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Safe, sustainable cleaning solutions and trans-dichloroethylene (trans DCE)

How Chemours™ uses trans DCE to create safe, sustainable and superior cleaning products.

At Fraser Technologies we provide expert advice and a wide range of world-leading chemistries and equipment solutions for component cleaning, electronics soldering, and heat transfer and carrier fluids.

Over the last 50 years, we have built our expertise around meeting technological advances, adapting to legislative changes, and solving environmental and safety challenges for companies in the aerospace, defence, electronics, medical, optics and automotive industries.

When it comes to solvent cleaning, we supply the new generation Opteon™ range from Chemours™. Chemours™ is one of the largest chemical manufacturers in the world and has been supplying the cleaning industry for over 40 years. These cleaning solvents use eco-friendly chemistries, which offer a superior cleaning performance. They are low in cost and provide a genuine alternative to the old hazardous solvents which have now been banned or restricted. The Chemours™ range of safe, environmentally friendly solvents have become widely accepted as best in class, next generation fluids and are approved for use in a large range of standard cleaning systems.

A key component of many of the Opteon™ products is trans-dichloroethylene (trans DCE). While traditional chlorinated products, such as trichloroethylene (TCE), benzene, perchloroethylene, methylene chloride and nPB, have properties which make them risks to human health and the environment, trans DCE offers superior cleaning performance properties and is a safe, sustainable component in cleaning solutions.

There is a great deal of misunderstanding around the safe use of trans DCE, with many mistaking the solvent with Dichloromethane (also known as methylene chloride), which is a very different product. While Dichloromethane poses substantial health risks, trans DCE performs well for safety testing.

The American Conference of Governmental Industrial Hygienists (ACGIH) exposure guideline for trans DCE identifies that individuals should be exposed to no more than 200ppm (8hr TWA), providing a large margin of safety between the exposure guideline and concentrations likely to be experienced in the workplace.

This table provides a comparison of solvent workplace exposure guidelines for some of the traditionally used solvents:

Product	8hr. TWA (ppm)
Trans DCE	200
trichloroethylene	10
perchloroethylene	25
methylene chloride	25
nPB	5-10

To eliminate any uncertainty around the safe use of trans DCE, this document explains the benefits of using trans within the Chemours™ Opteon™ range of products.

What is trans-Dichloroethylene?

Trans DCE is a chlorinated solvent, but is clearly differentiated from those listed above. When it is mixed with one of the Chemours™ new generation chemistries, the product becomes non-flammable, safe and has the capacity to solubilise substances such as oil. It is incorporated within some of Chemours™ most effective products: Opteon™ SF30®, SF79® and SF80®.

Chemical names: trans-1, 1 DCE; 1,2 dichloroethylene, trans-1, 2 dichloroethylene

Chemical formula: CClHCClH

How is it different from other chlorinated substances?

Intensive testing of trans DCE has been undertaken over recent years, and unlike substances such as nPB, it continues to prove itself in safety and environmental arenas. Trans DCE is a unique solvent in terms of its environmental health and safety profile, meaning that it is not regulated under 40 CFR Part 63 – Subpart T – National Emissions Standards for Halogenated Solvent Cleaning and has been approved by the US EPA Significant New Alternatives Policy Program (SNAP) as an acceptable substitute for ozone depleting substances (ODSs).

Flammability:

On its own, trans DCE is a flammable liquid, however, when it is mixed with the Opteon™ new generation of fluorinated products, these blends become azeotropes (a mixture of two liquids with a constant boiling point and composition throughout distillation) and the solvents become non-flammable, maintaining a constant composition at boiling point.

Product	SF30	SF79	SF80
Composition	74.7% (Z)-1,1,1,4,4,4-Hex-afluoro-2-butene*	>=90 - <=100 trans DCE	>=90 - <=100 trans DCE
	25.3% Trans DCE	>=2.5 - <10 Methoxytridecafluoroheptenеisomers	>=2.5 - <10 Methoxytridecafluoroheptenеisomers
Flash Point	None	None	None
Flame Limits	None	7.25% - 15.25%	7.25% - 15.25%

Safety for handlers:

Safety data surrounding trans DCE identifies that it is a safe, sustainable replacement for ODSs (Ozone Depleting Products) and hazardous air pollutants. Studies show that after repeated exposures to trans DCE – comparable to those in the work environment – there are no adverse health effects, even when exposed to 4000ppm. The safety guidelines set out by the ACGIH and Occupational Safety and Health Administration (OSHA) recommend an airborne exposure limit of 200ppm averaged over an 8-hour work shift, so there is a large margin of safety between the exposure and concentration likely to be found in the workplace.

Toxiological industry tests undertaken by trans DCE manufacturers have shown the following results:

Substance name	End use	Exposure routes	Potential health effects	Value
Trans-dichloroethylene	Workers	Inhalation	Long-term systematic effects	797 mg/m^3
	Consumers	Inhalation	Long-term systematic effects	198mg/m^3
	Consumers	Ingestion	Long-term systematic effects	57 mg/kg/bw/day

Environment:

Trans DCE is short-lived in the atmosphere, so it has very little impact on stratospheric ozone or climate change. By using solvents with trans DCE rather than other chlorinated substances, the solvent actively enables our customers to achieve significant reductions in the use of ODSs and compounds with high global warming potential.

Low GWP ©

Acid stability:

Unlike many other chlorinated and brominated solvents, the Chemours™ products containing trans DCE do not lead to machines becoming acidic and decomposing during operation. This means there is no need to passivate cleaning baths or add stabilisers to prevent corrosion in the cleaning systems or on the parts being cleaned, which can also significantly reduce costs because fewer cleanouts are required.

Trans DCE has a complex package of stabilisers which includes a liquid phase free radical scavenger (di-isobutylene), an acid acceptor (1,2-butylene oxide), pH control agent (diethyl amine), electron donor to stabilise metal surfaces (propanone) and a vapour phase free radical scavenger (isoprene). This comprehensive package of stabilisers combined with the relatively low water solubility of 894 ppm at the low boiling point of 47ºC, makes trans DCE a much more stable cleaning agent.

Precision cleaning:

The new generation Opteon™ products containing trans DCE have successfully replaced chlorinated, brominated and hydrocarbon solvents for many of our clients in the aerospace, automotive, military, optics and medical industries. Some of our clients have also recognised the safety and superior cleaning power of these products and have switched from an aqueous solution. Even the most sustainability conscious businesses can demonstrate the environmental benefits of using the solvents.

Opteon™ SF30 ®, SF79 ® and SF80 ® are non-flammable, and environmentally friendly solvents for cleaning applications such as vapour degreasing, oil and grease removal, high solvency defluxing, and silicone removal.

	Opteon™ SF30®	Opteon™ SF79®	Opteon™ SF80®
GWP	<2.5	<15	<25
KB Value	20	103	99
Boiling Point˚C	30	47	47
Specific Gravity SG	1.33	1.29	1.29
Surface TensionmNm	16.4	21	21
OEL	425 ppm	200ppm	200ppm
Flashpoint CC, ASTM D56 OC, ASTM D1310	None	None	None
Vapor Flammability ASTM E681 %vol	None	7.5-15.25	7.5-15.25

Fraser Technologies: A name you can trust

As a business, we are committed to finding the best option for our customers, helping them to achieve safe, sustainable, cost-effective and environmentally sound solutions. We work closely with Chemours™, which shares many of our company values, championing honesty and integrity while providing the best service and products for our customers.

We review performance to ensure we are providing the latest technology, best results and first class customer service, as well as meeting increasingly stringent regulations.

When you see our brand, you can be rest assured that you are getting a product you can trust – and we'll be with you for support at every stage of the process.

For more information or advice on trans DCE or any of our products, please call us on 01506 443 058, email sales@frasertech.co.uk or visit www.frasertech.co.uk.

References: Information taken from Material Safety Data Sheets (MSDS) and the United States Environmental Protection Agency (US EPA). MSDS available on request. For more technical information on the toxicological testing of Trans DCE, visit https://www.epa.gov.

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