



# HOW TO SUCCESSFULLY GUARANTEE THE QUALITY OF AN EMULSION

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# Who we are



**+ 70 years**  
of experience



**1 production site**



**61,3 M €**  
Turnover 2024



**250**  
employees

Mixing process equipment from laboratory  
formulation to large-scale production





# Introduction



- The **Challenges** of the Pharmaceutical Industry  
Consumers are looking for:
  - Products with **natural, safe**, and clinically supported ingredients
  - **Transparency** about processes
  - And a commitment to **sustainability**
- The **importance** of formulating products with good **texture, aspect, conservation** and **effectiveness of the active ingredients**
- The **mixing process** plays a **key role** in formulating high quality healthcare products

**How does controlling the emulsification process contribute to a better formulation for healthcare products?**



Pharmaceutical market:  
**\$1.645B in 2024**  
*(Grand View Research)*

**6.2% annual growth**  
by 2034  
*(Expert Market Research)*



1

## **Emulsions and stability**

2

Impact of process parameters in the emulsification process

3

The rotor-stator, key parameters for a successful emulsification

4

From lab to production with rotor-stators





# Emulsions and emulsification

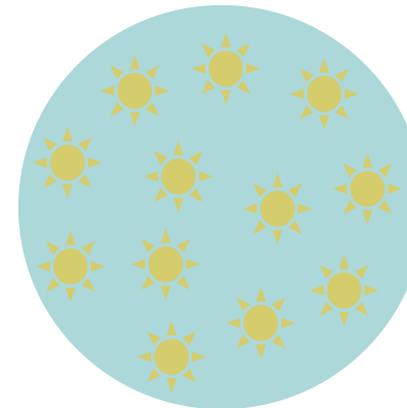
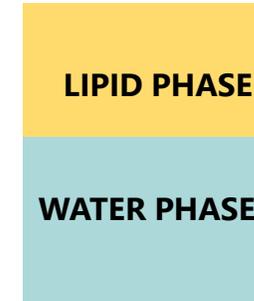


## EMULSIONS

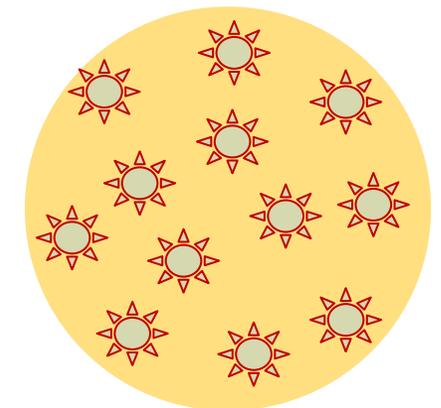
The emulsion represents the dispersion of one liquid in a second immiscible continuous liquid.

Emulsions are classified as:

- Oil-in-water emulsions (O/W)
- Water-in-oil emulsion (W/O)



Emulsion O/W



Emulsion W/O



# Emulsification and stability



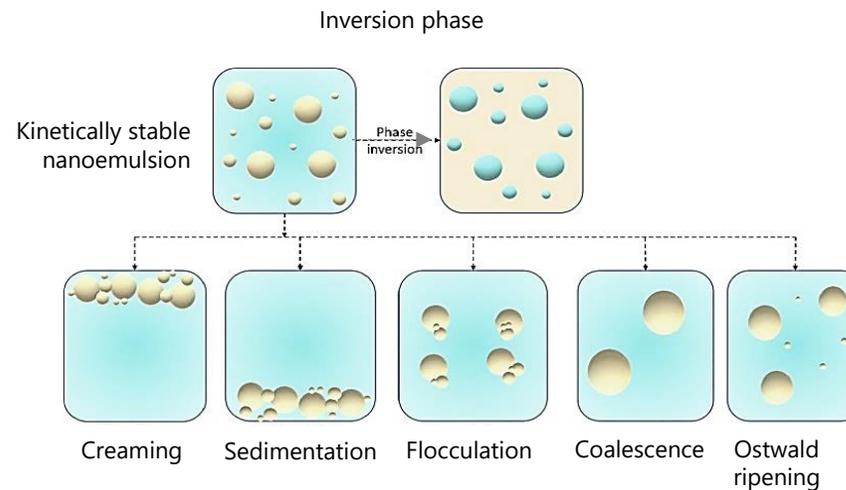
## EMULSIONS

The volume fraction of the dispersed phase is defined:

$$\phi = \frac{V_D}{V_D + V_C}$$

$V_D$  : Volume of the dispersed phase

$V_C$  : Volume of the continuous phase



## STABILITY

The stability of emulsions is governed by three conditions:

- No phase separation (demixing),
- No chemical reaction,
- No microbiological reaction.



# Emulsification and stability



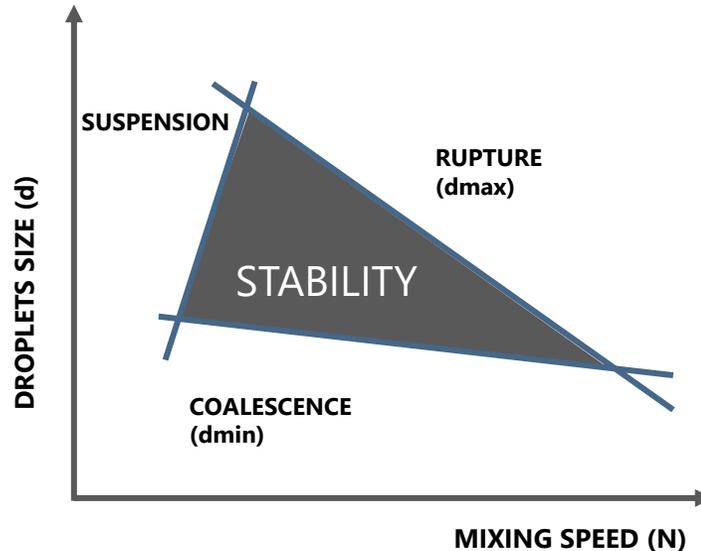
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The rotor-stator, key parameters  
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From lab to production with  
rotor-stators



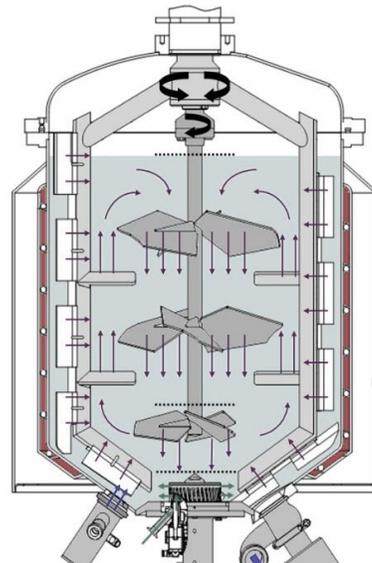


# High quality end product

## PROCESS CONTROL



**Controlling the process parameters** is a solution for achieving better emulsification, in order to produce a smooth, easy to apply and high quality end product.



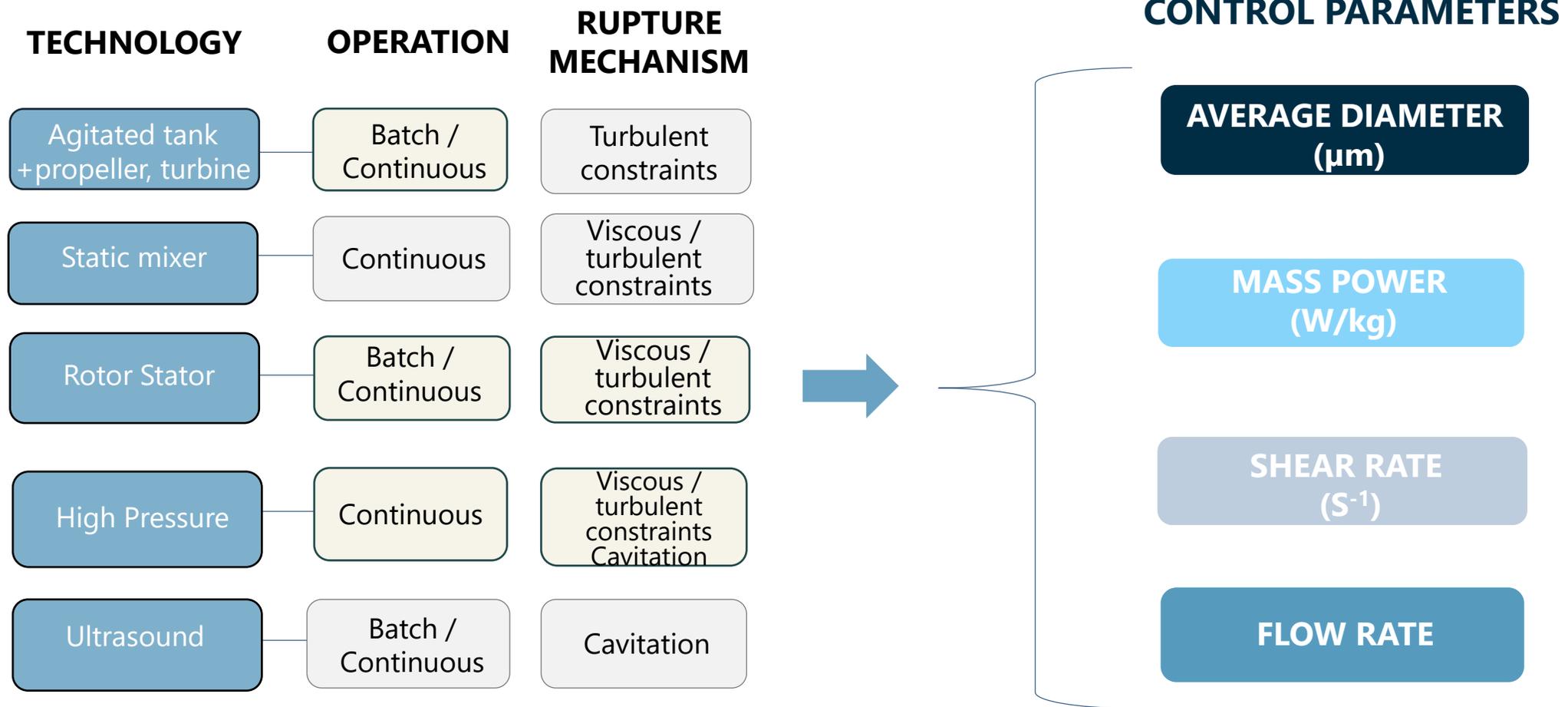
## Emulsification can be achieved with:

- Mechanical agitations
- High pressure homogenizers
- Static mixers
- Ultrasounds
- Membrane emulsification
- Spontaneous emulsion



## PROPELLER SHAPE & SPEED AS MAIN PARAMETERS

# Emulsification technologies





# OVERVIEW

- 1 Emulsions and stability
- 2 Impact of process parameters in the emulsification process
- 3 **The rotor-stator, key parameters for a successful emulsification**
- 4 From lab to production with rotor-stators





# Rotor-stator

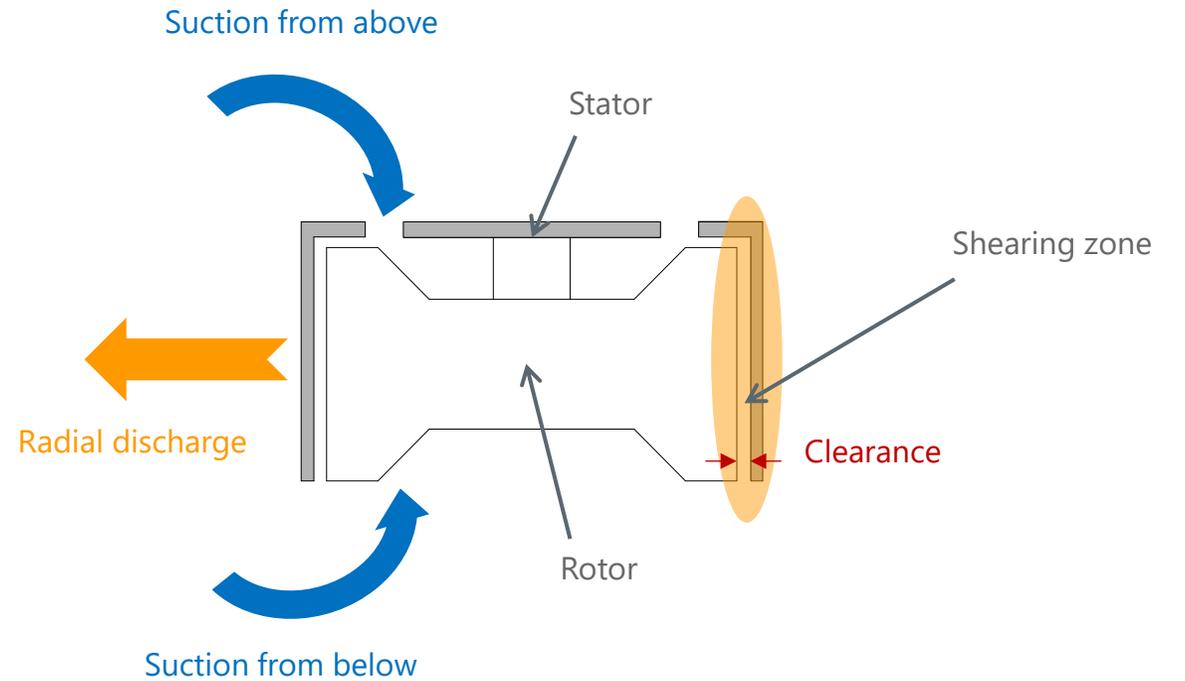


## ROTOR - STATOR

Geometry

Shearing / Flow rate

Mixing time





# Rotor-stator



## ROTOR - STATOR

Geometry  
Shearing / Flow rate  
Mixing time



## END PRODUCT

Natural ingredients  
With / Without thickener



## EMULSION

Droplets size  
Droplets distribution  
Viscosity



# Rotor-stator

## Performance of homogenizers (rotor/stator)

Rotor-stator	Shearing	Flow rate
R/S <b>A</b>	+++	-
R/S <b>B</b>	++	+
R/S <b>C</b>	+	+++

*Rotor-stator range, compliant with VMI laboratory homogenizers*



Narrow slots



Medium slots



Wide slots

## Two emulsions were prepared for this study:

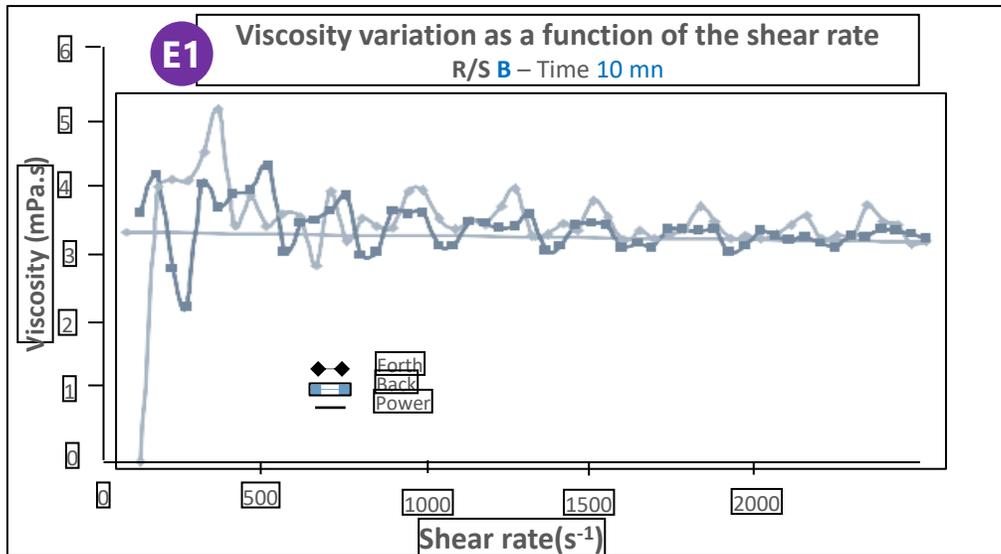
- E1** **Emulsion 1** : low viscosity, no thickener
- E2** **Emulsion 2** : high viscosity, with a thickener



# Rotor-stator

Rotor-stator	Speed (rpm)	Apparent viscosity
R/S A	1500	2.8
R/S B	1500	3.5

E1 Newtonian behavior



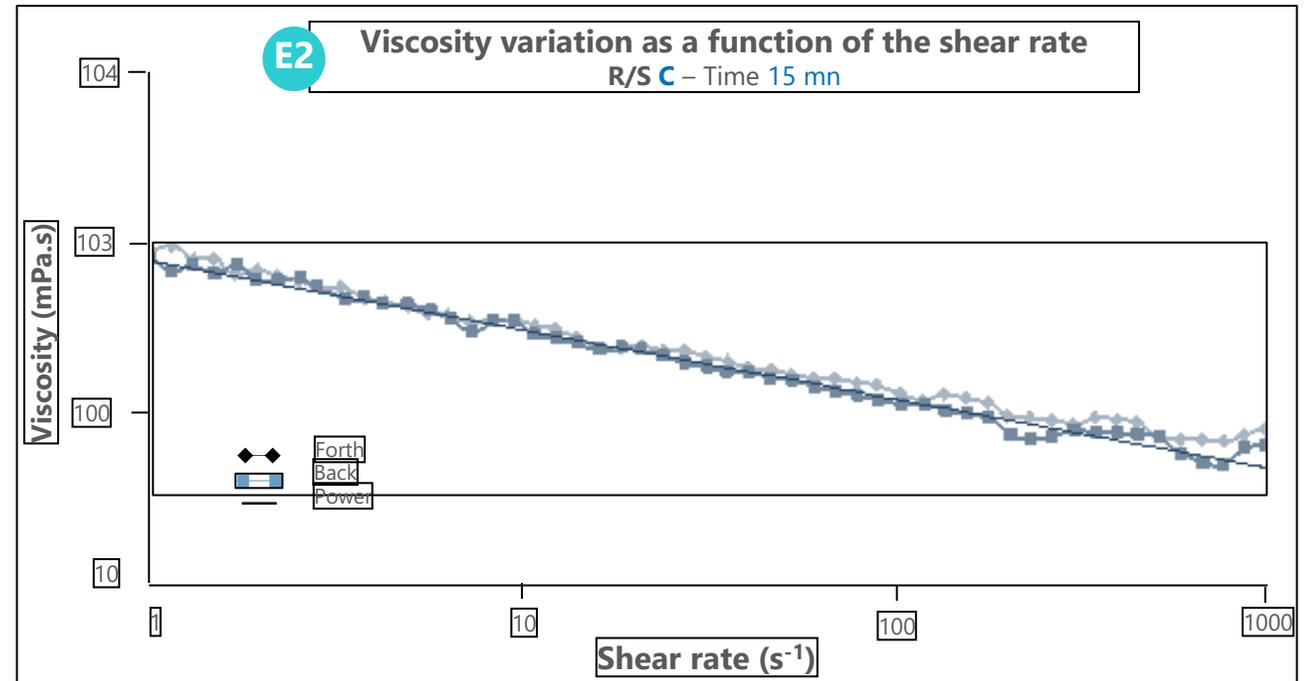
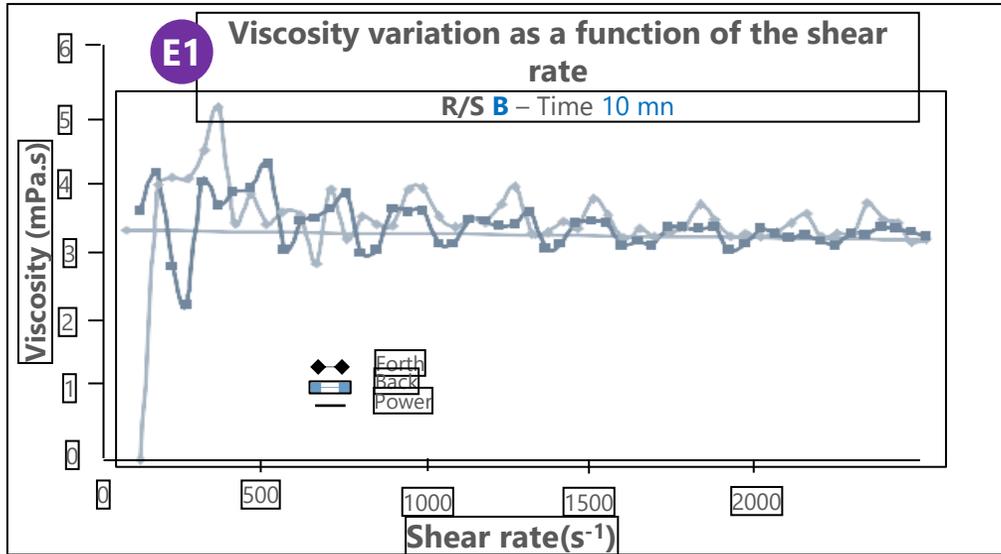


# Rotor-stator

Rotor-stator	Speed (rpm)	Apparent viscosity
R/S A	1500	2.8
R/S B	1500	<b>3.5</b>
R/S C	1500	141
R/S C	2000	<b>185</b>

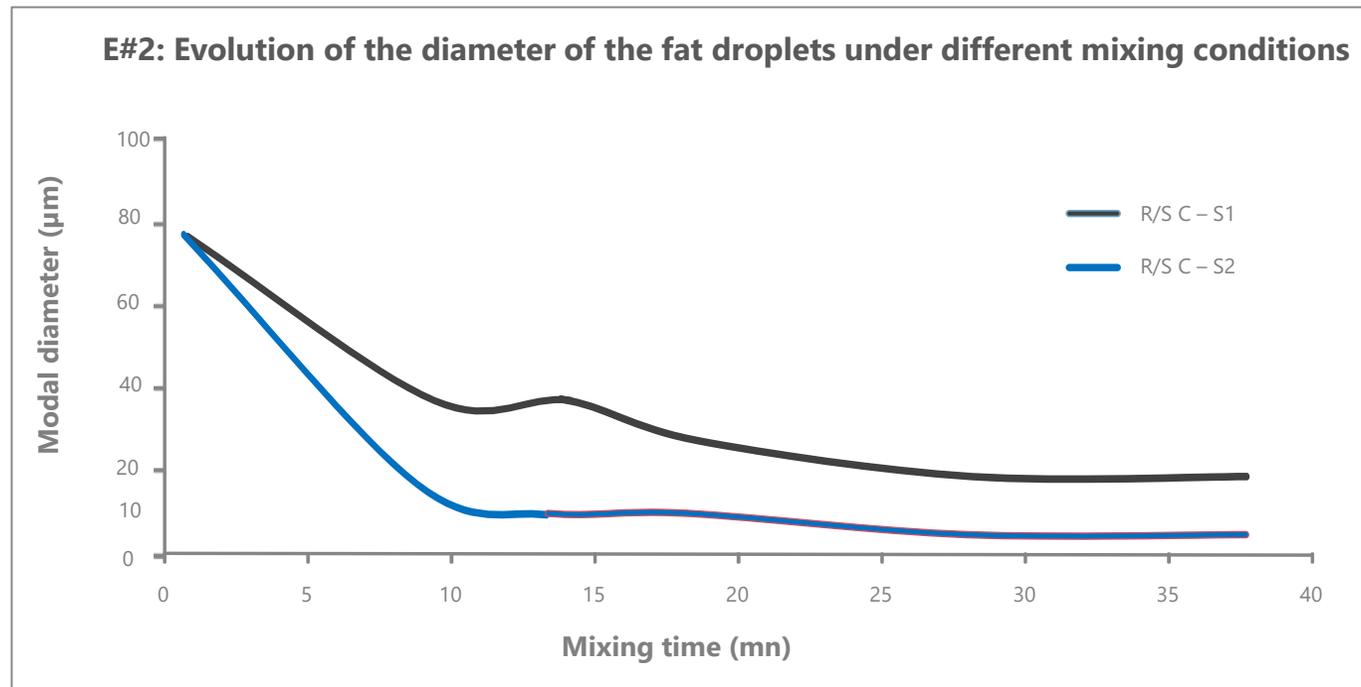
**E1** Newtonian behavior

**E2** Shear – Thinning behavior



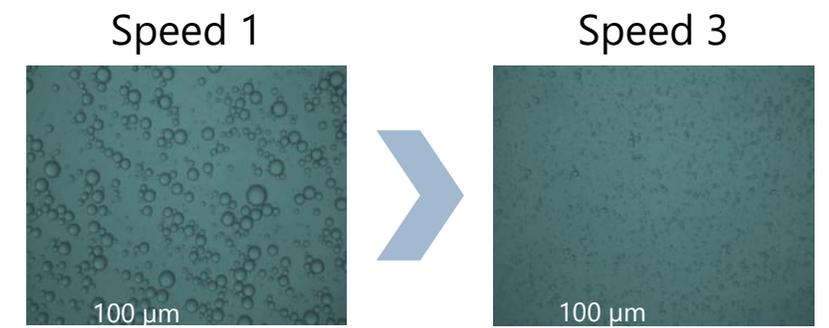
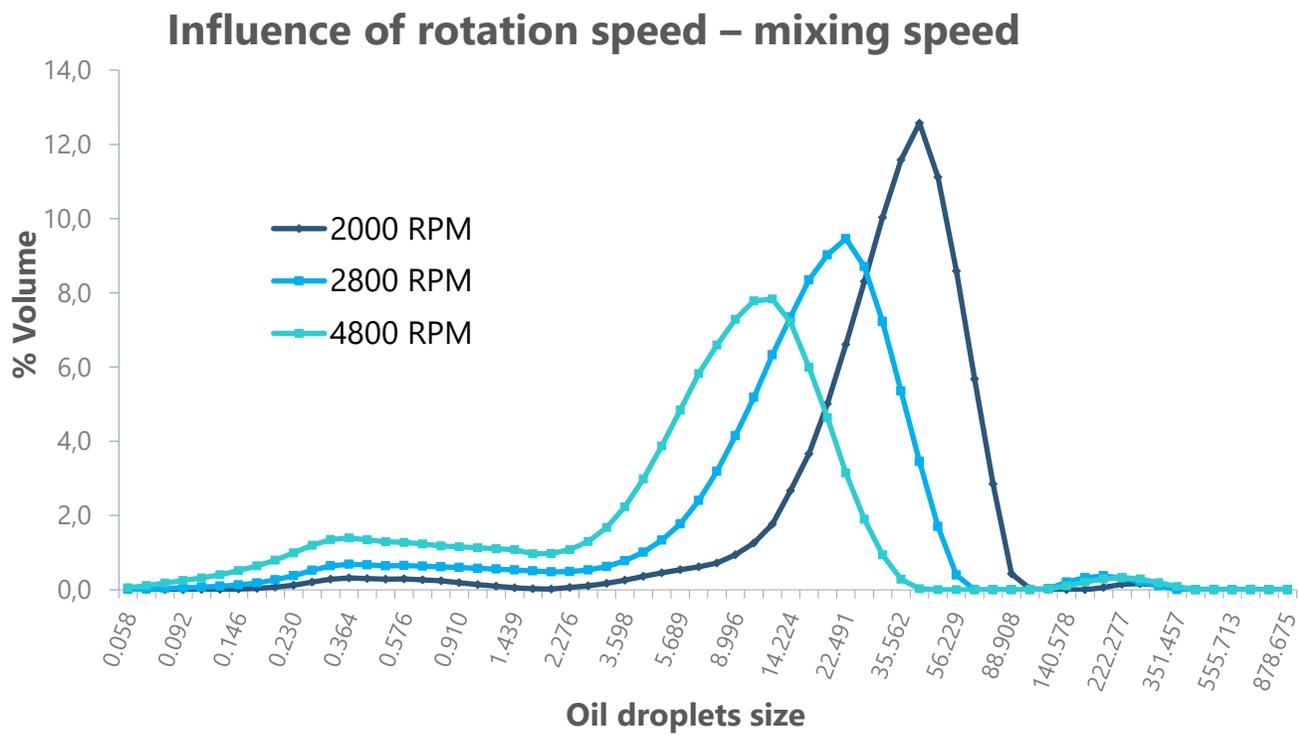
# Rotor-stator: impact of mixing speed

A higher speed would therefore allow for **greater fractionation** of the fat droplets.



# Rotor-stator: impact of mixing speed

Impact of the rotation speed: droplets size and distribution after 10 minutes





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# Rotor-stator scale-up

## Performance of homogenizers (rotor-stator) during the scale-up

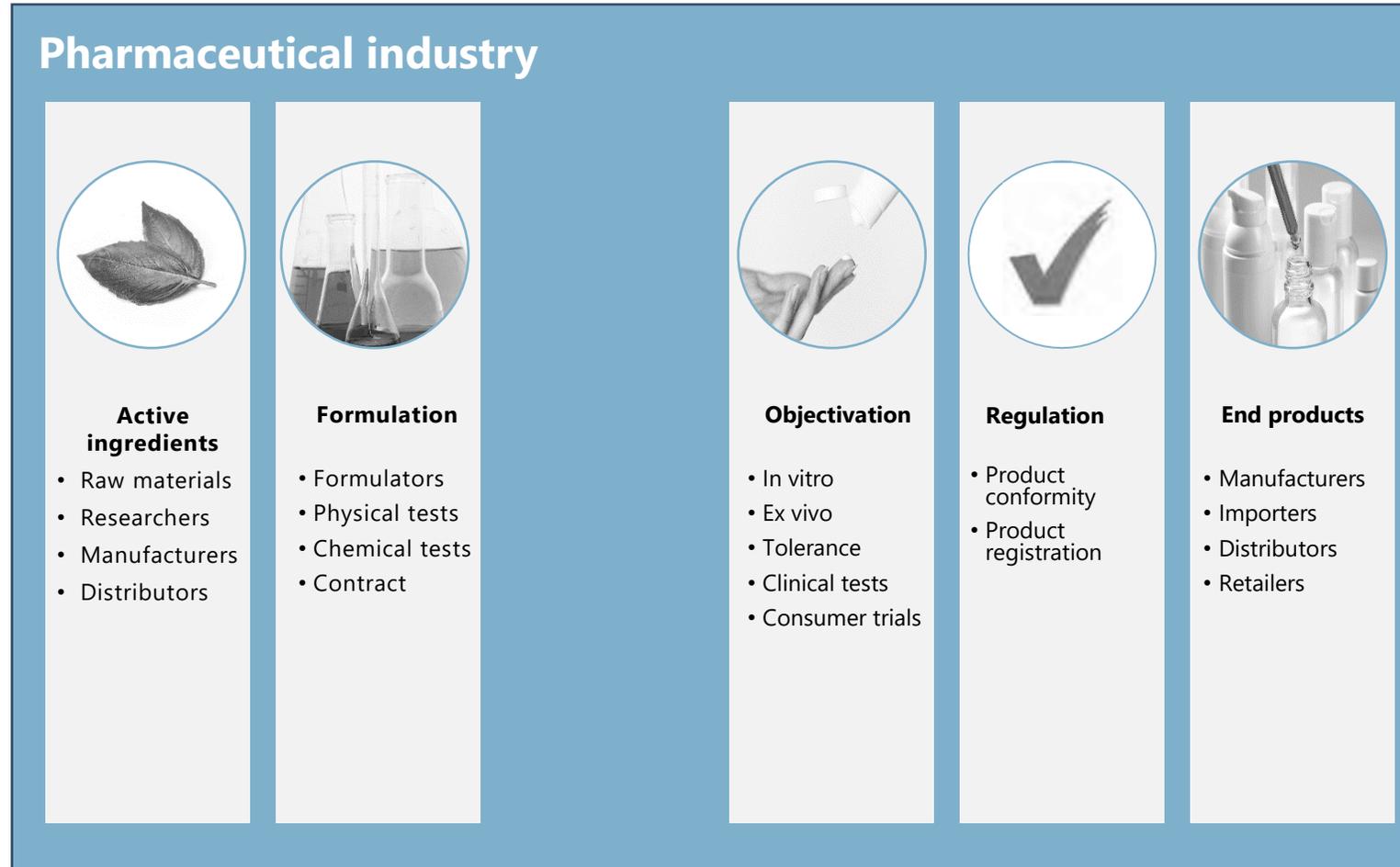


	LABORATORY	PILOT	PRODUCTION
EQUIPMENT	TURBOTEST ULTRALAB	TRILAB 10L	TRIMIX 150L
R/S Diameter (mm)	45	65	95
Emulsification speed (RPM)	4 000-5 000	4 500	3 500
Shear rate (s <sup>-1</sup> ) at max speed	38 000 - 47 000	61 000	70 000

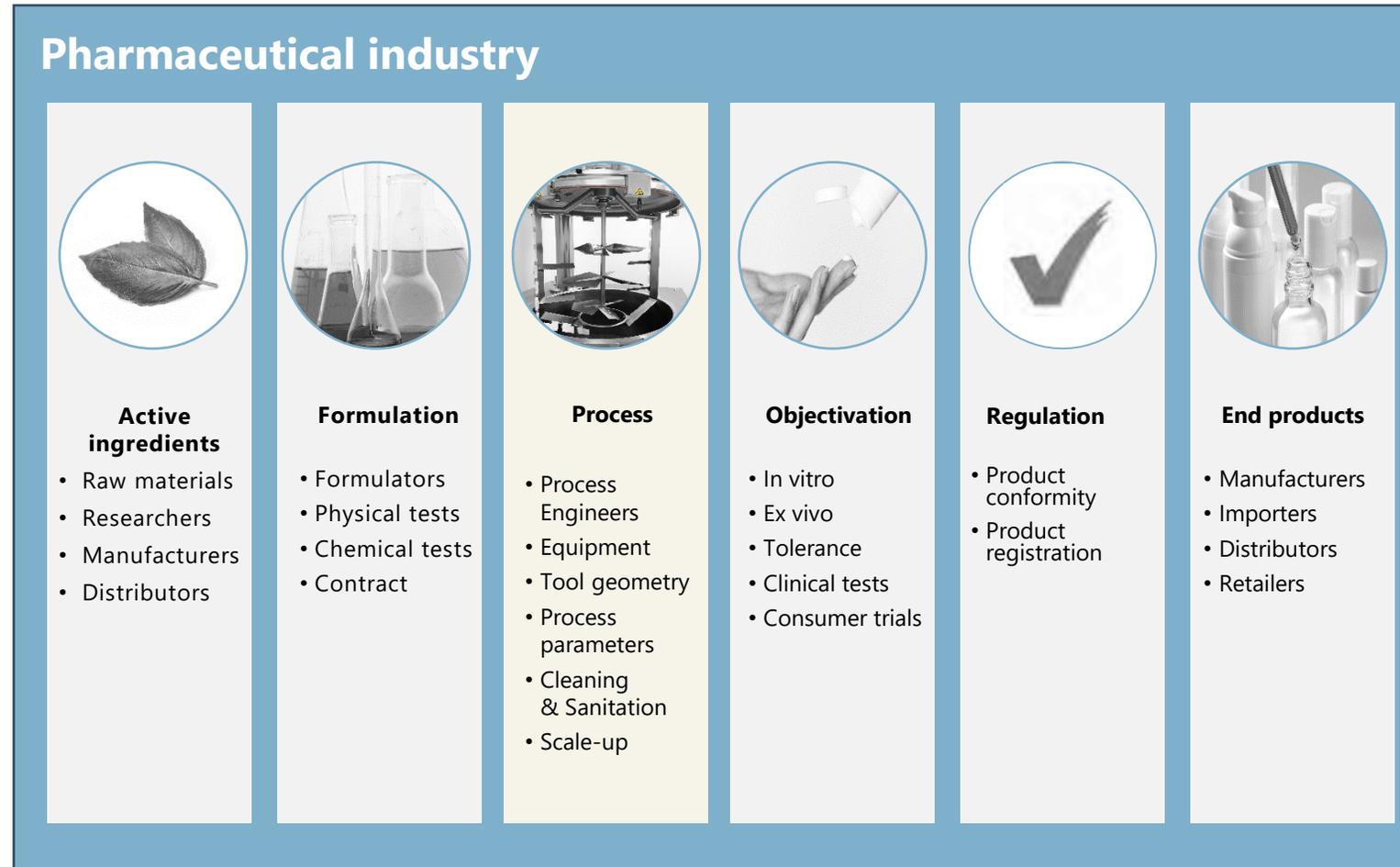
$$\text{Shear rate} = \frac{\pi \times N \times D}{\text{Clearance}}$$



## VALUE CHAIN



## VALUE CHAIN



Clean / organic / natural ingredients and products: A reality, not just a choice



Impact on "classic" formulations:  
Ingredients are seen as the main lever for the success of a formulation



High quality formulations: Process and mixing parameters are another major lever to improve the control of your formulations





THANK YOU  
FOR YOUR ATTENTION

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