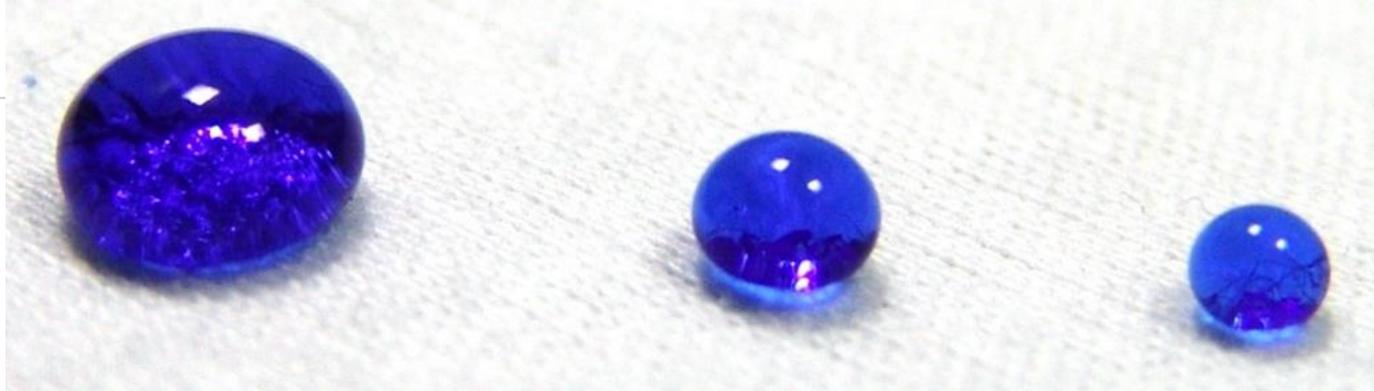


# Mitigation of environmental impact caused by **DWOR textile finishing chemicals** studying their nontoxic alternatives

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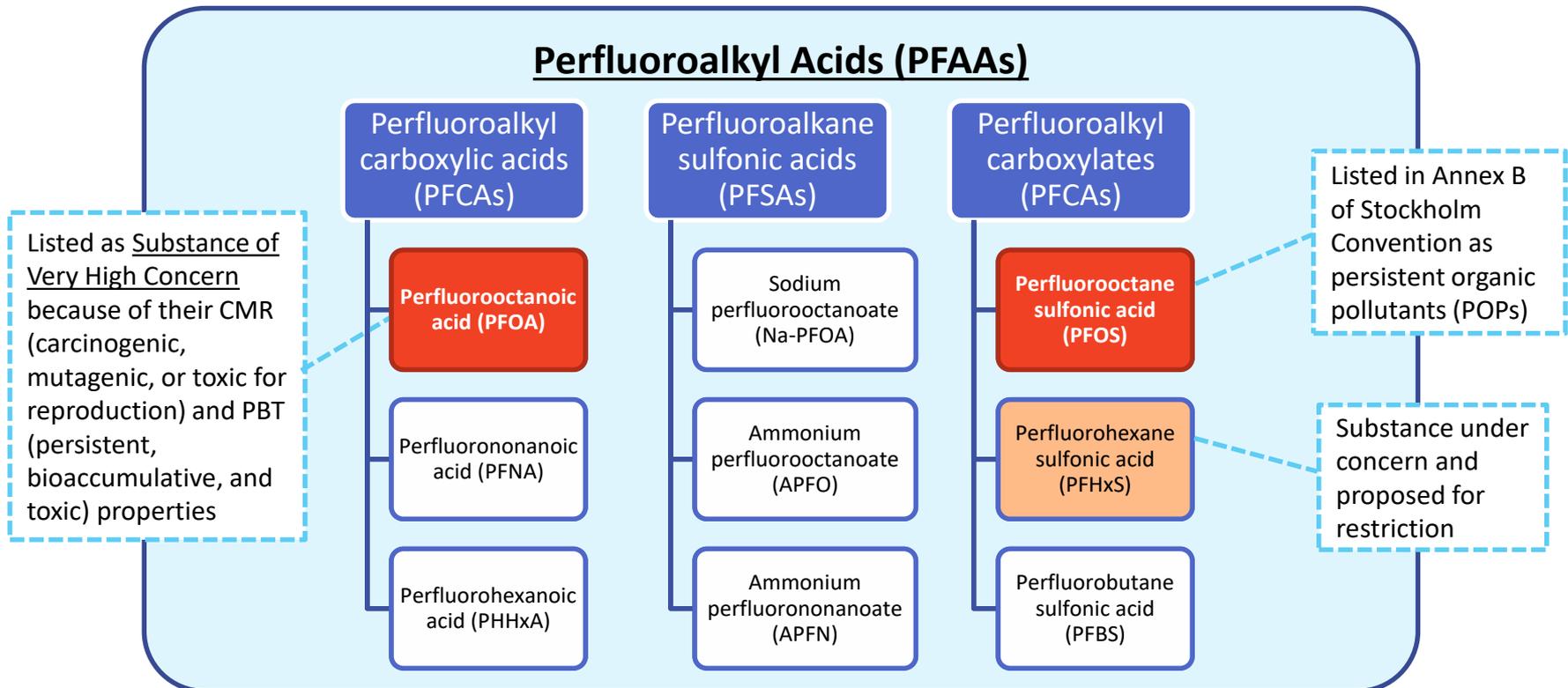
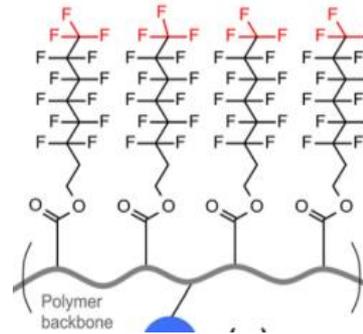
## **DWOR: Durable Water and Oil Repellents**

Chemical products used in the textile finishing industry to provide water and oil repellency to fabrics

## Conventional DWORs based perfluorinated compounds

Main **environmental concern** raised by these DWORs is that its **fluorinated chains** may be **severed from the polymeric backbone**, releasing perfluoroalkyl substances (PFAS) that degrade to perfluoroalkyl acids (PFAAs)

Among the different PFAAs, two compounds are the most concerning and studied: Perfluorooctanoic acid (PFOA) and Perfluorooctane sulfonic acid (PFOS).



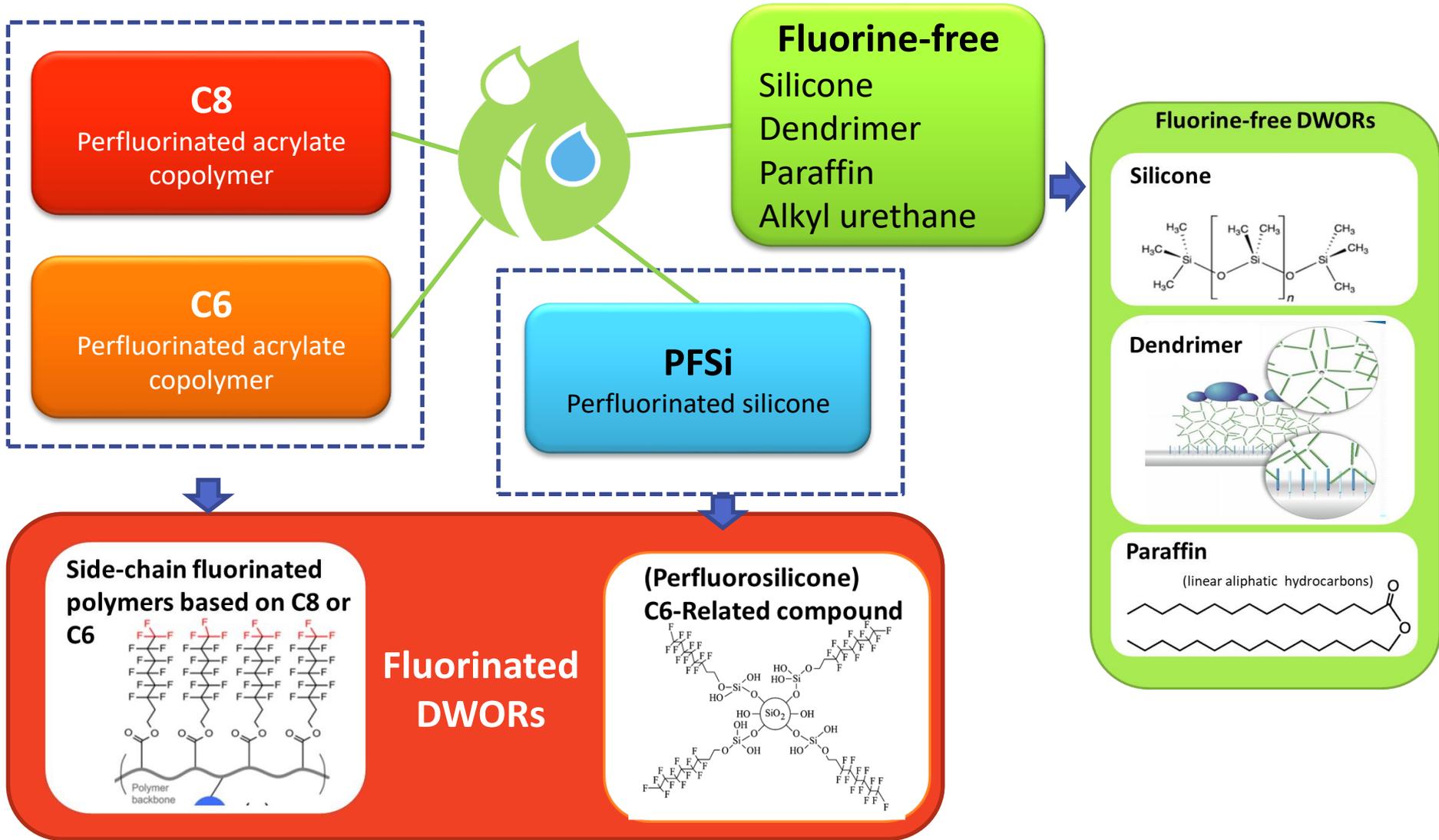


## Textile applications and fabrics





## DWOR finishing products selected





## Technical results summary

**AUTO**

**SPORT / WORK**

**HOME**

**FASHION**

AATCC 22,  
UNE EN ISO 4920

		Polyester nonwoven	Polyester knitted	Polyester woven	Wool woven	
Water repellency	PFCs	C8	<b>3,5</b>	<b>4,5</b>	<b>5</b>	3
		C6	<b>5</b>	<b>4,5</b>	3	<b>3</b>
		PFSi	2,5	<b>4,5</b>	<b>4,5</b>	<i>not tested</i>
	F-free	Silicone	<b>3</b>	2	<i>not tested</i>	<i>not tested</i>
		Dendrimer	2,5	<b>4,5</b>	2,5	<b>2</b>
		Paraffin	2	0,5	2,5	2,5
		Alkyl urethane	2	2	<b>4,5</b>	<i>not tested</i>

AATCC 118,  
UNE EN ISO 14419

		Polyester nonwoven	Polyester knitted	Polyester woven	Wool woven	
Oil repellency	PFCs	C8	<b>8</b>	<b>5,5</b>	<b>6,5</b>	0
		C6	<b>6,5</b>	<b>5,5</b>	2	<b>2,5</b>
		PFSi	6,5	<b>5</b>	<b>6</b>	<i>not tested</i>
	F-free	Silicone	<b>0</b>	<b>0</b>	<i>not tested</i>	<i>not tested</i>
		Dendrimer	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
		Paraffin	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
		Alkyl urethane	<b>0</b>	<b>0</b>	<b>0</b>	<i>not tested</i>

*Unwashed*

*10 washing cycles  
(30°C) + ironing*

*10 washing cycles  
(30°C) + ironing\**

*1 dry cleaning  
cycle + ironing*

*\*Only the industrial samples have been ironed*

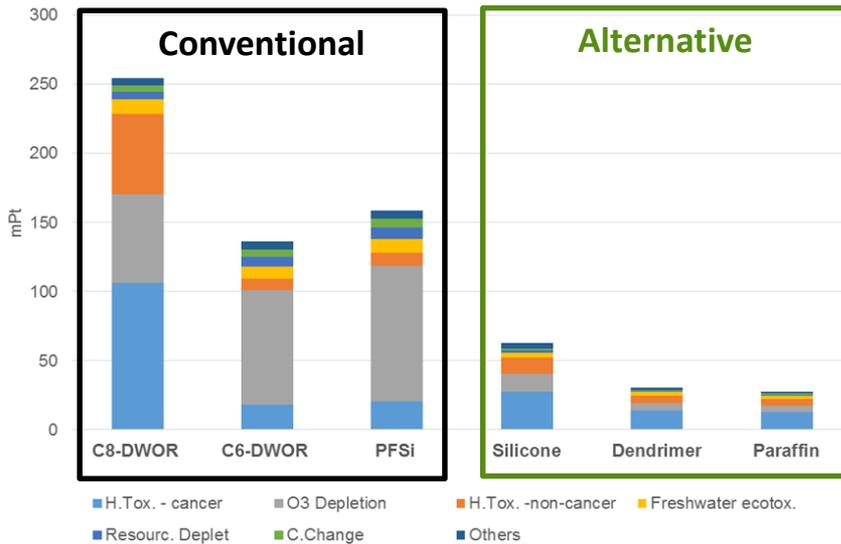
**Bold** indicates results from tests performed on the industrial demonstration



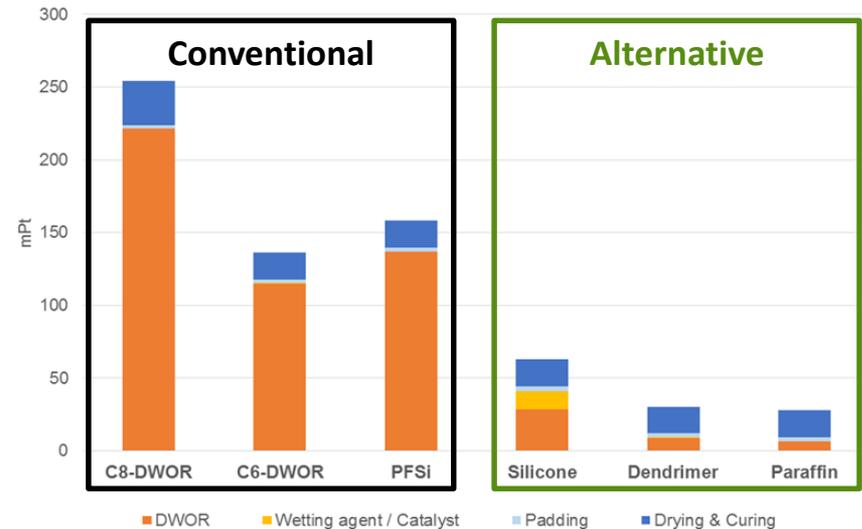
## Environmental impact: LCA

- **Higher** impact from **fluorine-based DWORs**.
- **Fluorine-free** DWORs present a **much lower overall footprint** (up to **30-40 times lower** than **C8-based**).
- Among fluorine-free, **dendrimer** and **paraffin** present a **slightly lower impact than silicone**.
- The impact categories that contribute the most to the overall impact of the products are **human toxicity** and **ozone depletion**.

Total impact (by category)



Total impact (by process)





## Conclusions

- ❑ For applications where only **water repellency** is required, **high performing fluorine-free alternatives** are available, with **lower environmental footprint**. Among these alternatives, the best technical results were obtained by the **dendrimer**.
- ❑ **No fluorine-free alternative** has been found to provide **oil repellency**. For uses where oil repellency is **essential**, **short-chain fluorocarbons** or **perfluorinated silicones** are the options with the lowest environmental impact.
- ❑ **Case-by-case studies** are recommended to decide if oil repellency is truly needed.



# Thanks!

▪ ***Any questions ?***

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