



PROJECT MIDWOR-LIFE Deliverable brief

Report on the study of textile materials, DWOR finishing and alternatives (Action A1)



Project acronym:	MIDWOR-LIFE
Project full title:	Mitigation of environmental impact caused by DWOR textile finishing chemicals studying their nontoxic alternatives
Grant agreement no.:	LIFE14 ENV/ES/000670
Responsible partner for deliverable:	AEI TEXTIL
Contributing partners:	LEITAT, CLUTEX, CS-POINTEX
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Nature ¹ :	R
Dissemination level ² :	PU
Total number of pages:	9
Version:	V1.0
Contract delivery date:	31/03/2016
Actual delivery date:	31/03/2016

Version control

Number	Date	Description	Publisher	Reviewer
1.0	310316	Published deliverable brief	AD	AD

¹ **Nature of Deliverable:** P= Prototype, R= Report, S= Specification, T= Tool, O= Other.

² **Dissemination level:** PU = Public, RE = Restricted to a group of the specified Consortium, PP = Restricted to other program participants (including Commission Services), CO= Confidential, only for members of the Consortium (including the Commission Services)



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0. Introduction

This document contains the results of **Action A.1 Selection of most representative textile materials and finishing technologies** which objective was to identify and select the different textile materials and finishing technologies and products which will be employed in the project. This action is divided in three tasks which are the textile materials selection, the finishing technologies selection and a survey on textile companies (results and result's analysis on the survey are presented at deliverable **A1.2 Report on the results of the survey**).

As results of **Action A.1**, 2 conventional long chain fluorocarbon based DWOR have been selected; 7 alternative DWOR products have been identified and selected and 5 textile fabrics of different composition, structure and weight have been selected.

Action A.1 has been developed from September'15 to March'16, coordinated by AEI TÈXTIL and with the collaboration of LEITAT, CLUTEX and CS-POINTEX.

1. Selection of DWORs

1.1 Conventional DWORs

The most used products based on C-8 fluorocarbons are:

- 1- RUDOLF:
 - a. RUCOGUARD AFB CONC
 - b. REPELLAN® EPF-A
 - c. REPELLAN® KFC-A
- 2- TANATEX:
 - a. BAYGARD FD 8N
- 3- COLORCENTER:
 - a. CENTERGARD WHR
 - b. CENTERGARD FR
 - c. CENTERGARD TTR
- 4- THOR
 - a. QUECOPHOB LE 8
- 5- CHT BEZEMA
 - a. Tubiguard 66

1.2. Selection of alternatives

The research on conventional DWORs alternatives has been done separately in DWORs fluorine-based shorter chains and DWORs free of fluorocarbons.

In section 2.2.1 and 2.2.2 a list of manufacturers and main DWORs (short-chain, C-6) and FC-free is provided.

1.2.1 C6

The most used products based on C-6 fluorocarbons are:

- 1- HUNTSMAN:
 - a. PHOBOL CP
- 2- ARCHROMA:
 - a. Nuva N1811
- 3- POLYSISTEC:
 - a. POLYGUARD - 3936/N
 - b. POLYGUARD – 8036
 - c. POLYGUARD – 8054
- 4- TANATEX:
 - a. BAYGARD EFN:
- 5- RUDOLF:
 - a. RUCOGUARD AFB6 Conc
 - b. RUCOGUARD AFC6
 - c. RUCOGUARD AFH6
 - d. RUCOGUARD AFR6
- 6- PULCRA:
 - a. REPELLAN XC-6 PLUS
 - b. REPELLAN FT-626
 - c. REPELLAN NC-6
 - d. REPELLAN CNC-6
- 7- DAIKIN:
 - a. UNIDYNE TG-5521
- 8- DEVAN:
 - a. Ecorelease
- 9- SOLVAY:
 - a. Fluorolink® 5032
 - b. Fluorolink® P56
- 10- COLORCENTER
 - a. CENTERGARD BWS



11- THOR

- a. QUECOPHOB LE 6

12- CHT BEZEMA

- a. Tubiguard FA2-F
- b. Tubiguard SR 2010-F W
- c. Tubiguard PC3-F
- d. Tubiguard AN-F
- e. Tubiguard 90-F

1.2.2 Other chemical compositions

The most used products based on other chemical compositions are:

PFSI (Perfluorosilicones)

1. DAIKIN:

- a. UNIDYNE TG-5521 → C6 + silicone

2. SOLVAY:

- a. FOMBLIN
- b. GOLDEN

SOL-GEL

1. NANO-X

- a. X-TEX EC5028

Silicone

1- PROTEX:

- a. DRYOL S 600

Next section contains a table indicating the final selection of DWORs and the justification on why these products have been selected.



1.3 Summary of final selection

Number	Technology	Company	Brand	Chemistry	Comments
1	CONVENTIONAL	RUDOLF	RUCOGUARD AFB CONC	Long Chain Fluorocarbon (c8)	-
2	CONVENTIONAL	PULCRA	REPELLAN® EPF-A	Long Chain Fluorocarbon (c8)	-
3	ALTERNATIVE	HUNTSMAN	PHOBOL CP	Short Chain Fluorocarbon (c6)	PFOA-free
4	ALTERNATIVE	ARCHROMA	NUVA N4118	Short Chain Fluorocarbon (c6)	PFOA-free. Nano-dispersion of fluoropolymer
5	ALTERNATIVE	RUDOLF	RUCOGUARD AFC6	Short Chain Fluorocarbon (c6)	PFOA-free dendrimer and 3D hyperbranched polymer
6	ALTERNATIVE	PULCRA	REPELLAN XC-6 PLUS	Short Chain Fluorocarbon (c6)	PFOA-free
7	ALTERNATIVE	NANO-X	X-TEX EC5028	SOL-GEL	SOL GEL without fluorine. PFOA-Free
8	ALTERNATIVE	DAIKIN	UNIDYNE TG-5521	Perfluorosilicones	Structured coating: C6 + silicone
9	ALTERNATIVE	PROTEX	DRYOL S 600	Silicones	Completely Fluor-free



Regarding DWOR finishing, the tendency is to replace the C8 fluorocarbon chemistry by C6 or C4 fluorocarbon products or even fluorine-free water repellents. In fact, currently, new commercial DWOR finishes are coming onto the market based on short chain fluorocarbons, hybrid systems or they are fluorine free.

Regarding short chain fluorocarbon, the most widely used in industry are RUCOGUARD and RUCOSTAR from Rudolf Chemie and NUVA N4118 from Archroma. This is one of the conclusions we have detected at the survey's results. By the experience of LEITAT and talking with finishers, we've observed that other finishes based on short chain fluorocarbon are from Huntsman and Pulcra with their brands PHOBOL CP and REPELLAN XC-PLUS, respectively. So, because of that, and because of the performance showed by these 4 products, we've selected it as a representative of short chain fluorocarbon alternatives. It is interesting to clarify, that other solutions with C4 chemistries, such SCOTCHGARD by 3M, was not selected because of this chemistry exhibits lower repellency but better stain release.

The selection of the other alternatives is done according to the interest from companies to be studied in the project and due the state of the art which has been done. We've selected three products, one per each alternative that seems to be an alternative on the future. SOL-GEL technology, perfluorosilicones and modified silicones. LEITAT has experience in SOL-GEL technology and suggests to work with NANO-X because is one of the most used of the alternatives at commercial level, with good performance.

In the case of prefluorosilicones, Daikin has a solution with an hybrid fluorocarbon (c6) and silicone. Daikin is one of the producers with higher knowledge in the field of fluorocarbon with lots of innovations and patents. In this case, the Unidyne(TM) TG-5521 fabric treatment delivers the advantages of two complementary chemistries - the superior oil and water repellency of new C6 fluorine platform, which enhances the product's environmental performance, and the soft touch of silicones.

Finally, we've detected one product based on silicone from Protex, (DRYOL S 600) with an acceptable performance in oil test reported by the company that looks one of the most innovative solution of the completely fluor-free alternatives. Although we know that is not a real alternative to products based on fluorocarbons in terms of performance, due the innovations and interest showed by the company, and due the performance reported by the company, we think that could be an alternative to be studied in MIDWOR-LIFE project.

In the case of conventional products (C8 fluorocarbon), we have decided to select products from the same company of selected as a short chain fluorocarbon alternative. Specifically they have been selected from RUDOLF and PULCRA, as they were the most used by the companies surveyed that coincided with the selected companies as alternatives.

2. Selection of fabrics

A list of different fabric references has been revised in order to select the most representatives according to the different sectors that are interested in water and oil repellence such as automotive, sport, fashion, work wear and home textiles.

The final selection of 5 representative fabrics is the following (in colour). Note that there are 9 different fabrics pre-selected in order to avoid possible difficulties in acquiring:

Number	Weight	Composition	Sector
1	230 g/m ²	100% PES	Automotive
2	220 g/m ²	90% PA/10%EI	Sport (cycling)
3	195 g/m ²	100% PES	Sport (mountain)
4	180g/m ²	100% WO	Fashion (suit)
5	175g/m ²	100% CO	Fashion (shirt)
6	170g/ m ²	65%PES/35%CO	Fashion (trouser)
7	250 g/m ²	49%PP / 47%PES / 4%CO	Home (sofa)
8	175g/m ²	100% PES	Workwear (polo)
9	250 g/m ²	80COP / 18%PES / 2%antistatic	Workwear (trouser)

Each fabric is a representative one of the sector studied, according to the most common characteristics used to develop them.