

**dilute – but elastic – emulsion:**

***how to gelify an aqueous phase with an organo-gelator***

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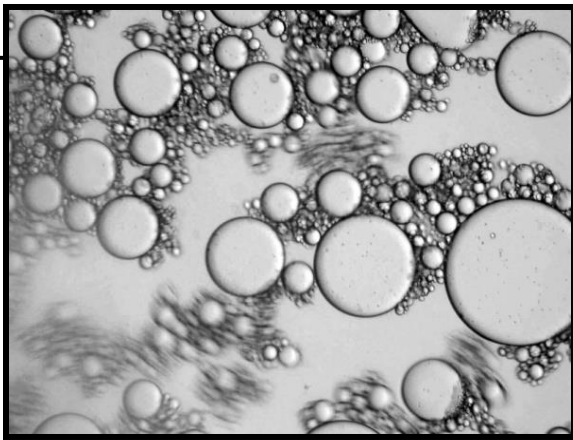
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**3 UMR 1332 INRAE, Bordeaux, France.**

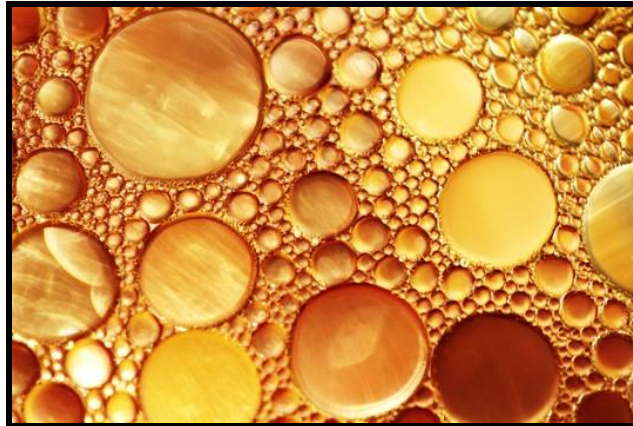
**4 BIA, INRAE, Nantes, France.**



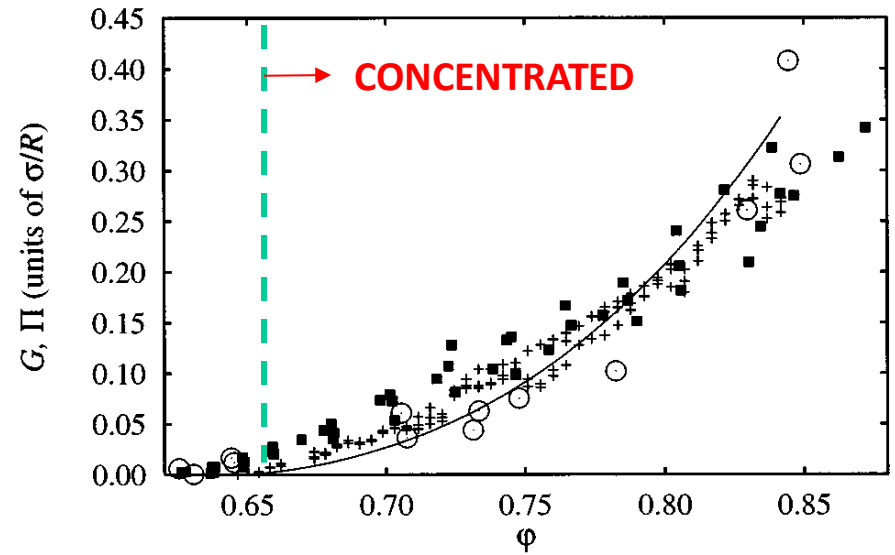


droplet size

oil fraction :  $V_{oil} / V_{emulsion}$



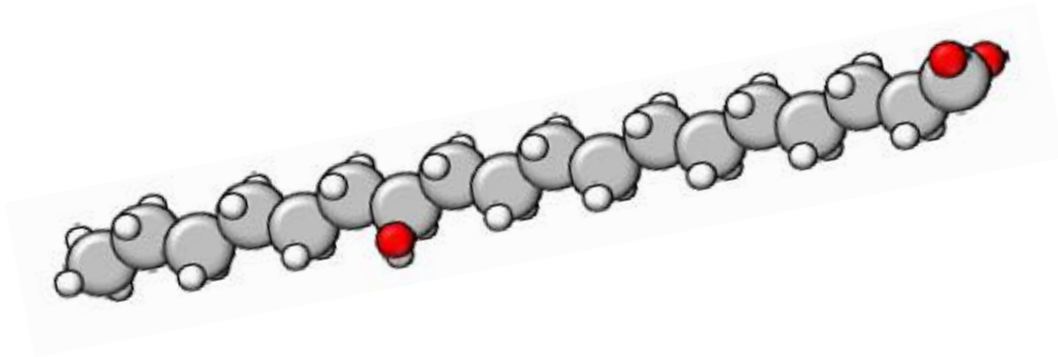
Above a critical oil fraction :



elastic behavior

yield stress

## 12-HSA : 12-hydroxystearic acid



Castor oil plant



Tomato skin

cheap and 'green'

in association with :

Counter-ion



C2



C3



C4



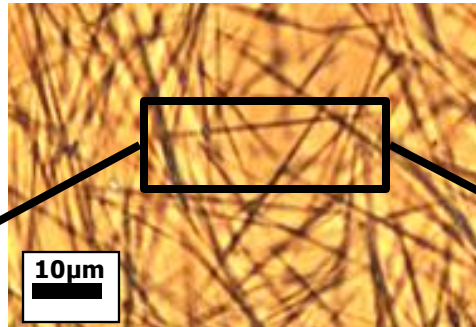
C5



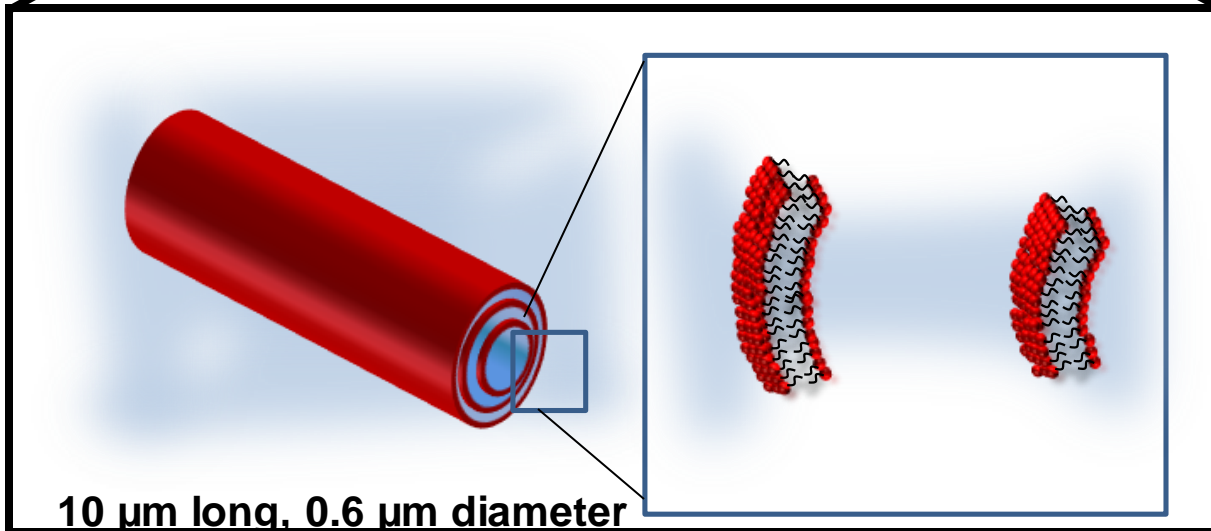
C6

alkanolamines

acting as counter-ions



10 μm



10 μm long, 0.6 μm diameter

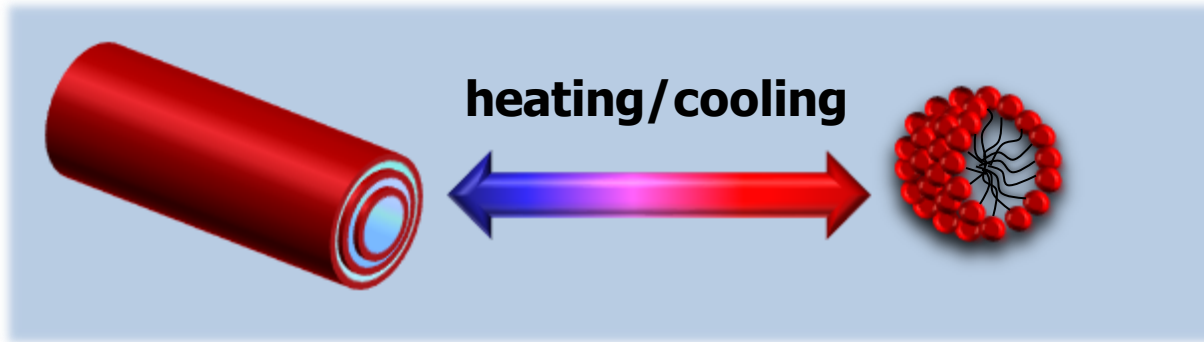
In water :

HAS and alkanolamine  
self-assemble...

... to make  
long tubular structures

# a transition at the supramolecular scale with temperature

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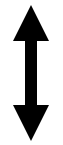
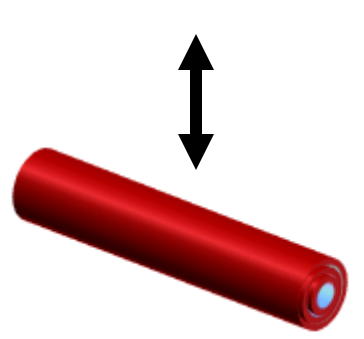
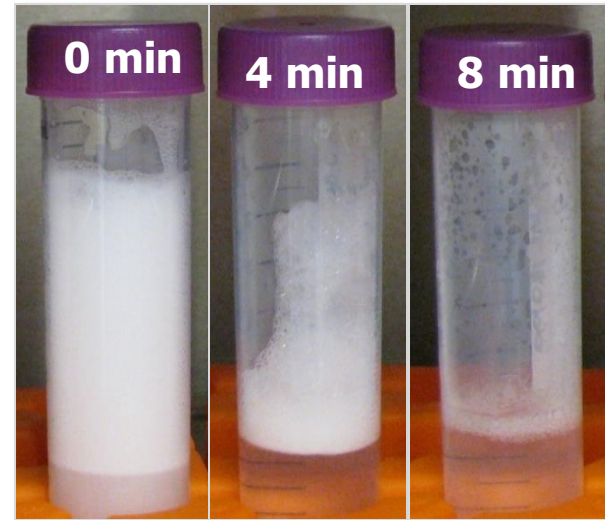
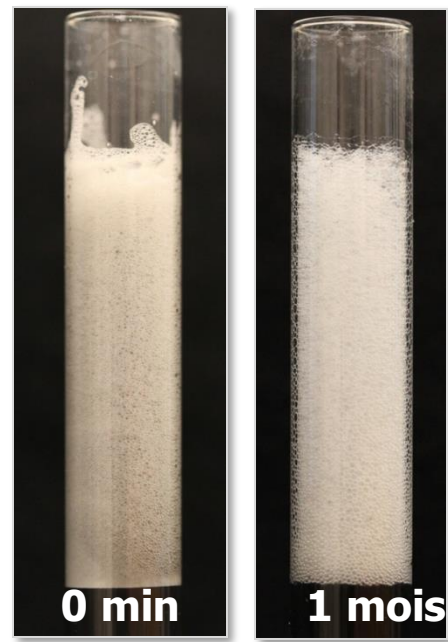
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The tube – micelle transition is observed for all counterions,  
over a large range of concentration ratio,  $R$ .

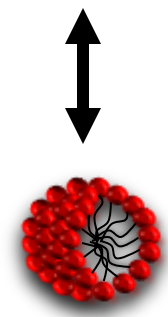
The value of the transition temperature  $T_M$  depends on counter-ion and  $R$ :

It can then be adjusted between 20 and 78°C

## direct correlation between supramolecular structures and foam stability



-> designing different types of responsive foams

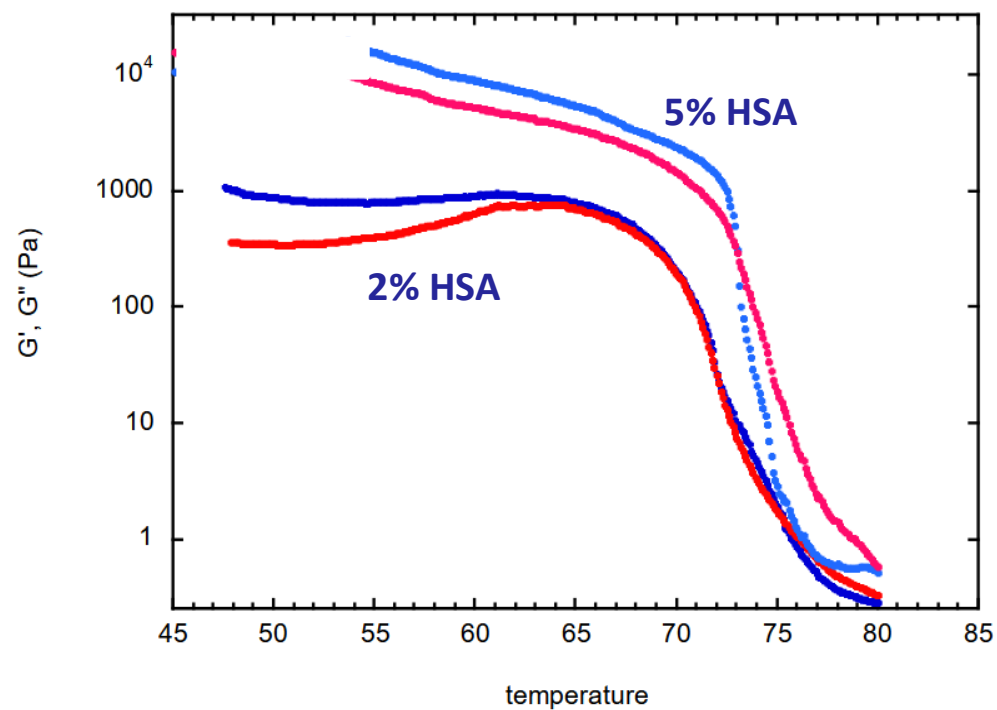




heating  
in paraffin :

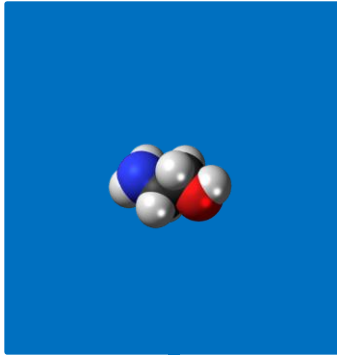
## 12-HSA : an efficient organogelator

valid for various oils :  
paraffin, mirytol, dodecane, ..



# process and experimental conditions

ethanolamine  
in water



12-HSA in oil

hot plate



mixing while  
cooling  
down to room T

Preparing dilute  
emulsions :

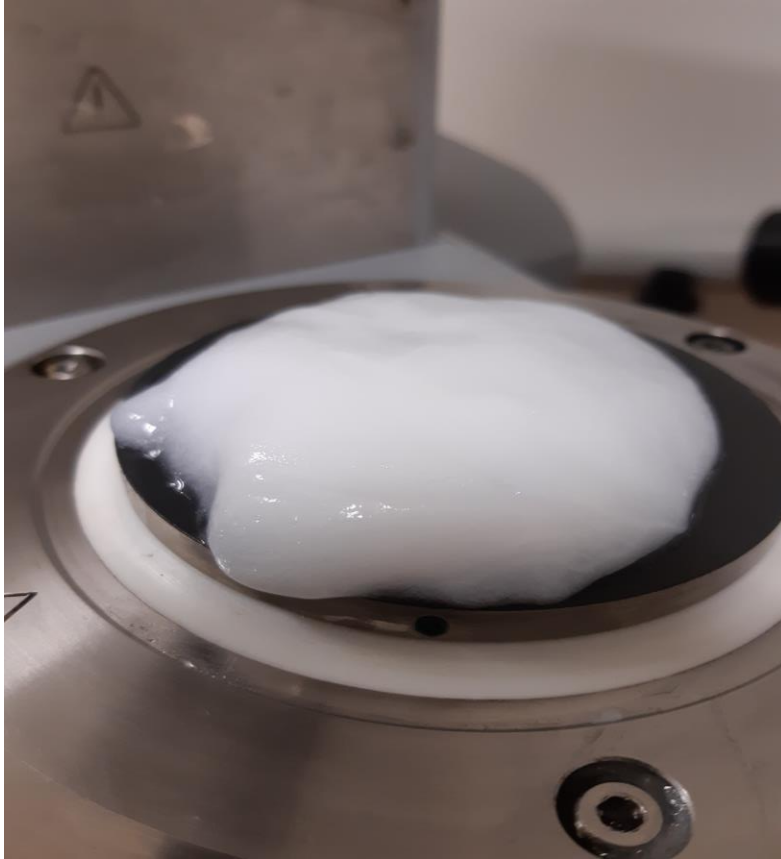
oil fraction : 0.35

$R, n_{\text{eth}} / n_{\text{HSA}} :$

0 -> 0.5



# Macroscopic observations



**gelly-like texture !?**

**For  $0.2 < R < 0.35$**

**Uniform and stable emulsion**

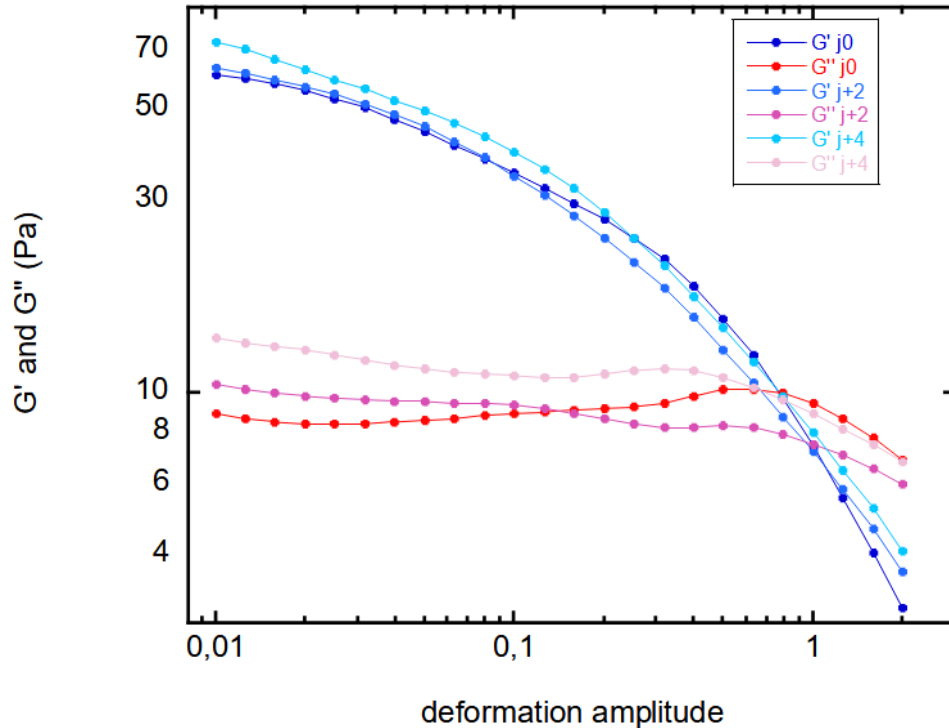


**For  $R < 0.2$  : unstable**

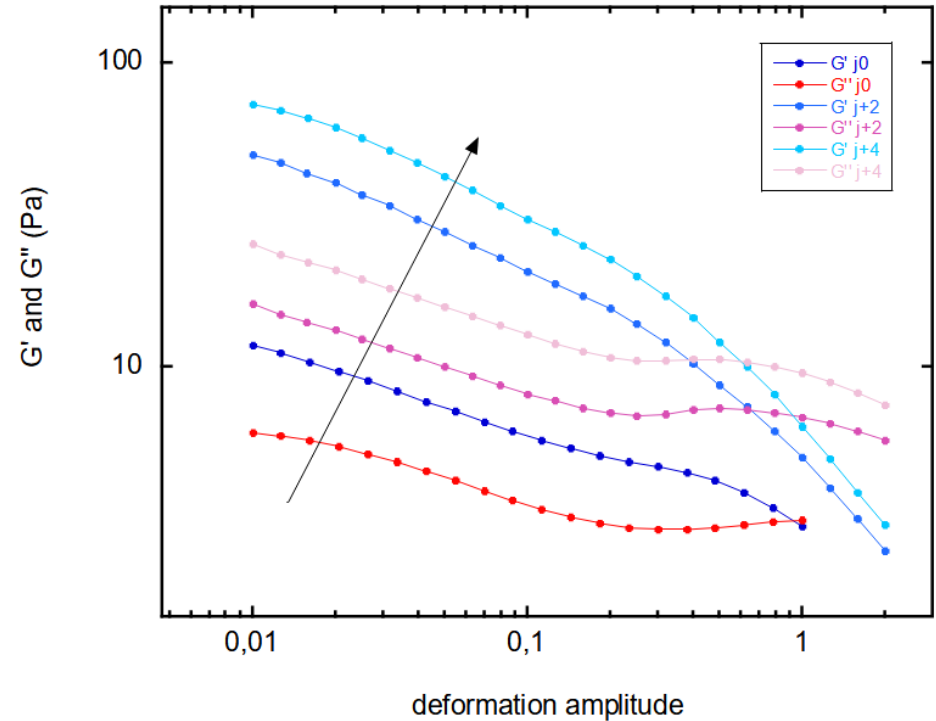
**For  $R > 0.4$  : fluid emulsion**

Amplitude sweep experiments at  $f=1\text{Hz}$  / plate-plate geometry :

At low  $\gamma$  :  $G' > G''$  - then yielding



aging effect for paraffin

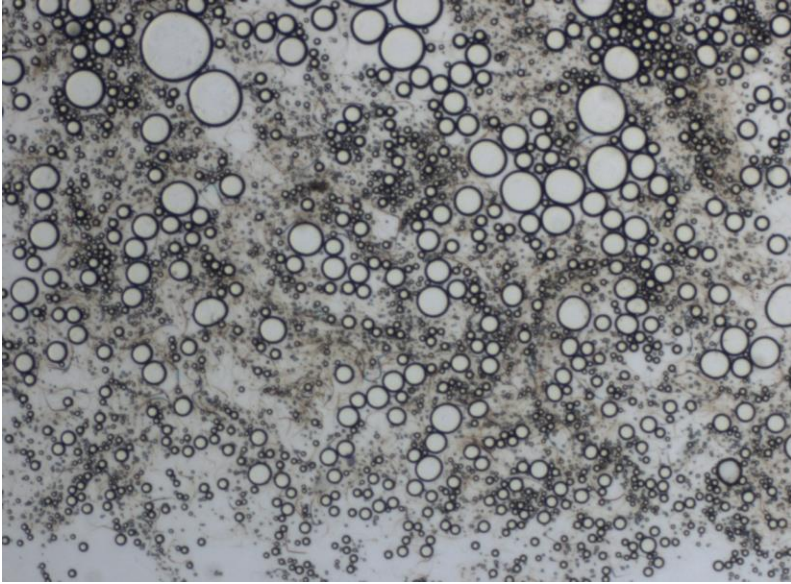


typical elastic behavior  
of a concentrated emulsion



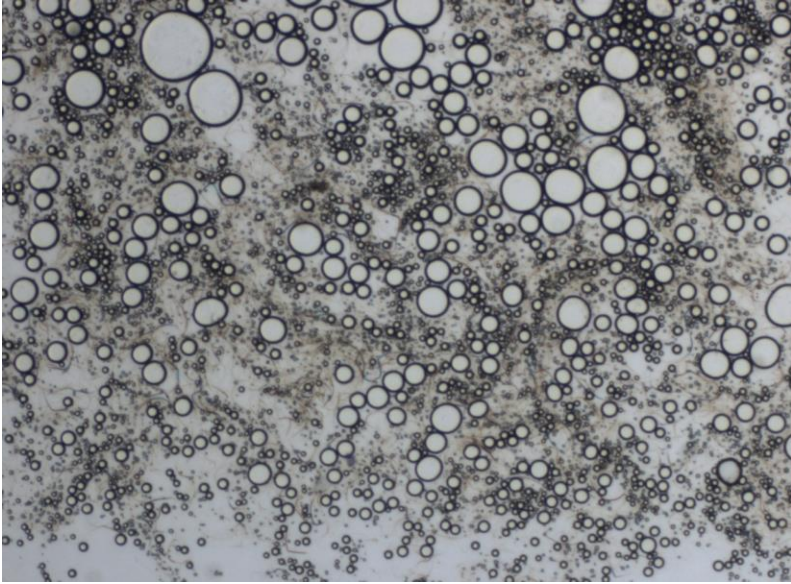
not consistent with  
an oil fraction of 0.35...!?

## At the scale of the droplets



M  
Y  
R  
I  
T  
O  
L

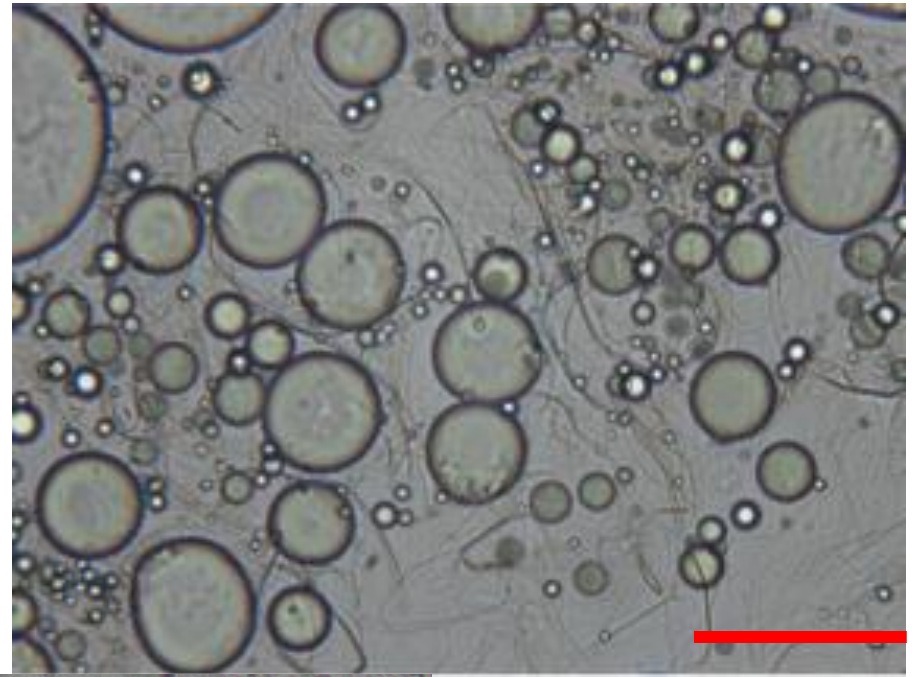
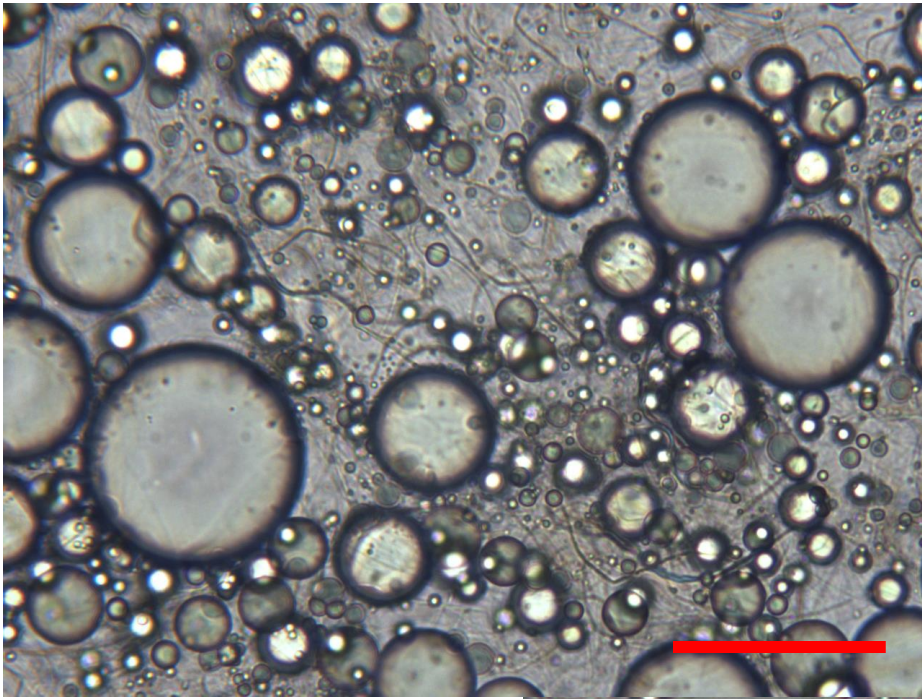
# At the scale of the droplets



M  
Y  
R  
I  
T  
O  
L

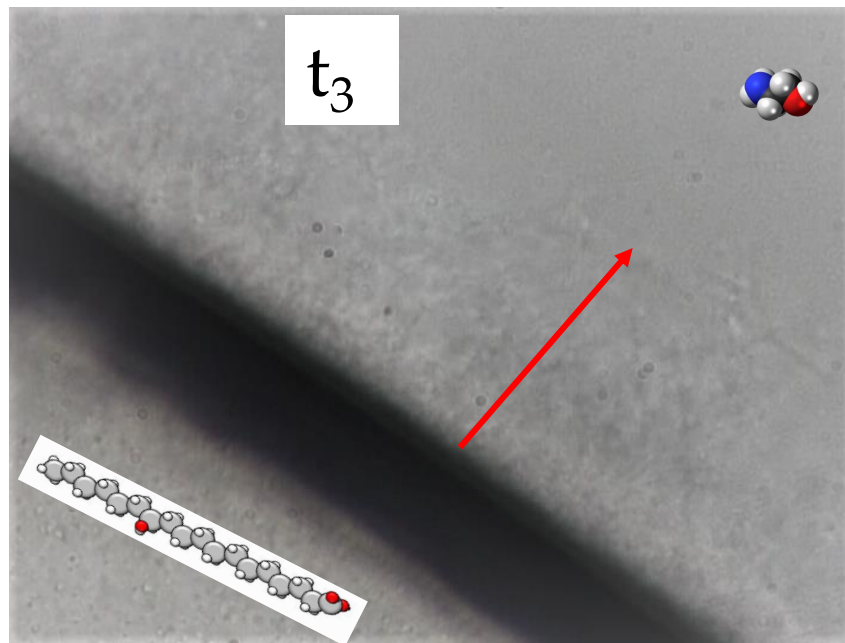
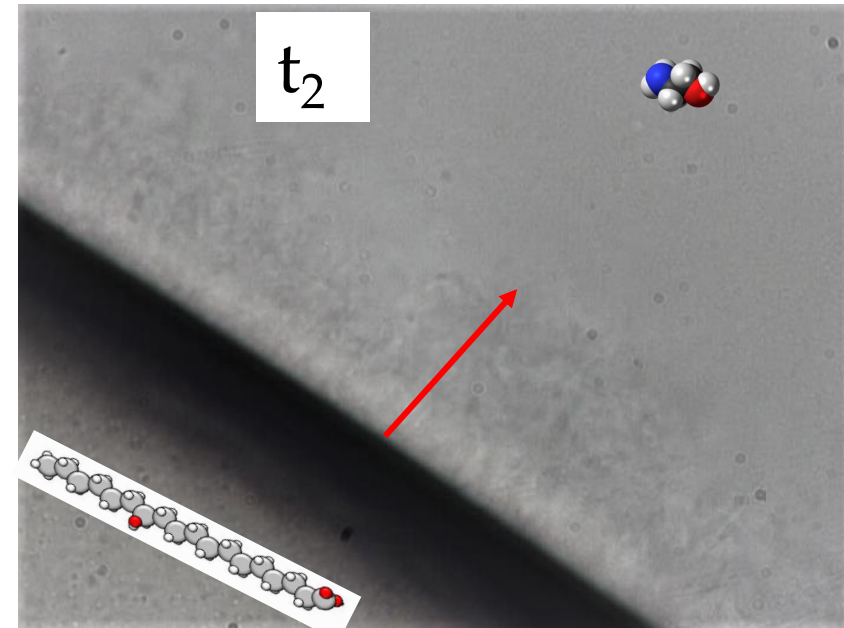
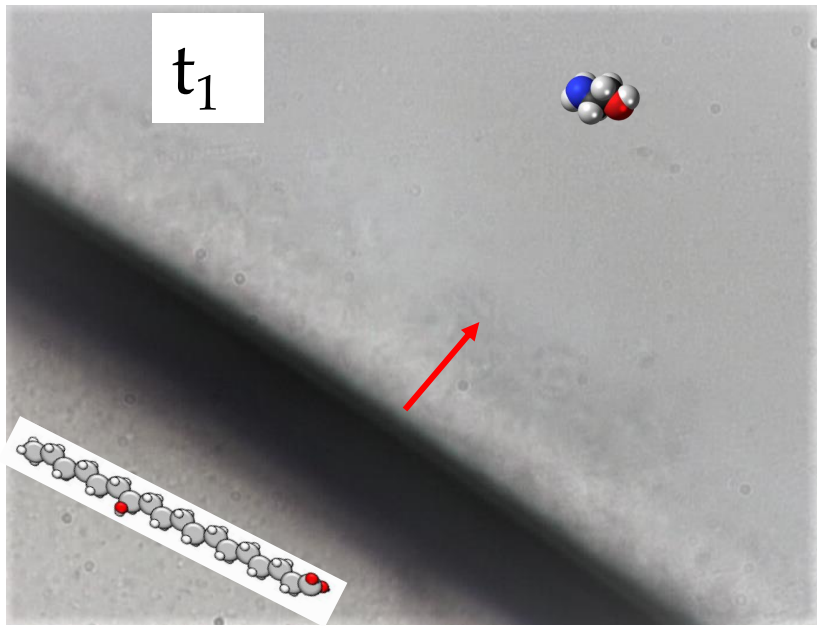


# At the scale of the droplets



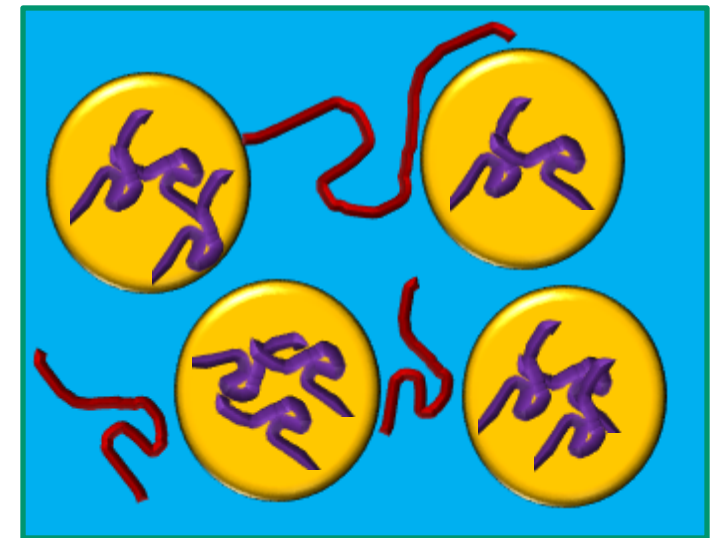
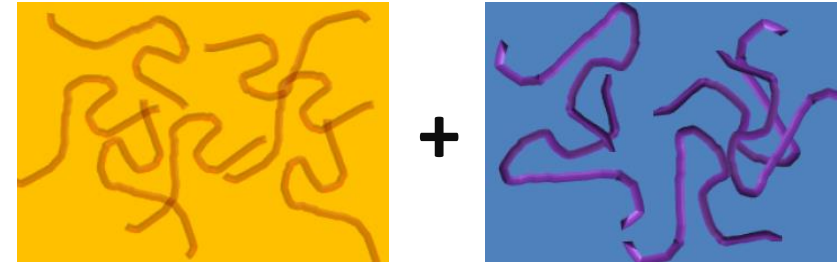
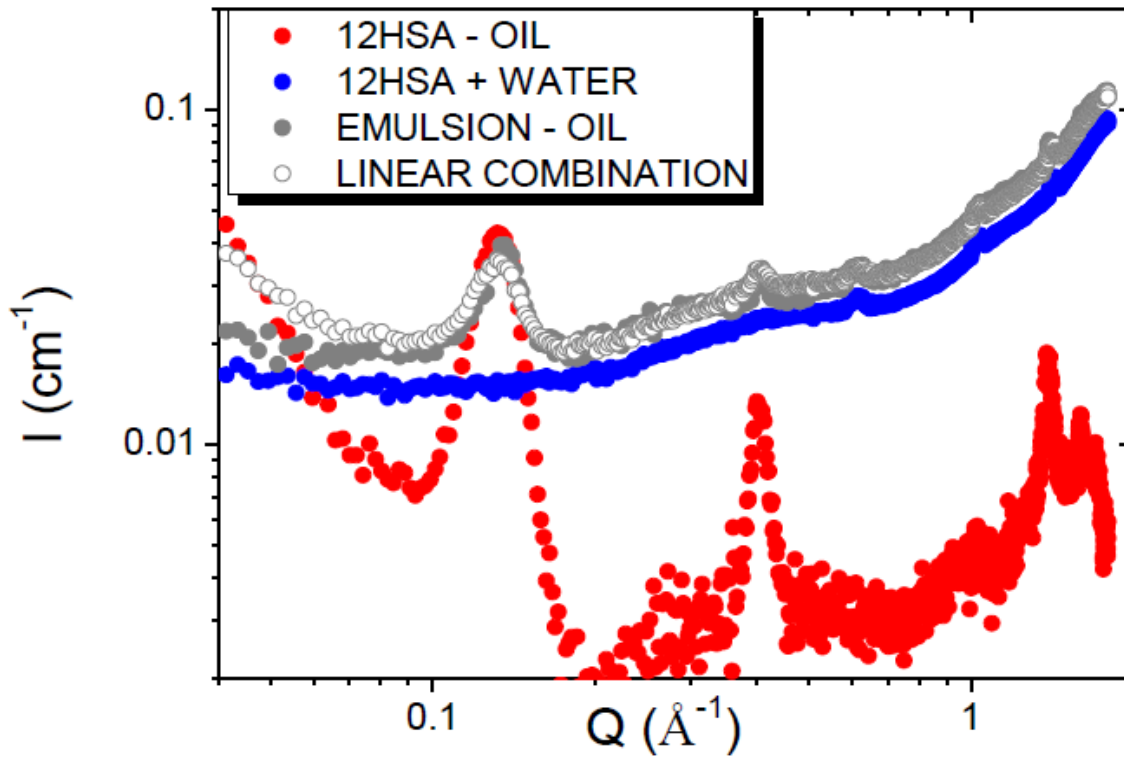
P  
A  
R  
R  
A  
F  
I  
N

# transfer at the interface



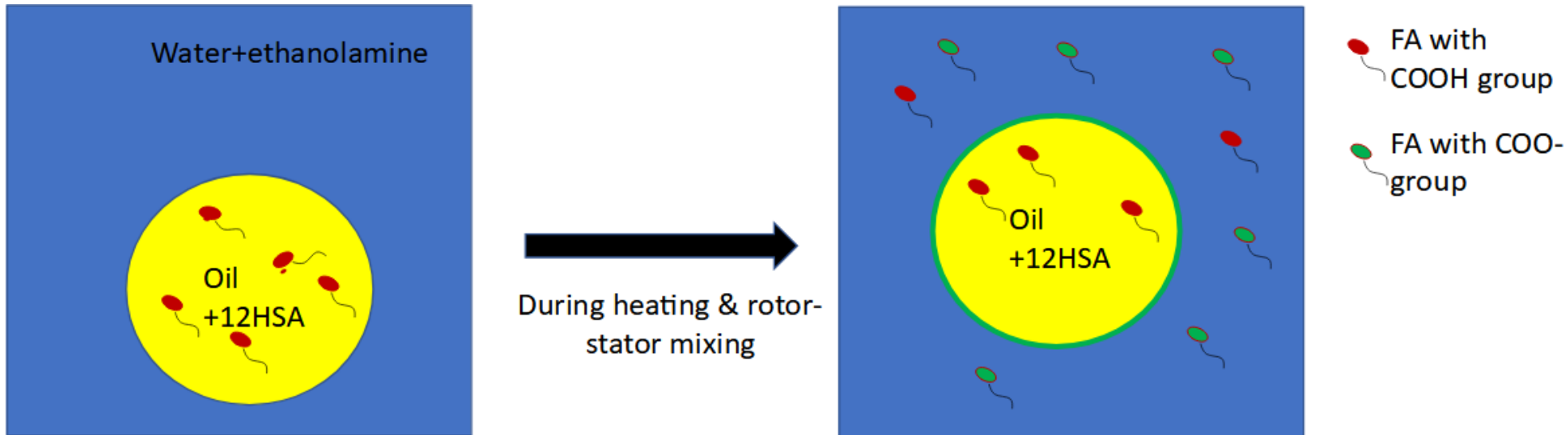
fibrils are  
growing in  
time  
from the  
interface...

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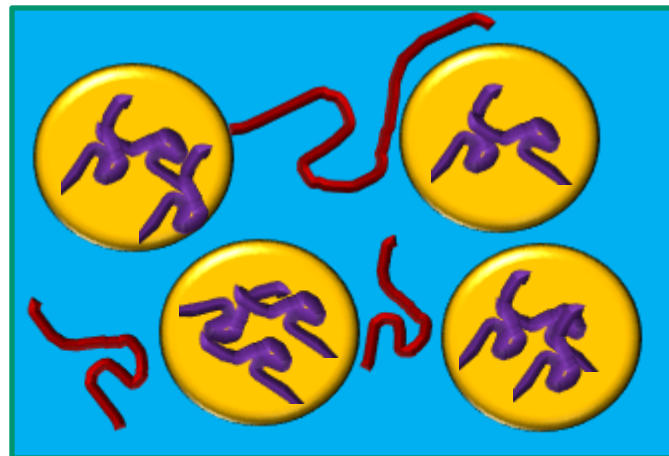


**12-HSA crystalline fibers both in oil & water phases**

# Transfer and crystallization



Then, under cooling :



the continuous water phase gets gelified by crystalline fibrils emerging from oil

a dilute emulsion with the texture and features of a concentrated one !



a dilute - but elastic - emulsion : thanks to fibers gelifying the continuous phase

It is an organogelator (12HSA) - coming from the oil phase - which gelify water !

such emulsions are stable for months and adjustable by the oil properties



**12-HSA/alkanolamine :**  
a simple, green and versatile system

- organogelator
- thermoresponsive self-assemblies in water
- responsive foams
- gelified emulsions

**No need to add surfactants !**