Electronic Supplementary Information for *Soft Matter* manuscript :

Coalescence in concentrated emulsions: Theoretical predictions and comparison with experimental bottle test behaviour

Huy-Hong-Quan Dinh [a,b], Enric Santanach-Carreras [a,b], Véronique Schmitt [c] and François Lequeux [d,e]

[a] *Laboratoire Physico-Chimie des Interfaces Complexes, Bâtiment CHEMSTARTUP, RD 817, 64170 Lacq, France*

[b] *TOTAL SA, Pôle d'Etudes et de Recherches de Lacq, BP 47, 64170 Lacq, France*

[c] *Centre de Recherche Paul Pascal, 115 Avenue Schweitzer, 33600 Pessac, France*

[d] *Laboratoire Sciences et Ingénierie de la Matière Molle, ESPCI Paris, PSL University, Sorbonne Université, CNRS UMR 7615, F-75005 Paris, France*

[e] *Laboratoire Physico-Chimie des Interfaces Complexes, ESPCI Paris, 10 rue Vauquelin, F-75231 Paris, France*

1. Interfacial tension measurement

To measure the water/oil interfacial tension , we use a commercial set-up (software Tracker- TECLIS) based on the pendant drop method. After forming the drop, we monitor the evolution of the measured interfacial tension (IFT), then we take a value of IFT after 600 seconds where the IFT curve is saturated (See Figure S1). Table S1 and Figure S2 below show the list of saturated IFT values at different concentrations of Span 80.

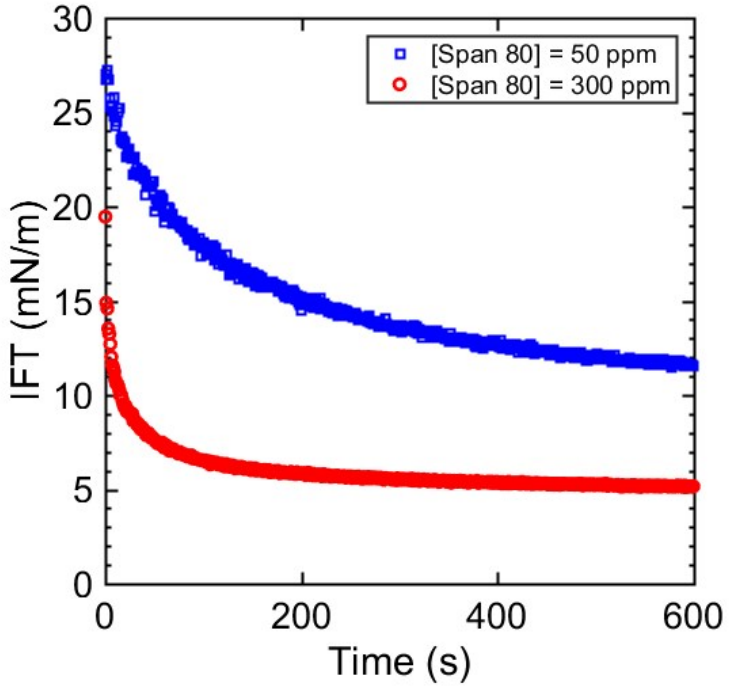


Fig. S1: Time evolution of measured IFT by pendant drop method

[Span 80] (ppm)	IFT (mN/m)
0.1	40
0.5	40.20
1	39
1.5	36.64
2	36.37
3	35.68
4	33.57
7	31.30
10	27.57
25	21.15
50	11.48
70	10.06
100	6.60
200	7.42
300	5.20
1000	6.07

Table S1: List of measured values of IFT

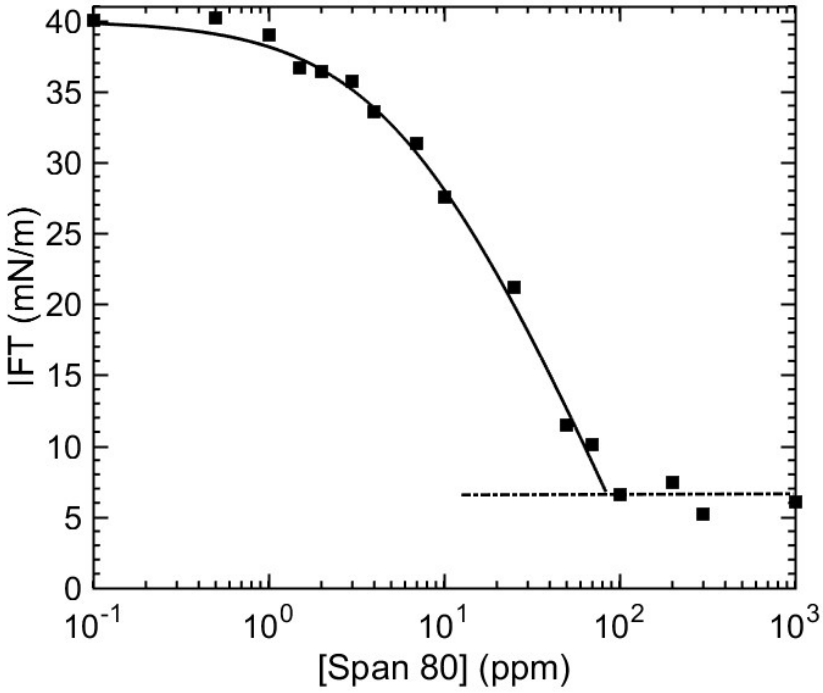


Fig. S2: Measured IFT as function of Span 80 concentrations

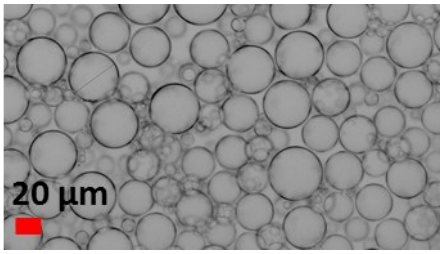
The experimental points in Fig. S2 is fitted by Langmuir's adsorption model :

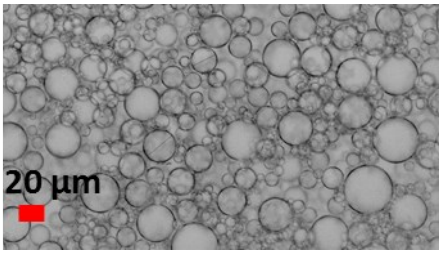
$\gamma = \gamma_0 - RT\Gamma_{sat} ln(1 - Kc)$

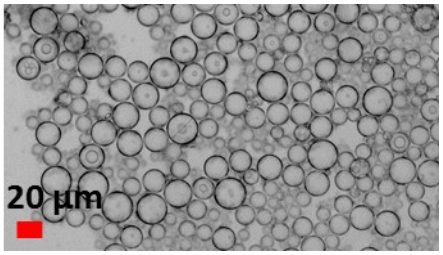
From the fit, we obtain thus for our system: $\Gamma_{sat} = 5 \times 10^{-6}\, mol/m^2$ and $K = 0.2\ 1/ppm$

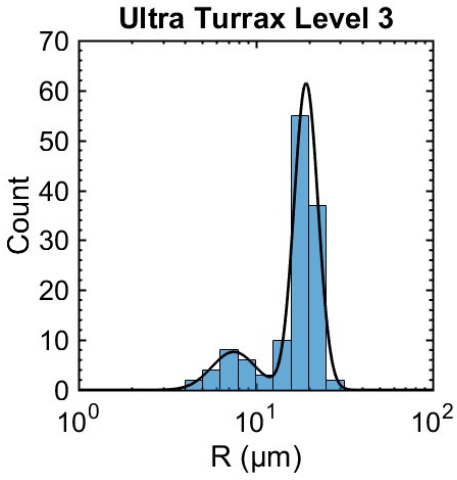
2. Droplet size distribution from microscopic images

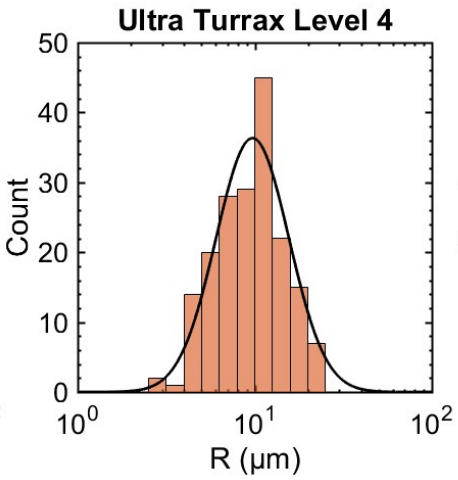
To measure the emulsion droplet size distribution, we use microscope to visualize the emulsion droplets. After emulsification, we pick a small sample of emulsion dense zone and dilute it on a glass substrate with oil solution containing the same quantity of used surfactant. The sample is then visualized by microscope to obtain the droplets images. For each level of Ultra Turrax, the size distribution is obtained from the size measurement of over around 150 droplets. The figure below shows the result of this measurement for emulsions at 3 different level of Ultra Turrax (Level 3: 11000 RPM, Level 4: 15000 RPM and Level 6: 30000 RPM). A typical microscopic image at each level is showed. The continuous lines are the fit for the size distribution with the Gaussian curves.

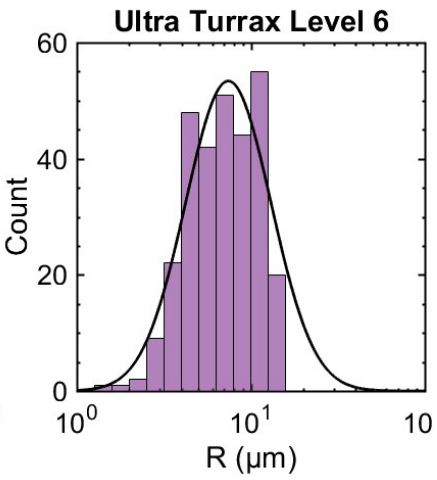












$\bar{R} = 17.2$ **µm**

$R_{32} = 19.7$ **µm**

Standard deviation : 5.2 µm

$\bar{R} = 10.3$ **µm**

$R_{32} = 12.1$ **µm**

Standard deviation : 4.5 µm

$\bar{R} = 7.1$ **µm**

$R_{32} = 9.5$ **µm**

Standard deviation : 3.2 µm