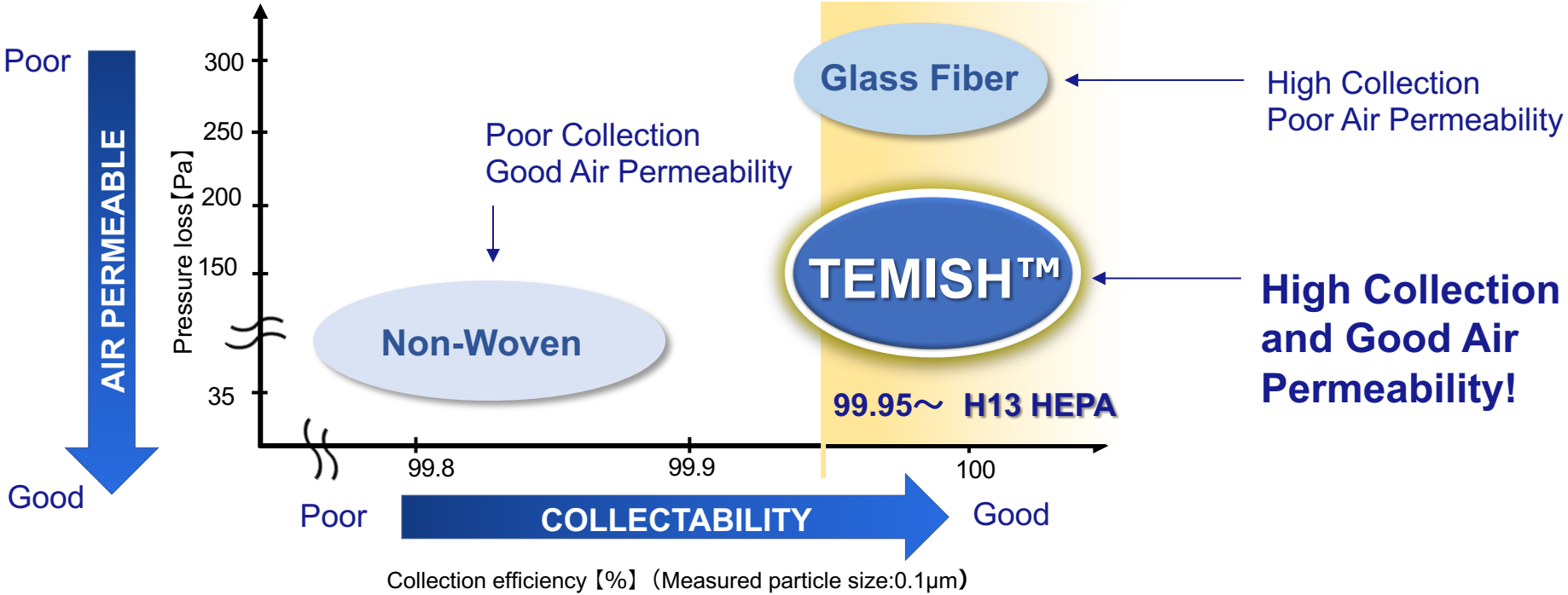
Highly Balanced Performance

Excellent balance between collection efficiency and pressure loss.



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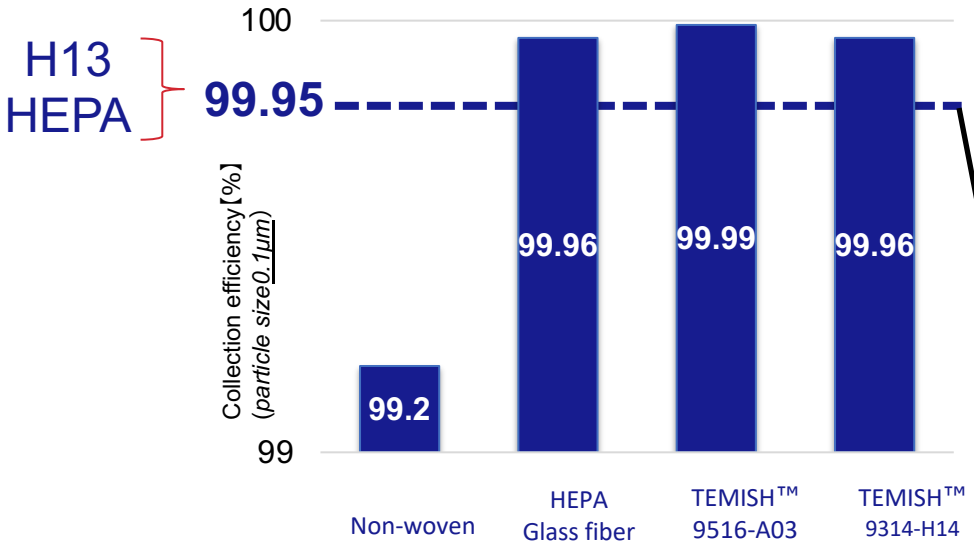
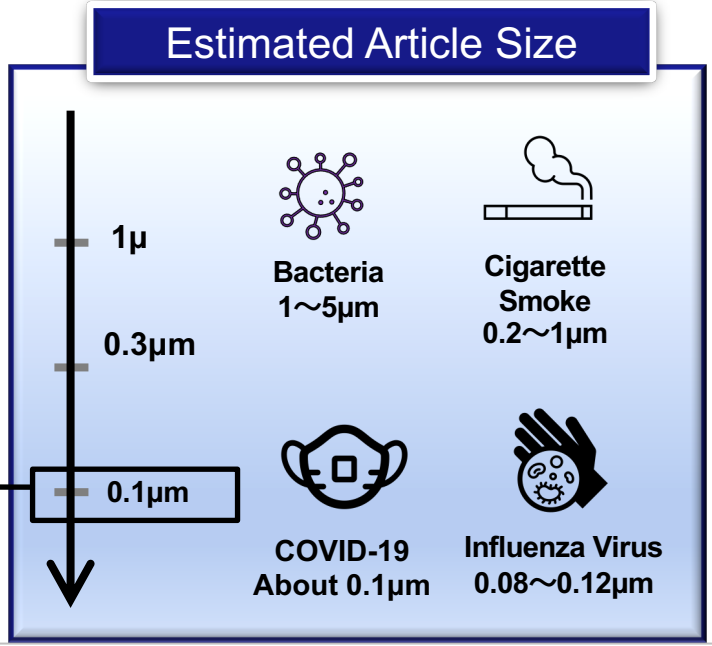
Highly Balanced Performance (Collection Efficiency)

TEMISH ™ collects viruses in minutes.



* *Linear velocity 5.3cm/sec*



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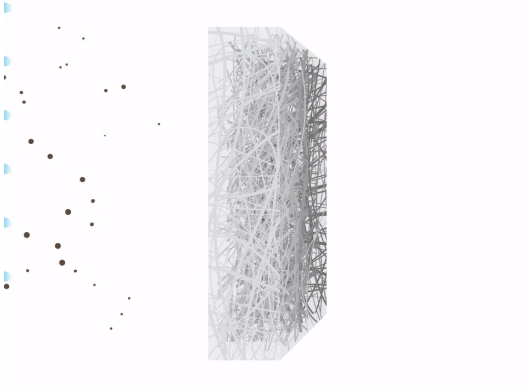
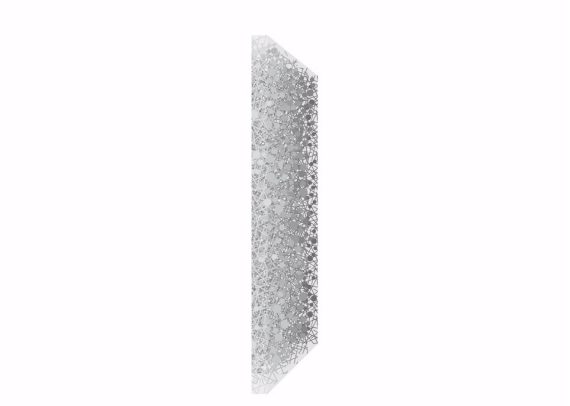
Filter Size/Pressure Drop

Glass Media
Internal Filtering Style



Thickness = 300～500μm
Fiber diameter = 2μm

TEMISH™ / PTFE Media
Surface Filtering Style



→ 2X more Air Permeable
→ Low Impurity
-Dust release
→ High Mechanical Strength
→ Chemical/ Moisture Resistance

Thickness = 10μm
Fiber diameter ＜ 0.2μm

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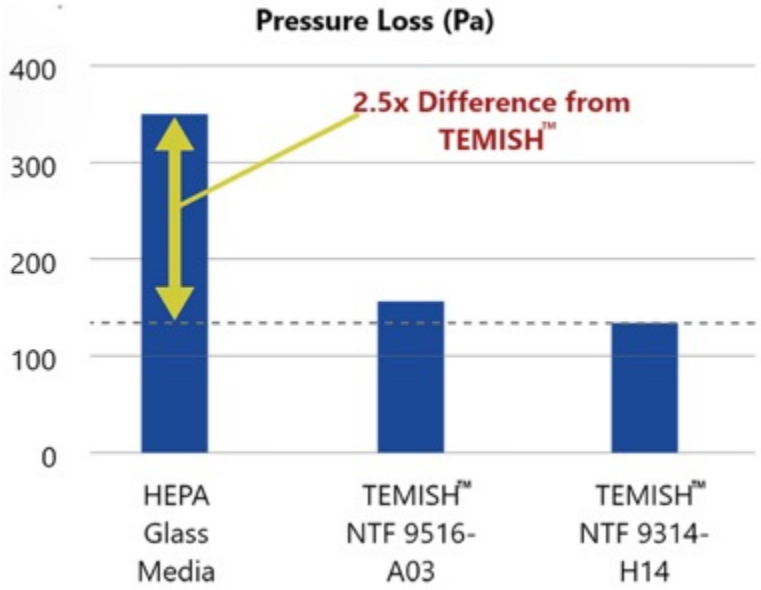
Highly Balanced Performance (Pressure Loss)

More Air Permeable than Glass Fiber



Benefits Of Low-Pressure Loss

✓ Miniaturization of fan/filter size
✓ Increased in volume
✓ Quietness

Low Pressure Loss = Improved Performance

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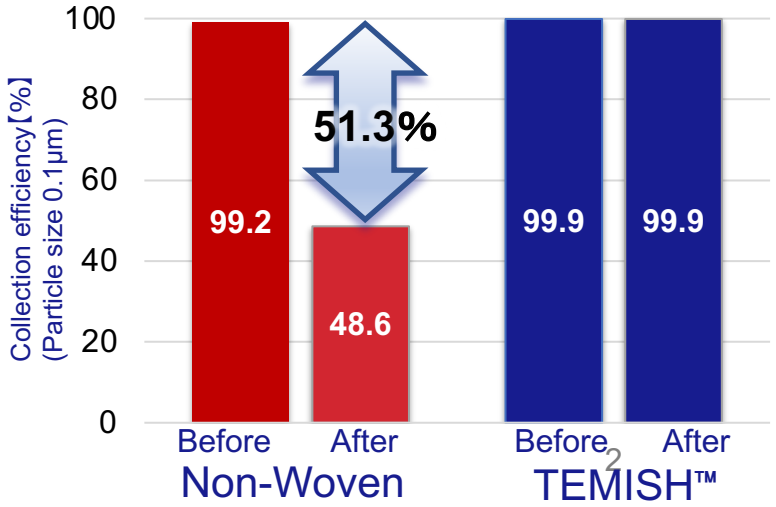
Longevity – Reusability

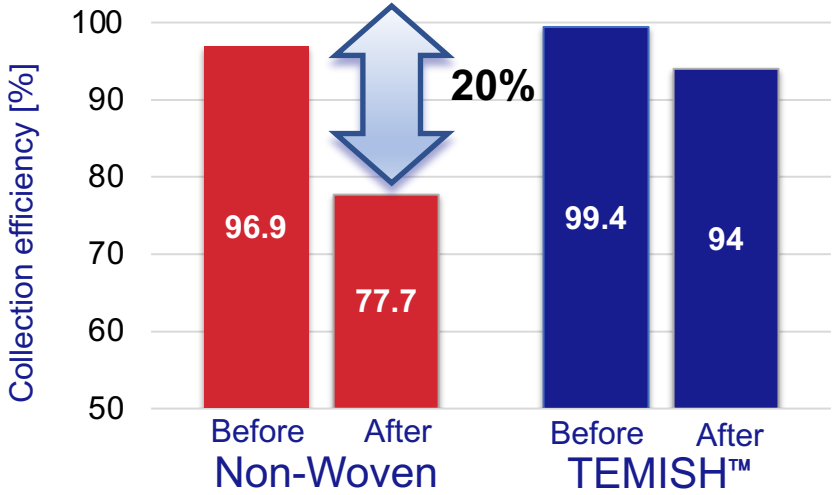
TEMISH ™ maintains performance after deterioration

*Filter sprayed with alcohol**



*IPA 75%

*Filter washed with water & detergent**



*Immerse in detergent water → rinse with water → Dehydration for total 15min. Dry in the sun for 8hrs.

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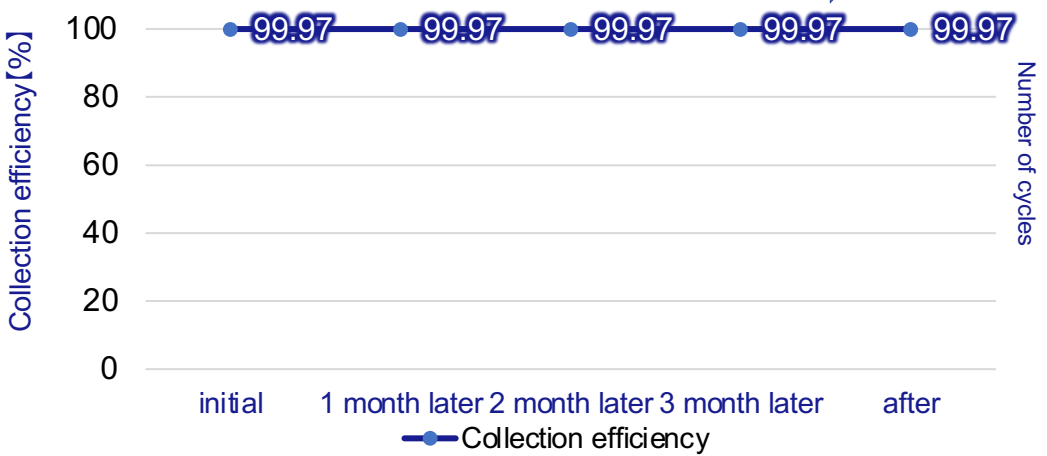
Maintains Performance Over Time

TEMISH™

Deterioration Over Time

Performance Maintained



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TEMISH™ UVC-resistant Irradiation Experiment

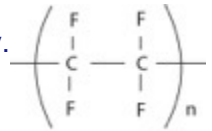
Test wavelength：254nm(High bactericidal effect even in UV)

Test Results

UVC Irradiation amount[mJ/㎠]		10,000	100,000	1,000,000
Estimated number of days of use [days]*		50	500	5,000
TEMISH™ (NTF9307-L03)	Collection efficiency	Good		
	Strength	Good		
HEPA glass filter	Collection efficiency	Good		
	Strength	Moderate		
Non-woven	Collection efficiency	Good		Fail (tear)
	Strength	Good		Fail (tear)

*200mJ/cm2 /day(Irradiation required for inactivation:10mJ/cm2　Number of irradiations per day: 20 times/day)

C-F Bond
Very stable chemically.
The strongest bond
among organic bonds.



Non-Woven
Rubbed by finger

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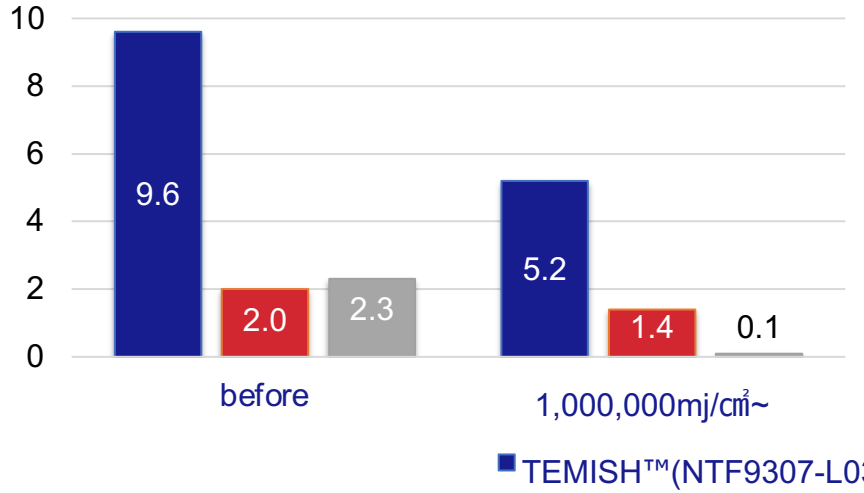
TEMISH™ UVC-resistant irradiation

Maintains strength and performance as a filter even after UVC irradiation.

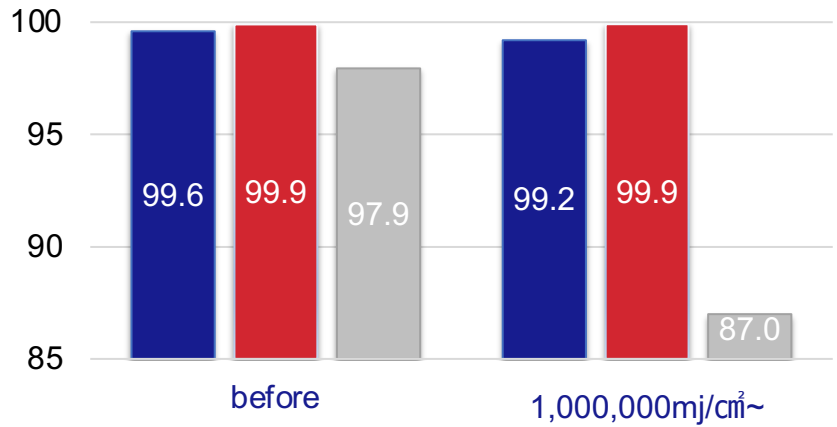
Tensile Strength【MPa】

※20×20mm,200mm/min



Collection Efficiency【%】

※Line speed 5.3cm/sec, Particle size 0.1um



■TEMISH™(NTF9307-L03) ■Glass Filter ■Non-woven

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Summary

Consider your filtration requirements to find the best filter type for your application.

Media Type	Collection Principle	Initial Collection Efficiency	Initial Pressure Drop	Filter Thickness	Longevity - Efficiency	Longevity – Pressure Drop	UV Resistance
Nonwoven (PP/PE)	Charged Fiber	++	+++	Moderate	+	++	+
Glass	Depth Filtration	+++	+	Thicker	+++	+++	+++
TEMISH PTFE	Micro Porous Structure	+++	++	Thinner	+++	++	+++

- Balance between collection efficiency & pressure drop
- Filter size
- Longevity
- Reusability
- Reusability
- Performance over time
- UVC Exposure

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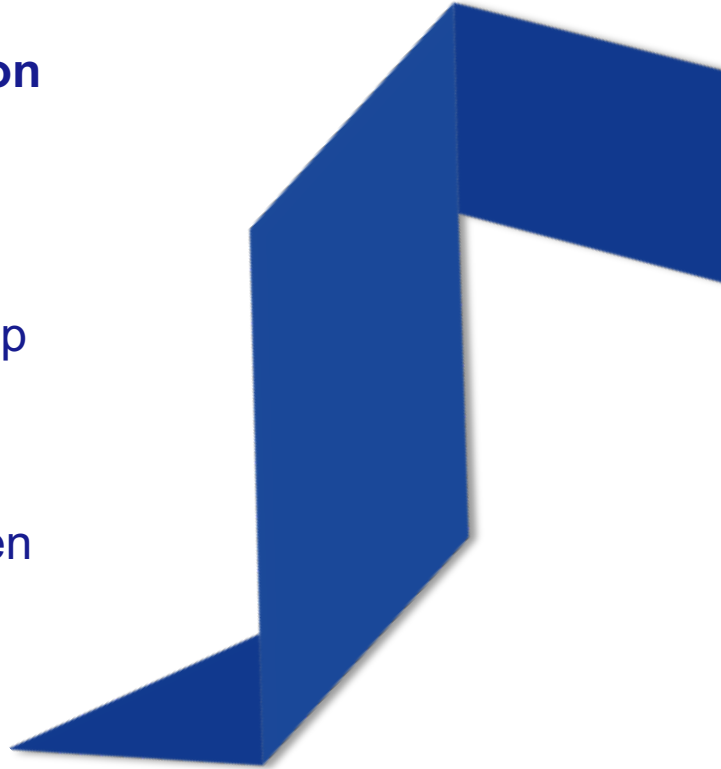
Nitto Technical Support

Nitto offers FREE technical support and evaluation for filtration applications.

We can help:

- Find the best product from our wide product line-up
- Provide high quality products
- R&D and Testing expertise
- Find solutions to problems based on market proven experience

Support.Us@nitto.com



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