QUANTUM FILTRATION
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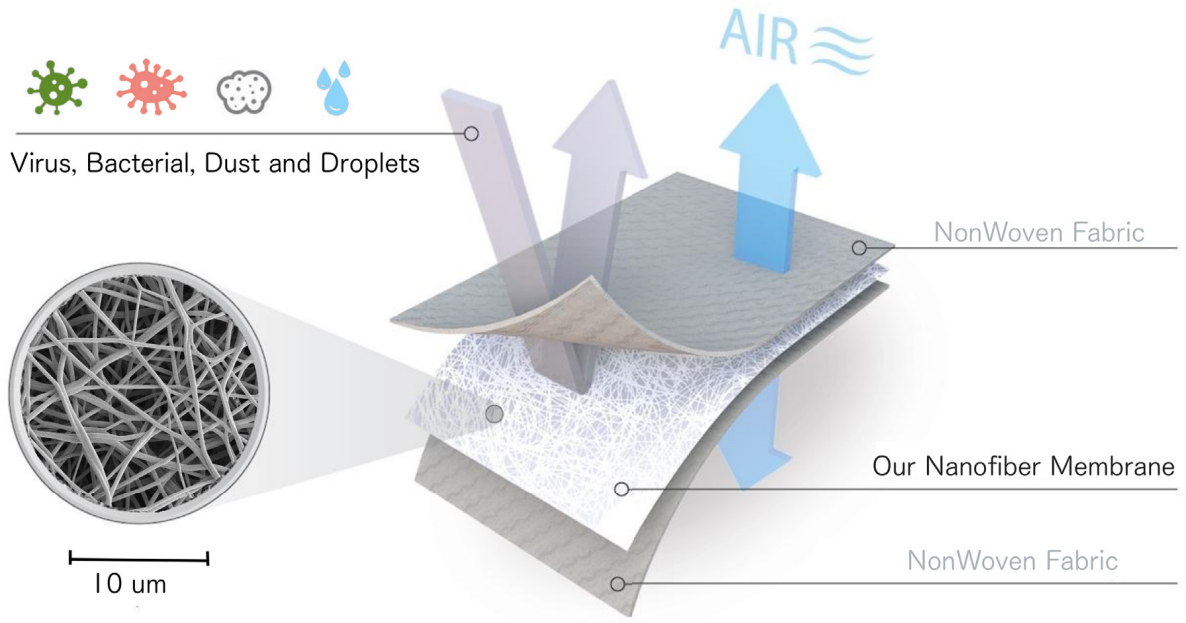
DATA SHEET

Antiviral Nanofibrous **Protective Mask**

Quantum Filtration Masks made up of nano-sized fibers impregnated with antiviral agents, deliver 99% filtration efficiency. In addition, it provides extraordinary comfortable wear satisfaction. The membranes, which consist of a featherlight nanofiber layer with two thin non-woven fabrics, fully meet user expectations with its superior moisture and air permeable structure and morphology.

99%
Filtration Efficiency



Applications

Bacterial and viral protection for first responders, doctors, nurses, healthcare networks, military, assisted living facilities, protection from pollution, smog, diesel fumes and cigarette smoke, suitable for protection from all particulates including airborne biohazards.

Specifications

Filter material	: Proprietary
Structure	: Non-woven nanofibers with an average size of 0.2μm
Filtration efficiency	: 99% at 85 L/min

Features

- **99% filtration efficiency**
- Protects against pathogens that includes but not limited to **Corona (COVID-19)** and **Influenza (H1N1)** viruses
- **Very high surface area** per unit mass that enhances capture efficiency
- Gradient pore size specifically designed to **trap small pathogens**
- Significantly **higher breathability** than N95 masks
- **Flexible and comfortable** in wearing
- **Killing of bacteria and deactivation of virus** attribute is currently under laboratory scientific verification

Mask Membrane Tests

Lab Name	Test Name	Results	Purpose	Comments
Air Techniques International	**Filtration Effiency**	Pass	NIOSH	Averge over 99% filtration efficiency
Nelson Laboratories	**Synthetic Blood Penetration**	Pass	ASTM F2100	No Penentration
Nelson Laboratories	**Flammability Test**	Pass	ASTM F2101	Class 1 (Top Class)
Nelson Laboratories	**Cytotoxicity**	Pass	ASTM F2102	Grade 0 (Best Grade)
Nelson Laboratories	**Particle Filtration Efficiency**	Pass	ASTM F2103	Average 99%
Nelson Laboratories	**Virus Filtration Efficiency**	Pass	ASTM F2104	Averge 99.5%
Nelson Laboratories	**Bacterial Filtration Efficiency**	Pass	ASTM F2105	Averge 99.5%
MicroChem Laboratory	**MS2 Bacteriophage**	Pass	AATCC 100	Over 99% virus reduction
Matregenix Research Center	**Antimicrobial Study**	Pass	ASTM E2315	Over 99.9% reduction after 25 min contact time
MicroChem Laboratory	**Human coronavirus, Strain 229E**	On-going	AATCC 100	N/A
Matregenix Research Center	**H1N1 and H3N2**	On-going	Antiviral Property	N/A
Matregenix Research Center	**Membrane microstructure**	Available upon request	N/A	Visual SEM images interpretation, fiber diameter analysis, Porosity measurements, contact angle

Air Techniques INTERNATIONAL

FILTER TEST REPORT

CUSTOMER **Matregenix**		TEST CRITERIA		NUMBER ORDERED N/A	DATE RECEIVED Various
PURCHASE ORDER NUMBER N/A		PENETRATION @ RATED FLOW		NUMBER RECEIVED 3	DATE TESTED 4/28/20
FILTER MODEL NUMBER N/A		RESISTANCE (mm W.G.) @ 100 % RATED FLOW		NUMBER ACCEPTED N/A	DATE SHIPPED N/A
MANUFACTURER --		SPECIFICATION NaCl aerosol characteristics compliant with NIOSH 42CFR Part 84		REJECTS	
		TEST			
FILTER DESCRIPTION Flat Sheet Media		Test Air Temperature 22.2° C	TEST FLOW (SLPM) 85 ± 0.1	PENETRATION NA	RESISTANCE NA
P.O. Approved By: N/A	RATED FLOW (SLPM) 85± 1	BAROMETRIC PRESS N/A Alicat Flow Meter	Test Air Humidity in 40% RH	DAMAGE NA	OTHER NA

ITEM No.	FILTER SAMPLE NUMBER(SEQUENCE)	TEST RESULTS			FILTER TESTED BY:
		RESISTANCE (mm W.G.)	PENETRATION %	FILTRATION EFFICIENCY %	
			@100%	N/A	
1	Sample #18	32.2	0.3051	99.6949	MH
2	Sample #19	27.6	0.6203	99.3797	MH
3	Sample #20	30.3	0.4635	99.5365	MH

DISTRIBUTION	7 second load/1 second test NIOSH 42 CFR Part 84: 0.075 ± 0.020 µm CMD @ <1.86 GSD (0.30 µm MMD)	TESTED BY: Meng Hu

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Flammability of Clothing Textiles Final Report

Test Article:	QFM-04-14_001
Study Number:	1289161-S01
Study Received Date:	16 Apr 2020
Testing Facility:	Nelson Laboratories, LLC 6280 S. Redwood Rd. Salt Lake City, UT 84123 U.S.A.
Test Procedure(s):	Standard Test Protocol (STP) Number: STP0073 Rev 06 Customer Specification Sheet (CSS) Number: 202002323 Rev 01
Deviation(s):	None

Summary: This procedure was performed to evaluate the flammability of plain surface clothing textiles by measuring the ease of ignition and the speed of flame spread. The parameter of time is used to separate materials into different classes, thereby assisting in a judgment of fabric suitability for clothing and protective clothing material. The test procedure was performed in accordance with the test method outlined in 16 CFR Part 1610 (a) *Step 1 - testing in the original state*. Step 2 - *Refurbishing and testing after refurbishing*, was not performed. All test method acceptance criteria were met. Testing was performed in compliance with US FDA good manufacturing practice (GMP) regulations 21 CFR Parts 210, 211 and 820.

Test Article Side Tested: Outside Surface
Orientation: Machine

Test Criteria for Specimen Classification (See 16 CFR Part 1610.7):

Class	Plain Surface Textile Fabric
1	Burn time ≥3.5 seconds
2	Not applicable to plain surface textile fabrics
3	Burn time <3.5 seconds

The 16 CFR Part 1610 standard specifies that 10 replicates are to be tested if, during preliminary testing, only 1 test article exhibits flame spread and it is less than 3.5 seconds or the test articles exhibit an average flame spread less than 3.5 seconds. Five replicates are to be tested if no flame spread is observed upon preliminary testing, if only 1 test article exhibits flame spread and it is equal to or greater than 3.5 seconds, or if the average flame spread is equal to or greater than 3.5 seconds. In accordance with the standard, 5 replicates were tested for this study.

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Study Director For Curtis Gerow, B.S. — 06 May 2020 Study Completion Date

1289161-S01

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Latex Particle Challenge Final Report

Test Article:	QFM-050120-001 QFM-050120-002 QFM-050120-003 QFM-050120-004 QFM-050120-005	
Purchase Order:	M-050120-005	
Study Number:	1296805-S01	
Study Received Date:	06 May 2020	
Testing Facility:	Nelson Laboratories, LLC 6280 S. Redwood Rd. Salt Lake City, UT 84123 U.S.A.	
Test Procedure(s):	Standard Test Protocol (STP) Number:	STP0005 Rev 07
Deviation(s):	Quality Event (QE) Number(s):	QE22125

Summary: This procedure was performed to evaluate the non-viable particle filtration efficiency (PFE) of the test article. Monodispersed polystyrene latex spheres (PSL) were nebulized (atomized), dried, and passed through the test article. The particles that passed through the test article were enumerated using a laser particle counter.

A one-minute count was performed, with the test article in the system. A one-minute control count was performed, without a test article in the system, before and after each test article and the counts were averaged. Control counts were performed to determine the average number of particles delivered to the test article. The filtration efficiency was calculated using the number of particles penetrating the test article compared to the average of the control values.

The procedure employed the basic particle filtration method described in ASTM F2299, with some exceptions; notably the procedure incorporated a non-neutralized challenge. In real use, particles carry a charge, thus this challenge represents a more natural state. The non-neutralized aerosol is also specified in the FDA guidance document on surgical face masks. All test method acceptance criteria were met. Testing was performed in compliance with US FDA good manufacturing practice (GMP) regulations 21 CFR Parts 210, 211 and 820.

Test Side:	Either
Area Tested:	91.5 cm^2
Particle Size:	0.1 µm
Laboratory Conditions:	21°C, 24% relative humidity (RH) at 0214; 20°C, 25% RH at 0318
Average Filtration Efficiency:	98.95%
Standard Deviation:	0.152

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Sarah Guzman electronically approved for	30 May 2020 20:45 (+00:00)
Study Director Curtis Gerow	Study Completion Date and Time

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Viral Filtration Efficiency (VFE) Final Report

Test Article:	QFM-050120-001 QFM-050120-002 QFM-050120-003 QFM-050120-004 QFM-050120-005
Purchase Order:	M-050120-005
Study Number:	1296803-S01
Study Received Date:	06 May 2020
Testing Facility:	Nelson Laboratories, LLC 6280 S. Redwood Rd. Salt Lake City, UT 84123 U.S.A.
Test Procedure(s):	Standard Test Protocol (STP) Number: STP0007 Rev 16
Deviation(s):	None

Summary: The VFE test is performed to determine the filtration efficiency of test articles by comparing the viral control counts upstream of the test article to the counts downstream. A suspension of bacteriophage ΦX174 was aerosolized using a nebulizer and delivered to the test article at a constant flow rate and fixed air pressure. The challenge delivery was maintained at 1.1 - 3.3 x 10^3 plaque forming units (PFU) with a mean particle size (MPS) of 3.0 µm ± 0.3 µm. The aerosol droplets were drawn through a six-stage, viable particle, Andersen sampler for collection. The VFE test procedure was adapted from ASTM F2101.

All test method acceptance criteria were met. Testing was performed in compliance with US FDA good manufacturing practice (GMP) regulations 21 CFR Parts 210, 211 and 820.

Test Side:	Either
Test Area:	~40 cm^2
VFE Flow Rate:	28.3 Liters per minute (L/min)
Conditioning Parameters:	85 ± 5% relative humidity (RH) and 21 ± 5°C for a minimum of 4 hours
Positive Control Average:	2.0 x 10^3 PFU
Negative Monitor Count:	<1 PFU
MPS:	2.7 µm

Reid Jones electronically approved for	03 Jun 2020 14:11 (+00:00)
Study Director James Luskin	Study Completion Date and Time

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Bacterial Filtration Efficiency (BFE) and Differential Pressure (Delta P) Final Report

Test Article:	QFM-050120-001 QFM-050120-002 QFM-050120-003 QFM-050120-004 QFM-050120-005
Purchase Order:	M-050120-005
Study Number:	1296816-S01
Study Received Date:	06 May 2020
Testing Facility:	Nelson Laboratories, LLC 6280 S. Redwood Rd. Salt Lake City, UT 84123 U.S.A.
Test Procedure(s):	Standard Test Protocol (STP) Number: STP0004 Rev 18
Deviation(s):	None

Summary: The BFE test is performed to determine the filtration efficiency of test articles by comparing the bacterial control counts upstream of the test article to the bacterial counts downstream. A suspension of *Staphylococcus aureus* was aerosolized using a nebulizer and delivered to the test article at a constant flow rate and fixed air pressure. The challenge delivery was maintained at 1.7 - 3.0 x 10^3 colony forming units (CFU) with a mean particle size (MPS) of 3.0 ± 0.3 µm. The aerosols were drawn through a six-stage, viable particle, Andersen sampler for collection. This test method complies with ASTM F2101-19 and EN 14683:2019, Annex B.

The Delta P test is performed to determine the breathability of test articles by measuring the differential air pressure on either side of the test article using a manometer, at a constant flow rate. The Delta P test complies with EN 14683:2019, Annex C and ASTM F2100-19.

All test method acceptance criteria were met. Testing was performed in compliance with US FDA good manufacturing practice (GMP) regulations 21 CFR Parts 210, 211 and 820.

Test Side:	Either
BFE Test Area:	~40 cm^2
BFE Flow Rate:	28.3 Liters per minute (L/min)
Delta P Flow Rate:	8 L/min
Conditioning Parameters:	85 ± 5% relative humidity (RH) and 21 ± 5°C for a minimum of 4 hours
Positive Control Average:	2.1 x 10^3 CFU
Negative Monitor Count:	<1 CFU
MPS:	3.1 µm

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Reid Jones electronically approved for — 09 Jun 2020 14:37 (+00:00)
Study Director James Luskin — Study Completion Date and Time

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Synthetic Blood Penetration Resistance Final Report

Test Article:	QFM-04-14_001
Study Number:	1289168-S01
Study Received Date:	16 Apr 2020
Testing Facility:	Nelson Laboratories, LLC 6280 S. Redwood Rd. Salt Lake City, UT 84123 U.S.A.
Test Procedure(s):	Standard Test Protocol (STP) Number: STP0012 Rev 09
Deviation(s):	None

Summary: This procedure was performed to evaluate surgical facemasks and other types of protective clothing materials designed to protect against fluid penetration. The purpose of this procedure is to simulate an arterial spray and evaluate the effectiveness of the test article in protecting the user from possible exposure to blood and other body fluids. The distance from the target area surface to the tip of the cannula is 30.5 cm. A test volume of 2 mL of synthetic blood was employed using the targeting plate method.

This test method was designed to comply with ASTM F1862 and ISO 22609 (as referenced in EN 14683:2019 and AS4381:2015) with the following exception: ISO 22609 requires testing to be performed in an environment with a temperature of 21 ± 5°C and a relative humidity of 85 ± 10%. Instead, testing was performed at ambient conditions within one minute of removal from the environmental chamber held at those parameters.

All test method acceptance criteria were met. Testing was performed in compliance with US FDA good manufacturing practice (GMP) regulations 21 CFR Parts 210, 211 and 820.

Number of Test Articles Tested:	32
Number of Test Articles Passed:	32
Test Side:	Either Side
Pre-Conditioning:	Minimum of 4 hours at 21 ± 5°C and 85 ± 5% relative humidity (RH)
Test Conditions:	20.3°C and 22% RH

Results: Per ASTM F1862 and ISO 22609, an acceptable quality limit of 4.0% is met for a normal single sampling plan when ≥29 of 32 test articles show passing results.

Test Pressure: 120 mmHg (16.0 kPa)

Test Article Number	Synthetic Blood Penetration
1-32	None Seen

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(RWJ) for
Study Director James W. Luskin

29 Apr 2020
Study Completion Date

1289168-S01

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MEM Elution Final Report

Test Article:	QFM-050120-001
Purchase Order:	M-050120-005
Study Number:	1296799-S01
Study Received Date:	07 May 2020
Testing Facility:	Nelson Laboratories, LLC 6280 S. Redwood Rd. Salt Lake City, UT 84123 U.S.A.
Test Procedure(s):	Standard Test Protocol (STP) Number: STP0032 Rev 10
Deviation(s):	None

Summary: The Minimal Essential Media (MEM) Elution test was designed to determine the cytotoxicity of extractable substances. An extract of the test article was added to cell monolayers and incubated. The cell monolayers were examined and scored based on the degree of cellular destruction. All test method acceptance criteria were met. Testing was performed in compliance with US FDA good manufacturing practice (GMP) regulations 21 CFR Parts 210, 211 and 820.

Results:

Test Article:

Results Pass/Fail	Scores				Extraction Ratio	Amount Tested / Extraction Solvent Amount
	#1	#2	#3	Average		
Pass	0	0	0	0	6 cm^2/mL	120 cm^2 / 20 mL

Controls:

Identification	Scores				Extraction Ratio	Amount Tested / Extraction Solvent Amount
	#1	#2	#3	Average		
Negative Control - Polypropylene Pellets	0	0	0	0	0.2 g/mL	4 g / 20 mL
Media Control	0	0	0	0	N/A	20 mL
Positive Control - Latex Natural Rubber	4	4	4	4	0.2 g/mL	4 g / 20 mL

McKenna Wild electronically approved
Study Director McKenna Wild

13 May 2020 13:48 (+00:00)
Study Completion Date and Time

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MICROCHEM LABORATORY

STUDY REPORT

Study Title

Antibacterial Activity and Efficacy of Matregenix's Fabric

Test Method

American Association of Textile Chemists and Colorists Method 100
Assessment of Antibacterial Finishes on Textile Materials

Study Identification Number

NG15388

Study Sponsor

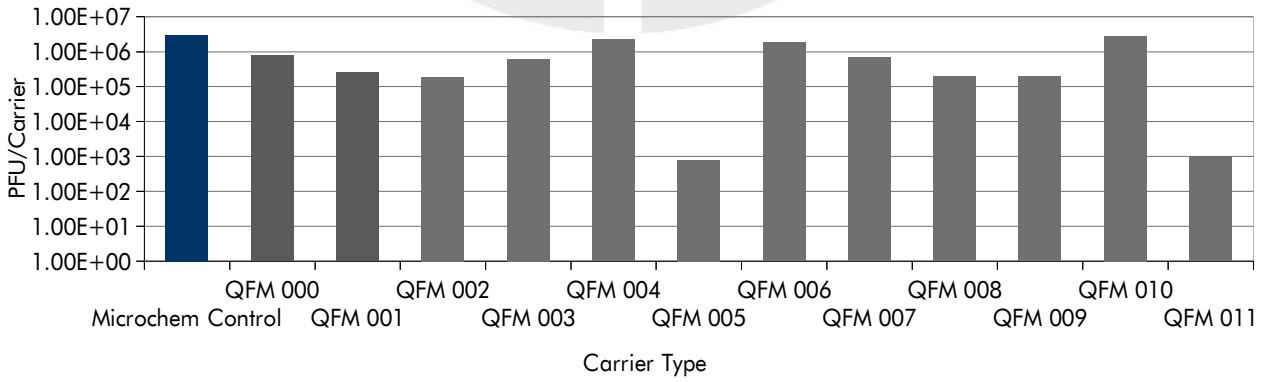
Kevin Guof
Matregenix
(307) 761-2203
kevin@matregenix.com

Test Facility

Microchem Laboratory
1304 W. Industrial Blvd
Round Rock, TX 78681
(512) 310-8378
Testing performed by: Sarah Warner, B.S.

Results of the Study

Test Microorganism	Carrier Type	PFU/Carrier	Percent Reduction Compared to Control	Log_{10} Reduction Compared to Control
MS2 Bacteriophage ATCC 15597-B1	Microchem Control	3.00E+06	N/A	
	QFM 000	7.70E+05	74.33%	0.59
	QFM 001	2.56E+05	91.47%	1.07
	QFM 002	1.88E+05	93.73%	1.20
	QFM 003	6.16E+05	79.47%	0.69
	QFM 004	2.20E+06	26.67%	0.13
	QFM 005	7.90E+02	99.974%	3.58
	QFM 006	1.80E+06	40.00%	0.22
	QFM 007	6.76E+05	77.47%	0.65
	QFM 008	1.90E+05	93.67%	1.20
	QFM 009	1.96E+05	93.47%	1.18
	QFM 010	2.80E+06	6.67%	0.03
	QFM 011	1.01E+03	99.966%	3.47
The limit of detection for this assay is 1.00E+01 PFU/carrier and is reported as <1.00E+01 PFU/carrier in the table above and as zero in the graph.				



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6/03/20

Antimicrobial Study of Nanofibers Report

Test Article: 12 Nanofibers
Study Number: QFM-060120-001
Study Received Date: 06/01/2020
Testing Facility: Matregenix Research Center, 5270 California Ave, #300 Irvine, 92617
Test Procedure(s): Modified ASTM E2315 Time-Kill Test
Deviation(s): None

Summary: This procedure was performed to evaluate effective antimicrobial time of 9 different nanofiber samples. It is designed based on the **ASTM E2315 "Standard Guide for Assessment of Antimicrobial Activity Using a Time-Kill Procedure.**

- 100ul of dilutions 10^-3 to 10^-5 were plated, incubated overnight at 37 C and counted the next day.
- 9 nanofiber samples were tested for a single time point (3 hours). 4 samples were selected and further tested using **Modified ASTM E2315 Time-Kill Test**- a multiple time series points method.
- At time points 25, 50, 75 and 100 minutes, 100uL of the 10^-3 to 10^-5 dilutions of E. coli was added to each respective plate, incubated overnight at 37 ºC and counted the next day.

All test method acceptance criteria were met.

Test bacteria: BL21 E-coli

Nanofibers: QFM-000, QFM-001, QFM-002, QFM-003, QFM-004, QFM-005, QFM-006, QFM-007, QFM-008, QFM-009, QFM-010, and QFM-011

Time points: 25, 50, 75, 100 and 180 min

Results: After 3 hours, all 8 nanofibers killed 100% E-coli bacteria. After 25 mins, there were no detectable bacterial (100% reduction) treated by QMF-003, QFM-007 and QFM-011 nanofiber samples. Untreated nanofiber showed a time-dependent increase in bacterial killing, but was the least potent among the four nano-fibers tested. QFM-003 was the most optimal fiber for bacterial killing as seen by the 12-minute time to kill 50% of bacteria compared to the 36 minutes it took untreated fiber to kill 50% of bacteria.

Kevin Guo

Study Director **Kevin Guo** **Study Completion Date**