MIDWOR - LIFE14 ENV/ES/000670

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PROJECT MIDWOR

User Manual of the MIDWOR webtool

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[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)

Contents

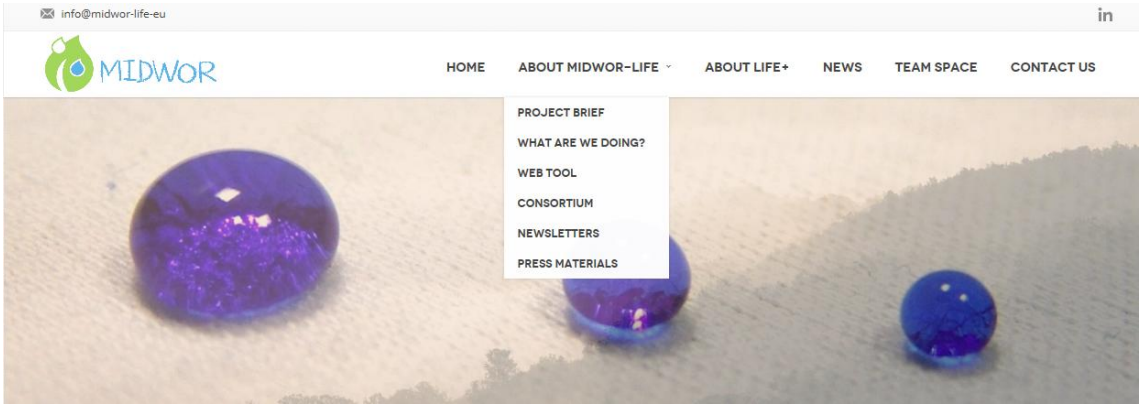
1. Goal

The aim of the MIDWOR tool is to aware the textile finishing industry about the environmental and human health impacts of using different DWOR substances in textile finishing processes by applying a life cycle thinking approach. The webtool provides useful information (environmental impact, human health impact and technical performance) of the different DWOR chemistries tested in MIDWOR project. The content of the environmental and human health database integrated in the present web tool is based on the assumptions, the results and the conclusions of the LCA (Life Cycle Assessment) studies made by the CETIM under Action B3.

The present document explains how to use the MIDWOR webtool.

2. Access to the MIDWOR webtool

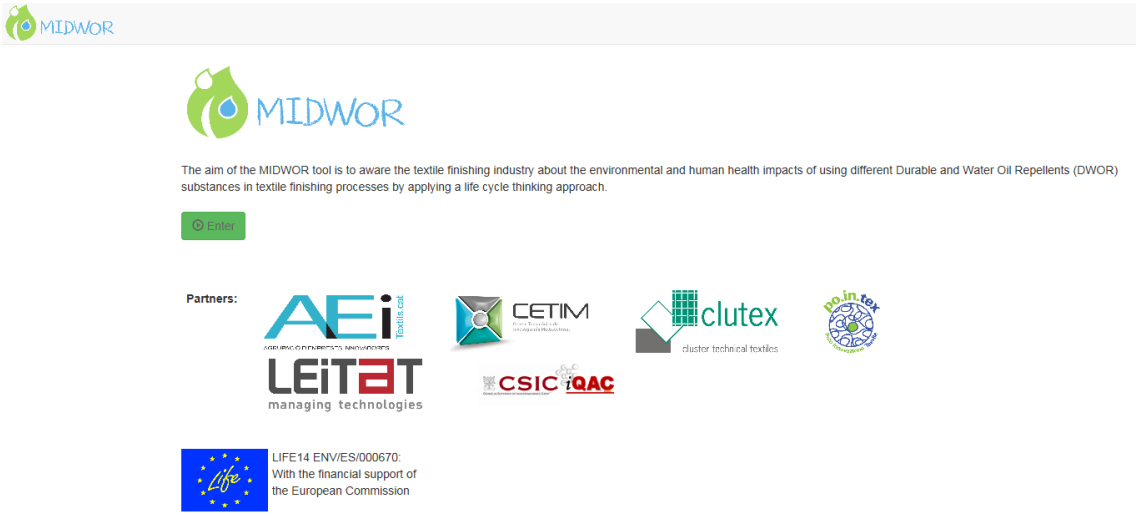
The webtool is integrated in the MIDWOR project website: https://www.midwor-life.eu/, in the section "*About MIDWOR-LIFE*"



3. How to use the MIDWOR webtool

The following steps must be followed by the users of the tool:

1) ***Enter*** to the tool



2) Complete the data requested related to the textile finishing process:

- **<u>Section 1. General data of the textile finishing process:</u>** the user must indicate the following information by selecting one of the options provided:
    - Technical functionality applied: water repellency; oil repellency; or water and oil repellency
    - Type of finishing process: padding, coating; bath exhaustion or others
    - Fabric composition: Polyester (PES); Wool (WO); Cotton (CO); Polypropilene (PP); Linene (LI)

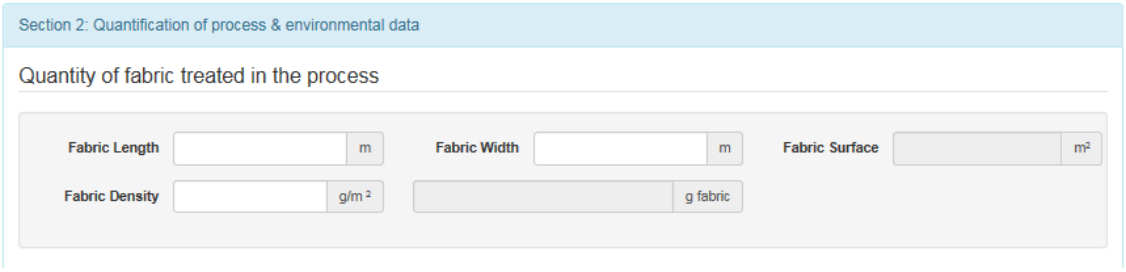
Only fabrics which contain one type of fibre can be selected and assessed with the MIDWOR tool.

- Fabric structure: non-woven; woven; or knitted.
- Type of DWOR product applied in the finishing treatment process:
  - C8 based product
  - C6 based product
  - Perfluorosilicone
  - Silicone
  - Paraffin
  - Dendrimer

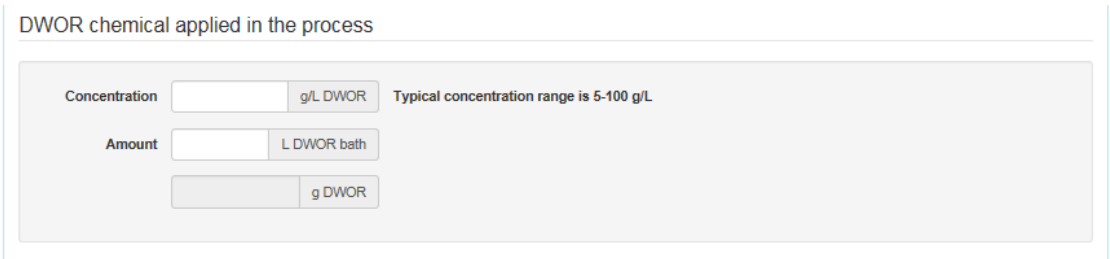
Click on "*Continue*" to proceed to Section 2.

➢ **Section 2. Quantification of process & environmental data:** The user must provide quantitative data of the finishing textile process, and in particular:

- Quantity of fabric treated in the process: Length of the fabric (m), width of the fabric (m) and density of the fabric (g/m^2) used in the process. From these values, the tool calculates automatically the fabric surface (m^2) and the amount of fabric expressed in g.

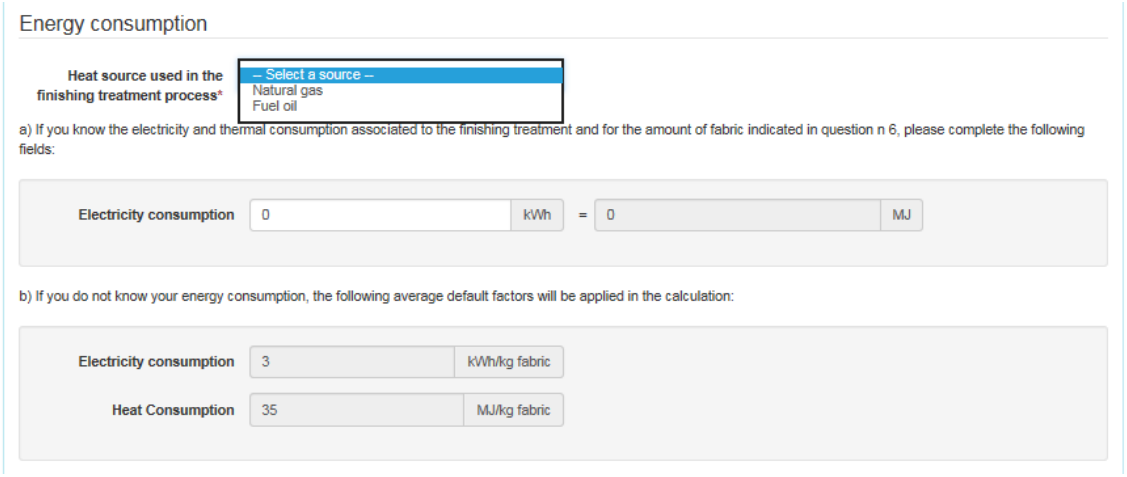


- DWOR chemical applied in the process: the concentration of the DWOR product applied (in g/L) must be indicated. Typical concentration ranges from 5 to 100 g/L depending on the DWOR product and the application. The user must indicate too the DWOR bath volume in Litres. From the previous data, the tool calculates automatically the amount of DWOR product used (in g).

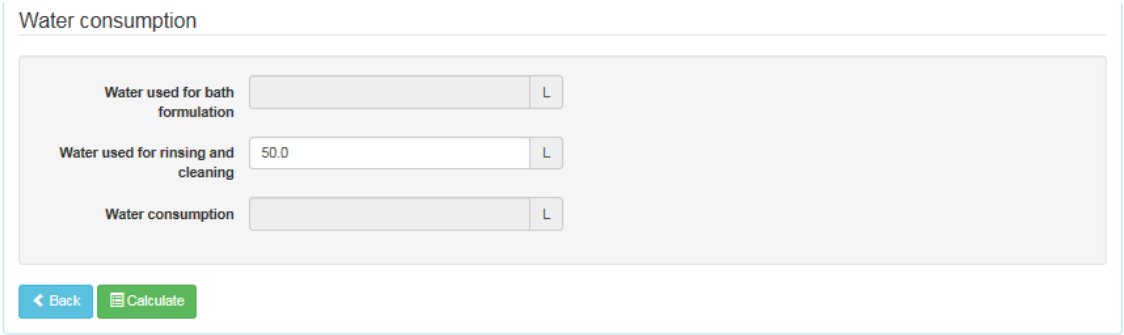


- Energy consumption of the process: first of all, the heat source used in the finishing treatment process must be selected: natural gas or fuel oil. If the user knows the electricity and thermal consumption associated to the finishing treatment and for the amount of fabric indicated in section 1, section a) must be completed. On the other hand, if the energy consumption associated to the

finishing process is unknown, default factors obtained from the literature are provided by the tool.



- Water consumption of the process: in this part, the user must indicate only the water used for rinsing and cleaning equipment (in L): 50 L is provided by the tool as a reference value. The water used for bath formulation (in L) is calculated automatically by the tool from the information introduced previously (bath volume and DWOR product concentration).



Finally, click on "*Calculate*" to show the results.

➢ Section 3. Results:

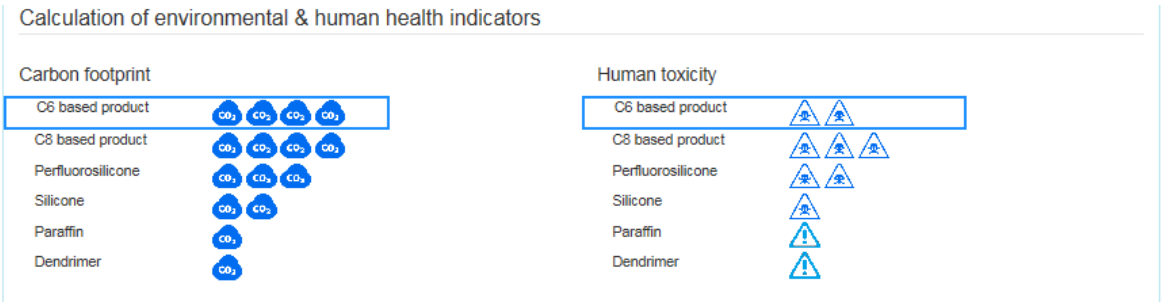
The results provided below are based on the conditions used during the applications of MIDWOR-LIFE project:

- Type of finishing process: Padding
- Fabric composition: Polyester (woven, nonwoven and knitted), Wool (woven). The results provided for the other fabric compositions are those obtained with polyester.
- Product concentration: The results presented have been obtained with the following concentrations:
    - C8 based product: 35 g/L

- C6 based product: 40 g/L
- Perfluorosilicone: 60 g/L
- Silicone: 60 g/L
- Dendrimer: 50 g/L
- Paraffin: 80 g/L

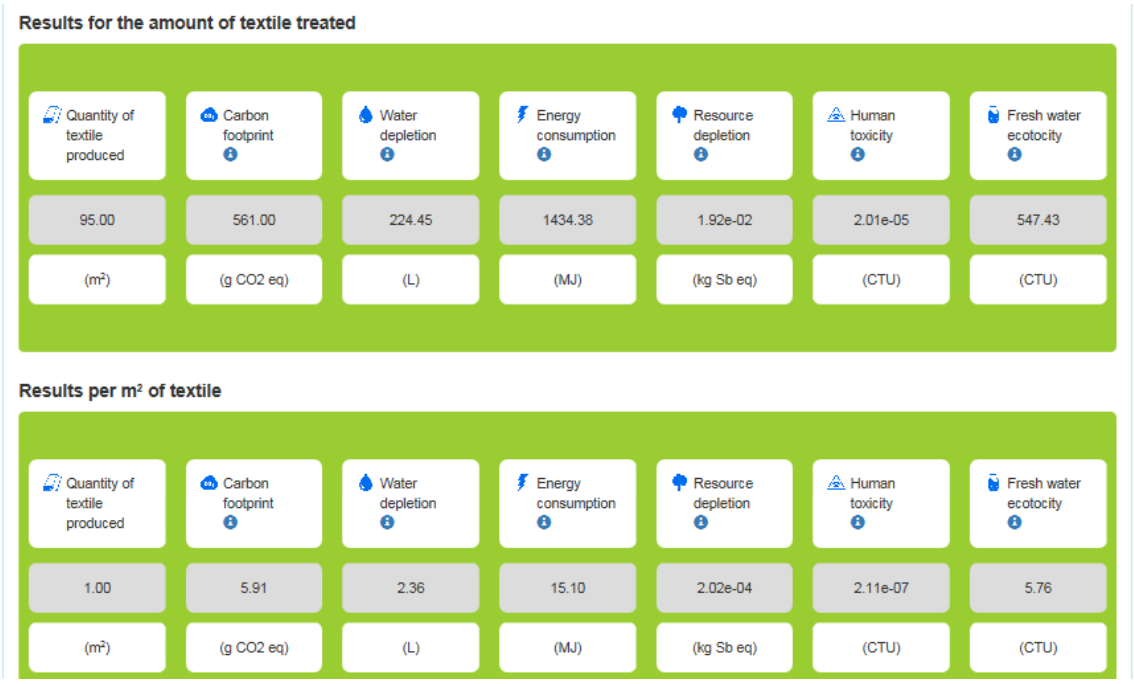
The environmental and human health results are displayed based on the data introduced by the user in the previous sections. The results are obtained by applying conversion factors that are integrated in the internal database of the webtool. The conversion factors have been obtained from the Life Cycle Assessment studies carried out in the industrial demonstrations participating in MIDWOR project.

- **Calculation of environmental & human health indicators:**
  First, a comparison of the impact in terms of Carbon footprint and Human Toxicity of the different DWOR chemistries are represented. The DWOR product assessed is marked in a blue box. Concerning the Carbon footprint indicator, the DWOR products with more CO_2 clouds represented indicate a higher impact on the total greenhouse gas emissions.
  The more skulls represented, the higher the level of human toxicity. The *skull pictogram* means that the impact on human toxicity is higher than in those products that contain an *attention pictogram* .



The tool provides quantitative results of different environmental and human health indicators assessed based on a life cycle thinking approach. The results are expressed in two different ways: 1) for the amount of textile treated in the finishing textile process; and 2) per m^2 of textile treated.

The results of the indicators are displayed as shown below:



Results for the amount of textile treated

Quantity of textile produced	Carbon footprint	Water depletion	Energy consumption	Resource depletion	Human toxicity	Fresh water ecotocity
95.00	561.00	224.45	1434.38	1.92e-02	2.01e-05	547.43
(m^2)	(g CO2 eq)	(L)	(MJ)	(kg Sb eq)	(CTU)	(CTU)

Results per m^2 of textile

Quantity of textile produced	Carbon footprint	Water depletion	Energy consumption	Resource depletion	Human toxicity	Fresh water ecotocity
1.00	5.91	2.36	15.10	2.02e-04	2.11e-07	5.76
(m^2)	(g CO2 eq)	(L)	(MJ)	(kg Sb eq)	(CTU)	(CTU)

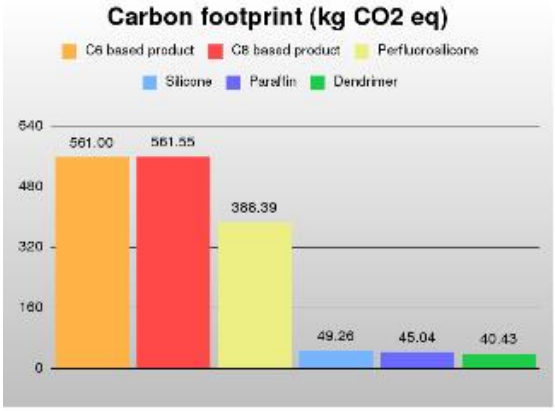
The indicators calculated by the tool are described below:

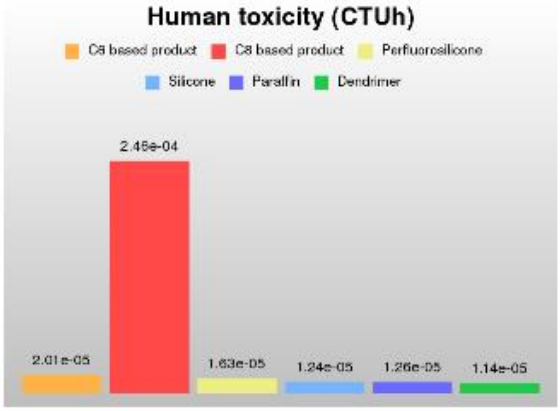
- **Carbon footprint (g CO_2 eq.):** this indicator calculates the total greenhouse gases emissions associated to the different DWOR products and resources (electricity, thermal energy and water consumption) used in finishing textile processes.. Climate change is related to emissions of greenhouse gases to air. The indicator is expressed in grams of CO_2 equivalent.
- **Water depletion (L)**: it calculates the water consumption during the finishing production of the functional textile, that is, the amount of water consumed as a resource during the manufacturing of the DWOR products used and in the fulfilled finishing processes (e.g. padding, drying and curing). It includes fresh water obtained from different natural sources. The Water depletion indicator from the impact assessment method, Swiss Ecoscarcity 2006, has been the one used. The indicator is expressed in Litres of water (L).
- **Energy consumption (MJ)**: it calculates the total accumulated demand of energy provided by different primary sources, both renewable (e.g. photovoltaic, wind energy, etc) and non-renewable included (e.g. natural gas, fuel-oil, electricity produced from fossil fuels). Energy consumption indicator takes into account not only the energy used in finishing textile process but also for the manufacturing of the DWOR products. It has been used the European Cumulative Energy Demand (CED) indicator from the method published by Ecoinvent. The indicator is expressed in MJ of energy.
- **Resource depletion (kg Sb eq):** resource depletion is the consumption of a resource faster than it can be replenished. Natural resources are commonly

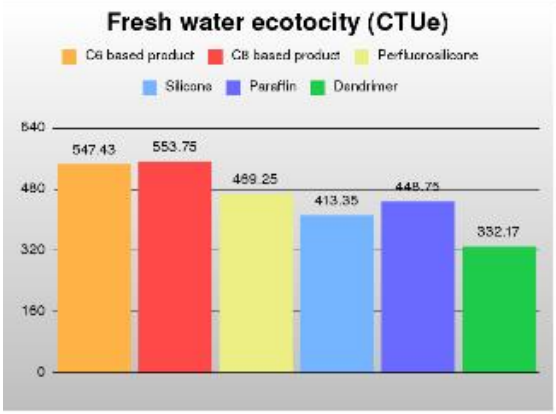
divided between renewable resources and non-renewable resources (e.g. fossil). Use of either of these forms of resources beyond their rate of replacement is considered to be resource depletion. Resource depletion is most commonly used in reference to mining, water usage and consumption of fossil fuels. The resources are counted from chemicals used as raw materials during the finishing process selected. The indicator is expressed in kg antimony (Sb) eq.

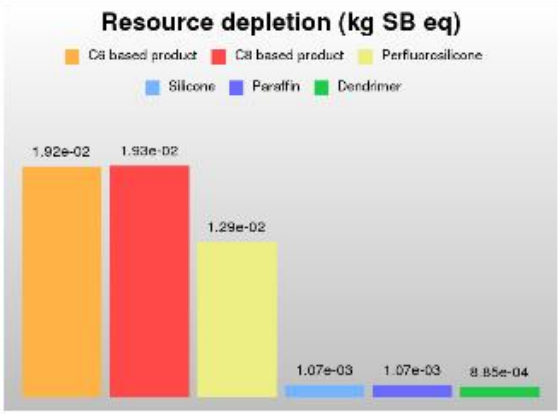
- **Human toxicity (CTUh):** the emission of chemical substances can have impacts on human health. Human toxicity in a LCA context covers a number of different effects: acute toxicity, irritation/corrosive effects, allergenic effects, irreversible damage/organ damage, genotoxicity, carcinogenic effects, toxicity to reproductive system/teratogenic effects, and neurotoxicity. The equivalence factors are determined for emission to different compartments: air, water, and soil and exposure via different media: air water, and soil. Health risks of exposure in the working environment are not included. The characterization factor for human toxicity impacts (human toxicity potential) is expressed in comparative toxic units (CTUh), which is the estimated increase in morbidity in the total human population per unit mass of a chemical emitted. Unit: [CTUh per kg emitted] = [disease cases per kg emitted]
- **Freshwater ecotoxicity (CTUe):** this category indicator refers to the impact on fresh water ecosystems, as a result of emissions of chemicals to air, water and soil. Therefore, this indicator reflects how chemicals affect freshwater and the organisms (e.g. invertebrates, fish, algae) living in it. The characterization factor for aquatic ecotoxicity impacts (ecotoxicity potential) is expressed in comparative toxic units (CTUe), an estimate of the potentially affected fraction of species (PAF) integrated over time and volume, per unit mass of a chemical emitted. Unit: [CTUe per kg emitted] = [PAF × m^3 × day per kg emitted].

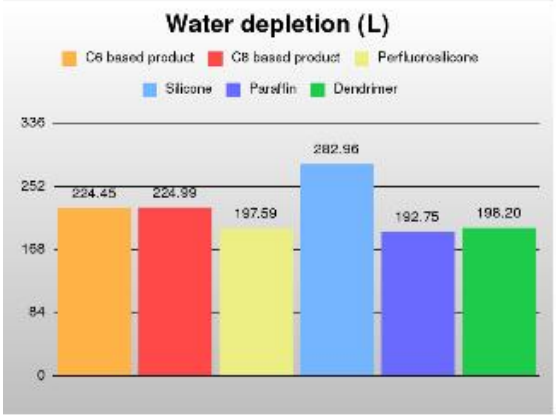
The tool also simulates which would be the impact in case of using other DWOR products by providing comparative charts for the environmental and human health indicators.

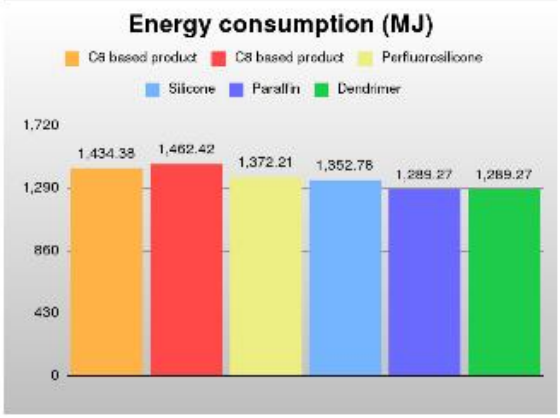






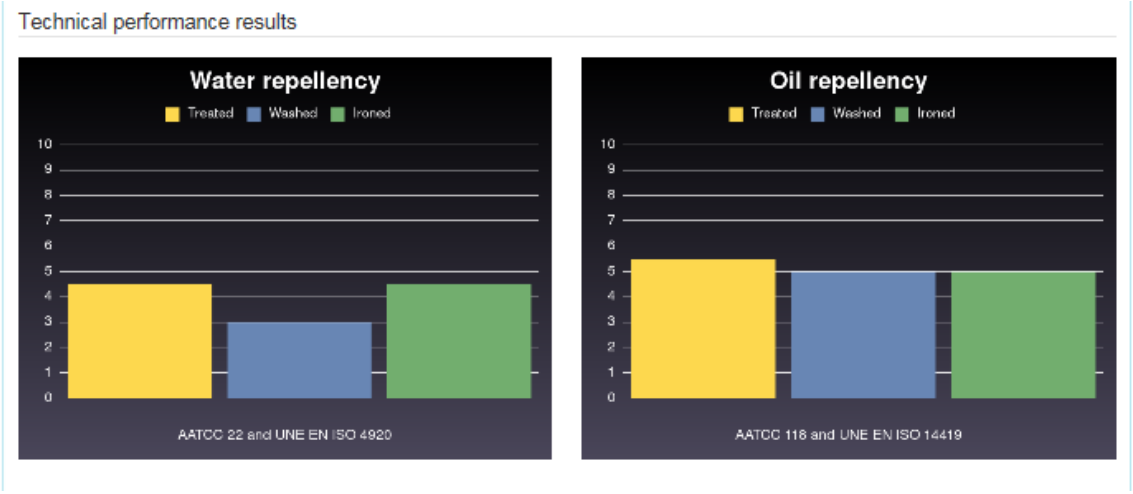






- **Technical performance results:**

The tool also provides information about the technical performance of the DWOR products tested and applied in polyester and wool textiles, which are the fabrics that have been used in MIDWOR project. The water and oil repellence grades after treating, washing and ironing the fabrics are represented in charts as shown below:



The water and oil repellence grades introduced in the tool database were obtained from the laboratory results and industrial results carried out in MIDWOR project. Further details are shown in the figure below:

Fabric: PES non woven	Water repellency			Oil repellency		
	Treated	Washed	Ironed	Treated	Washed	Ironed
C8 based product	3,5	0	0	8	0	0
C6 based product	5	0	0	6,5	0	0
Perfluorosilicone	2	0	0	6	0	0
Silicone	3,5	0	0	0	0	0
Paraffin	2	0	0	0	0	0
Dendrimer	3	0	0	0	0	0

Fabric: PES woven	Water repellency			Oil repellency		
	Treated	Washed	Ironed	Treated	Washed	Ironed
C8 based product	5	3,5	5	6,5	2,5	6,5
C6 based product	5	2	0	6,5	0,5	0
Perfluorosilicone	4,5	3	4,5	6,5	4	6
Silicone	0	0	0	0	0	0
Paraffin	2	1,5	0	0	0	0
Dendrimer	2	1,5	0	0	0	0

Fabric: PES knitted	Water repellency			Oil repellency		
	Treated	Washed	Ironed	Treated	Washed	Ironed
C8 based product	4,5	4	4,5	6,5	2	5,5
C6 based product	4,5	3	4,5	5,5	5	5
Perfluorosilicone	4,5	3	4,5	5	2	4
Silicone	4,5	2	2	0	0	0
Paraffin	0	0	0,5	0	0	0
Dendrimer	4,5	3	4,5	0	0	0

Fabric: Wool woven	Water repellency			Oil repellency		
	Treated	Washed	Ironed	Treated	Washed	Ironed
C8 based product	5	1,5	3	5,5	0	0
C6 based product	4,75	2,5	3,25	2,5	2,5	2,5
Perfluorosilicone	0	0	0	0	0	0
Silicone	0	0	0	0	0	0
Paraffin	4	2	2,5	0	0	0
Dendrimer	3,5	1,5	1,5	0	0	0

Not applied
Lab results
Industrial results

AATCC 22 and UNE EN ISO 4920: Water repellency – Spray test

This standard measures the resistance of fabrics to wetting by water or the water repellency of fibres. In Figure 9 the Spray Test Ratings are presented:

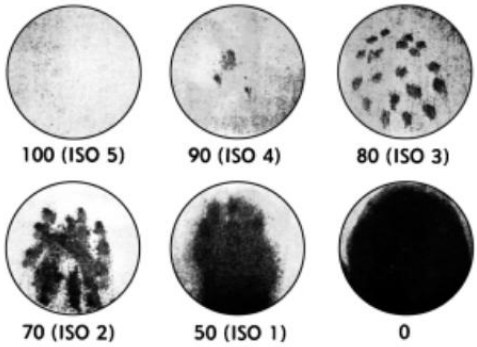


FIGURE 1. STANDARD SPRAY TEST RATINGS

- 100 (ISO 5): No wetting of the specimen face
- 90 (ISO 4): Slight random wetting of the specimen face
- 80 (ISO 3): Wetting of specimen face at spray points
- 70 (ISO 2): Partial wetting of the specimen face beyond the spray points
- 50 (ISO 1): Complete wetting of the entire specimen face beyond the spray points
- 0: Complete wetting of the entire face of the specimen

AATCC 118 and UNE EN ISO 14419: Oil repellency – Hydrocarbon Resistance Test

The AATCC Oil Repellency Grade is the numerical value of the highest-numbered test liquid which will not wet the fabric within a period of 30 sec. A grade of 0 is assigned when the fabric fails the Kaydol test liquid.

AATCC Oil Repellency Grade Number	Composition
0	None (Fails Kaydol)
1	Kaydol
2	65:35 Kaydol: n-hexadecane by volume
3	n-hexadecane
4	n-tetradecane
5	n-codecane
6	n- cecane
7	n-octane
8	n-heptane

Finally, the results can be downloaded in a pdf. file.