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Sri Trang Gloves (Thailand) PLC - Surat Thani Br
Attn. Ms. Insuwan
189 Moo 7, Phlai Wat, Kanchanadit
84160 Surat Thani
Thailand

Subject: Chemical permeation acc to EN 16523-1
Your reference: PO 19-02331
Contact person: **W.E.M. Boomaars**

Dear Ms. Insuwan,

At the request of Sri Trang Gloves (Thailand) PLC - Surat Thani Br (your reference PO 19-02331) ProQares performed permeation tests with industrial chemicals on protective materials. The tests were performed according to NEN-EN 16523-1:2015. The details of the received samples are presented in Table 1 and all test results, including the observations directly after testing (wet) and after drying (dry), are presented in Table 2 to 6 and Figure 1 to 4. The detailed description of the test procedures is presented in the Annex. Note that the test results are only applicable to the tested materials, mentioned in Table 1. The tests were performed between 20-05-2019 and 24-06-2019.

Table 1: Received samples

Sample code ProQares	Description by customer	Received
19PQ1000	Sample ID: 401185064 Latex Powder Free gloves	17-05-2019

Table 2: Permeation test with **Formaldehyde/MeOH (37/10%)**, $T = 23.2\text{ }^{\circ}\text{C}$

Sample code	Thickness (mm)			Average Thickness (mm)	Weight (g/m ²)	Breakthrough time (min)	Observed physical changes on the material (wet/dry)
19PQ1000A	0.08	0.09	0.08	0.08	95	> 480	None
19PQ1000B	0.09	0.09	0.08	0.09	93	> 480	None
19PQ1000C	0.08	0.09	0.09	0.08	93	> 480	None
Total average				0.08	94	> 480	

* Time point at which the permeation reaches the permeation rate of 1.0 µg/cm²/min

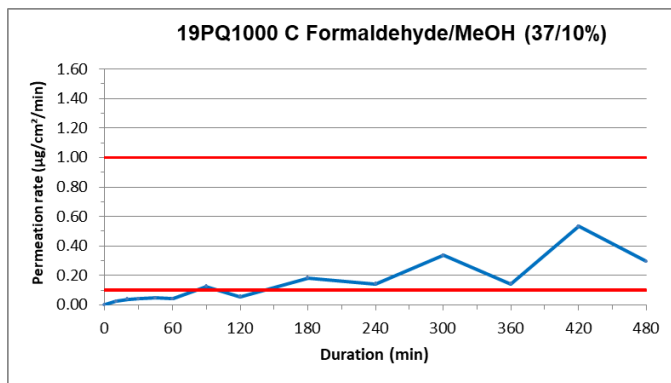
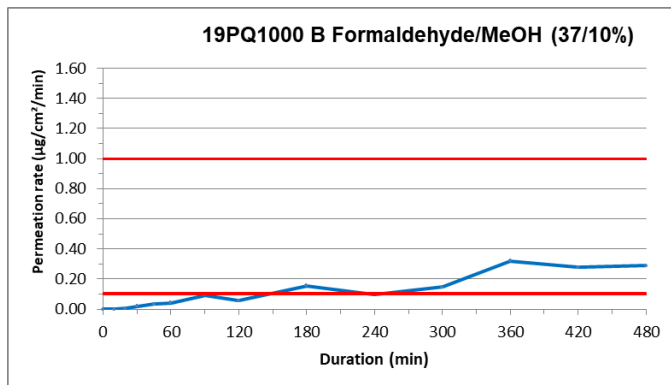
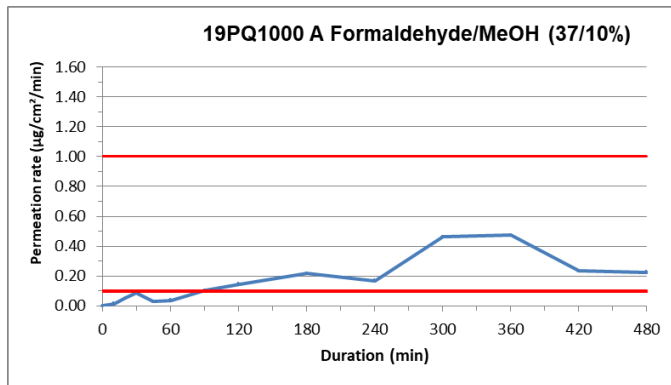


Figure 1 A, B and C Results Formaldehyde/MeOH

Table 3: Permeation test with **Hydrogen peroxide (30%)**, $T = 22.4^{\circ}\text{C}$

Sample code	Thickness (mm)			Average Thickness (mm)	Weight (g/m ²)	Breakthrough time (min)	Observed physical changes on the material (wet/dry)
19PQ1000A	0.10	0.10	0.10	0.10	108	> 480	None
19PQ1000B	0.09	0.09	0.08	0.09	94	> 480	None
19PQ1000C	0.10	0.10	0.10	0.10	113	> 480	None
Total average				0.09	105	> 480	

* Time point at which the permeation reaches the permeation rate of 1.0 µg/cm²/min

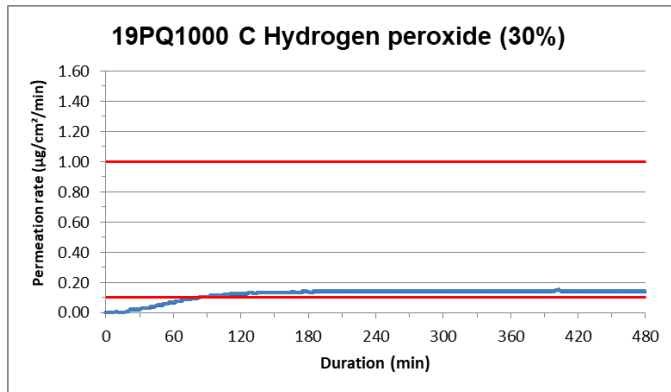
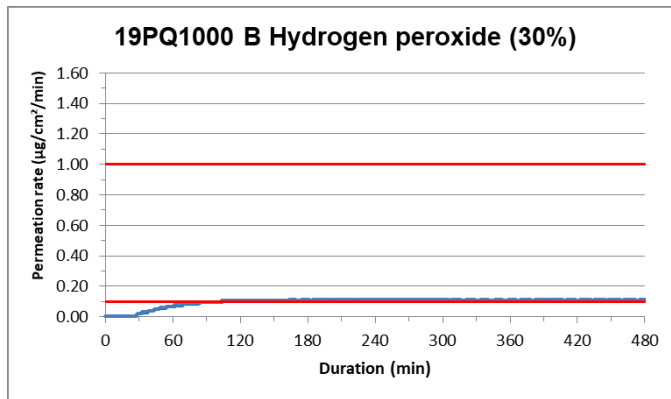
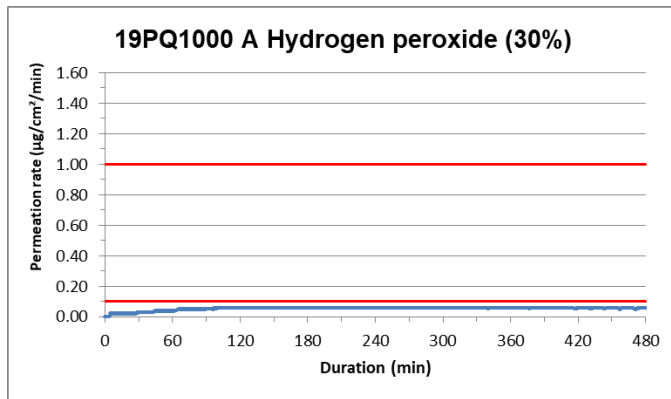


Figure 2 A, B and C Results Hydrogen peroxide

Table 4: Permeation test with **Sodium hydroxide (40%)**, $T = 23.3^{\circ}\text{C}$

Sample code	Thickness (mm)			Average Thickness (mm)	Weight (g/m ²)	Breakthrough time (min)	Observed physical changes on the material (wet/dry)
19PQ1000A	0.09	0.09	0.10	0.09	100	> 480	None
19PQ1000B	0.09	0.10	0.10	0.10	99	> 480	None
19PQ1000C	0.08	0.09	0.09	0.09	94	> 480	None
Total average				0.09	97	> 480	

* Time point at which the permeation reaches the permeation rate of 1.0 µg/cm²/min

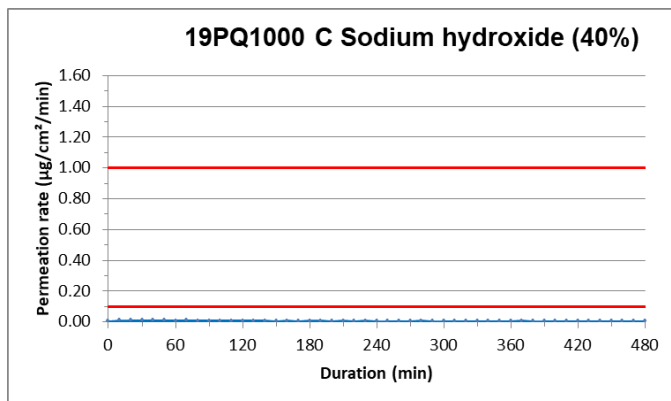
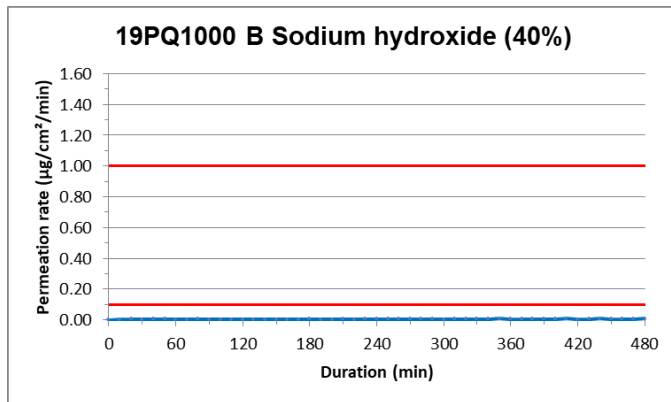
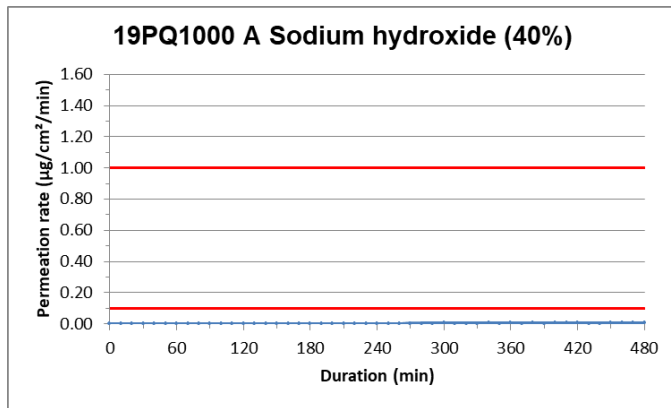


Figure 3 A, B and C Results Sodium hydroxide

Table 5: Permeation test with **Sulphuric acid (96%)**, $T = 23.3^{\circ}\text{C}$

Sample code	Thickness (mm)			Average Thickness (mm)	Weight (g/m ²)	Breakthrough time (min)	Observed physical changes on the material (wet/dry)
19PQ1000A	0.10	0.08	0.10	0.09	98	10	None
19PQ1000B	0.10	0.10	0.09	0.09	97	8	None
19PQ1000C	0.09	0.09	0.09	0.09	94	10	None
Total average				0.09	96	9	

* Time point at which the permeation reaches the permeation rate of 1.0 µg/cm²/min

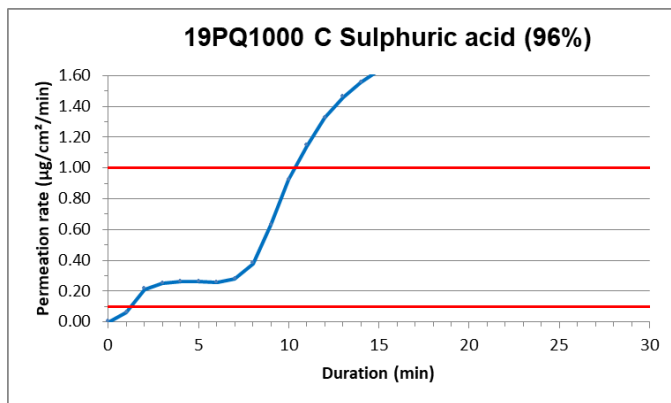
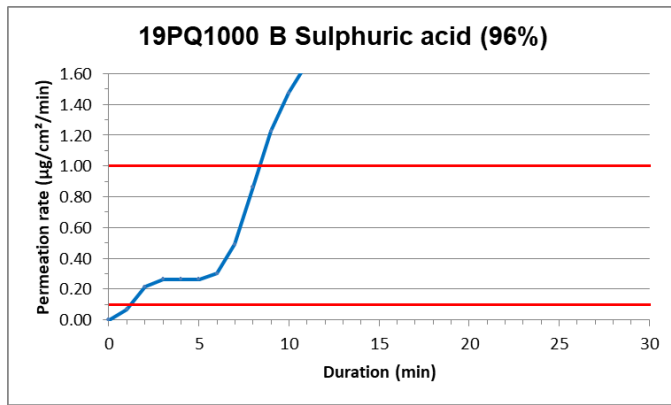
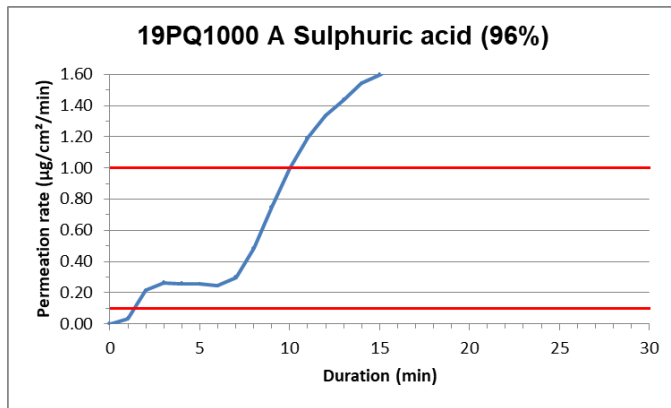


Figure 4 A, B and C Results Sulphuric acid

Table 6: Normalized breakthrough and overall result of the test.

Sample code	Chemical	%	Cas number	Breakthrough time (min)	Lowest result of test** (min)	Detection limit (µg/cm ² /min)
				1.0*		
19PQ1000A	Formaldehyde/MeOH	37/10	50-00-0	> 480	> 480	0.005
19PQ1000B	Formaldehyde/MeOH	37/10	50-00-0	> 480		
19PQ1000C	Formaldehyde/MeOH	37/10	50-00-0	> 480		
19PQ1000A	Hydrogen peroxide	30	7722-84-1	> 480	> 480	0.05
19PQ1000B	Hydrogen peroxide	30	7722-84-1	> 480		
19PQ1000C	Hydrogen peroxide	30	7722-84-1	> 480		
19PQ1000A	Sodium hydroxide	40	1310-73-2	> 480	> 480	0.05
19PQ1000B	Sodium hydroxide	40	1310-73-2	> 480		
19PQ1000C	Sodium hydroxide	40	1310-73-2	> 480		
19PQ1000A	Sulphuric acid	96	7664-93-9	10	8	0.05
19PQ1000B	Sulphuric acid	96	7664-93-9	8		
19PQ1000C	Sulphuric acid	96	7664-93-9	10		

** If the 3 tests breakthrough time results are within 20% of their mean the lowest results is defined as the result of the test.

We trust all things are clear to you. In case of any questions, please do not hesitate to contact us.

Kind regards,



W.E.M. Boomaars
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Mr. C. Jansen
Managing director

ANNEX 1 DESCRIPTION OF TEST METHODS

Quantitative permeation test with industrial chemicals according to NEN-EN 16523-1:2015

Sodium hydroxide, Sulphuric acid

Parameter	units	specification
Test cell		Alternative, validated cell
Contamination surface	cm ²	30.7
Closed/Open loop system		Closed
Collection medium		H ₂ O
Homogenisation		Stirring during experiment
Method of detection		Conductivity
Temperature	(°C)	23
Humidity	(%RH)	--
Test duration, max	(min)	480
Sampling interval	(min)	1
Calculation		Based on interpolation
Result reported	(min)	Breakthrough time
Accuracy	(%)	25*

The weight and thickness of each swatch is measured before mounting in the test cell. The swatch is mounted in the cell. The test cell is placed in a thermostatic cupboard at 23°C. The chemical permeating through the material is collected and analyzed with conductivity.

* Breakthrough times less than 10 minutes have more variation in the accuracy of the reported values.

Hydrogen peroxide

Parameter	units	specification
Test cell		Alternative, validated cell (EN cell)
Contamination surface	cm ²	4.9
Closed/Open loop system		Open
Collection medium		Air
Flow rate collection medium		> 5 cell volume changes per minute
Method of detection		Electrochemical sensor
Temperature	(°C)	23
Humidity	(%RH)	--
Test duration, max	(min)	480
Sampling interval	(min)	1
Calculation		Based on interpolation
Result reported	(min)	Breakthrough time
Accuracy	(%)	25*

The weight and thickness of each swatch is measured before mounting in the test cell. The swatch is mounted in the cell. The test cell is placed in a thermostatic cupboard at 23°C. The chemical permeating through the material is collected and analyzed with a Electrochemical sensor.

* Breakthrough times less than 10 minutes have more variation in the accuracy of the reported values.

Formaldehyde

Parameter	units	specification
Contamination surface	cm ²	20.3
Closed/Open loop system		Closed
Collection medium		H ₂ O
Homogenisation		Stirring during experiment
Method of detection		HPLC
Temperature	(°C)	23
Humidity	(%RH)	--
Test duration, max	(min)	480
Sampling interval	(min)	Variable
Calculation		Based on interpolation
Result reported	(min)	Breakthrough time
Accuracy	(%)	25*

The weight and thickness of each swatch is measured before mounting in the test cell. The swatch is mounted in the cell. The test cell is placed in a thermostatic cupboard at 23°C. The chemical permeating through the material is collected and analyzed by HPLC.

* Breakthrough times less than 10 minutes have more variation in the accuracy of the reported values.

ANNEX 2 DEVIATIONS FROM THE STANDARD (16523-HPLC)

Parameter	units	specification
Sample points	min	0, 10, 20, 30, 45, 60, 90, 120, 150, 180, 240, 300, 360, 420, 480