Application note

Emulseo x Darwin Microfluidics

FLUO-OIL™ 135: THE BEST ALTERNATIVE TO NOVEC™ 7500 FLUORINATED OIL

Discover **Emulseo**'s fluorinated oil that can be used as a replacement for Novec™ 7500 in microfluidic experiments.

INTRODUCTION

Fluorinated oils are widely used in droplet-based microfluidics for applications including macromolecular engineering, drug screening, digital PCR, and cell encapsulation. Novec™ 7500 from 3M, formulated by **Emulseo** as Fluo-Oil™ 7500 with FluoSurf™ surfactants, has been a standard choice. With the discontinuation of Novec™ 7500, **Emulseo** developed Fluo-Oil™ 135 as an alternative. This report compares the physico-chemical properties and microfluidic performance of Fluo-Oil™ 135 with Novec™ 7500.

I) CHEMICAL PROPERTIES

In the table below are summarized the main properties of both oils.

	Novec™ 7500	Fluo-Oil™ 135
Appearance	Transparent	Transparent
Boiling point (°C)	129	135
Viscosity (mPa.s)	1.24	1.72
Density	1.61	1.72

Table 1: Appearance and chemical properties of Novec™ 7500 and Fluo-Oil™ 135.

Fluo-Oil™ 135 shares with Novec™ 7500 similar appearance and boiling points. Its slightly higher density and viscosity may cause minor variations in droplet size or experimental outcomes, but these can be corrected by adjusting parameters such as flow rates.

II) MICROFLUIDIC PERFORMANCE

To assess the impact of replacing Novec™ 7500 with Fluo-Oil™ 135, water-in-oil droplets were generated with both oils and evaluated for size distribution, stability under PCR thermocycling and incubation, and molecular retention.

1. Material and methods

Experiments were performed using a PDMS flow-focusing microfluidic device coated with Fluo-ST1™, with 4% FluoSurf™ surfactant in the oil phase and either PBS or fluorescein solution as the aqueous phase. Flow rates were set at 300 µL/h (oil) and 100 µL/h (aqueous). Droplet formation was monitored microscopically and analyzed with ImageJ.

2. Results

Droplet size and size distribution

-Average diameter ~110 µm for both oils
-Monodisperse populations (CV ≈ 2–3%)

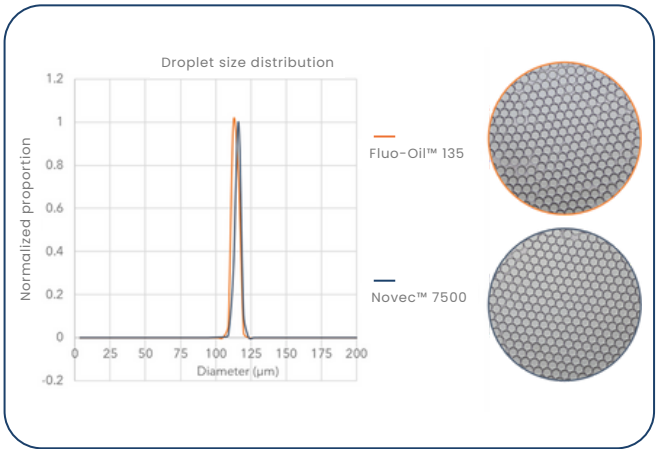


Figure 1: Droplet size distribution and associated pictures of water-in-oil droplets generated in Fluo-Oil™ 135 and Novec™ 7500.

Droplet stability

-Stable after 30 PCR cycles and 3 days at 37°C
-No significant variation in size or distribution

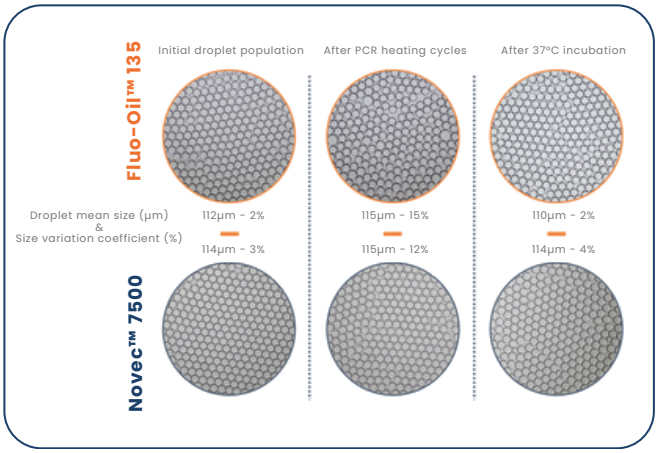
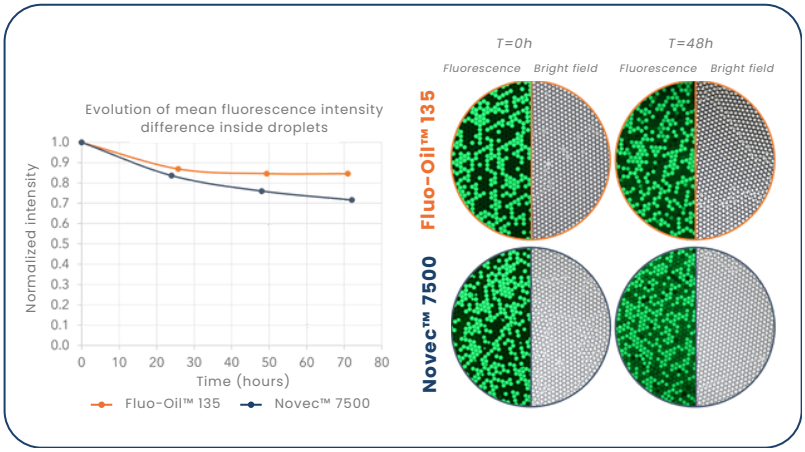


Figure 2: Pictures and associated average sizes and size coefficient of variation of water-in-oil droplets generated in Fluo-Oil™ 135 and Novec™ 7500 after generation, after 30 PCR heating cycles and after 3 days-incubation at 37°C.

Molecular retention inside droplets



-Fluorescein leakage:
~15% after 24h for both oils

-After 3 days:
Fluo-Oil™ 135 retains ~85% vs 70% for Novec™ 7500

-Retention with Fluo-Oil™ 135:
Better long-term retention

Figure 3: Evolution of mean fluorescence intensity inside water-in-oil droplets generated in Fluo-Oil™ 135 and Novec™ 7500. Droplet mean size=50µm, 37°C incubation.

CONCLUSION

Switching to Emulseo's Fluo-Oil™ 135 provides equivalent droplet stability to Novec™ 7500, while droplets generated with Fluo-Oil™ 135 show improved fluorescein retention.
Fluo-Oil™ 135 therefore represents an effective alternative for microfluidic applications.

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