



## Dried whey protein fractal aggregates for substituting texturizing additives in dairy products

Domitille de Guibert, Martin François, Anna Kharlamova, Ali Kerjough, Cécile Le Floch-Fouéré, Guillaume Delaplace, Romain Jeantet

### ► To cite this version:

Domitille de Guibert, Martin François, Anna Kharlamova, Ali Kerjough, Cécile Le Floch-Fouéré, et al.. Dried whey protein fractal aggregates for substituting texturizing additives in dairy products. 15th International Hydrocolloids Conference, Mar 2020, Melbourne, Australia. hal-02634107

**HAL Id: hal-02634107**

**<https://hal.inrae.fr/hal-02634107>**

Submitted on 27 May 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0 International License



# 15<sup>th</sup> International Hydrocolloids Conference

2 – 5 March 2020  
Melbourne,  
Australia

# INRAE

la science pour la vie, l'humain, la terre

## Dried whey protein fractal aggregates for substituting texturizing additives in dairy products

D de Guibert<sup>1</sup>, F Martin<sup>1</sup>, A Kharlamova<sup>2</sup>, A Kerjough<sup>1</sup>, C Le Floch Fouéré<sup>1</sup>, G Delaplace<sup>3</sup>, R Jeantet<sup>1</sup>

<sup>1</sup> STLO, INRA, AGROCAMPUS OUEST, 35042 Rennes, France

<sup>2</sup> IMMM, UMR-CNRS, 72085 Le Mans, France

<sup>3</sup> UMET, INRA, PIHM Team, 59651 Villeneuve d'Ascq, France

\*E-mail address: [domitille.deguibert@inra.fr](mailto:domitille.deguibert@inra.fr)



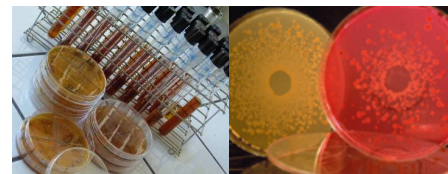


**A multidisciplinary and multiscale approach,  
reinforced by two high-calibre facilities:**

**Dairy Platform**



**Biological Resource Centre**



**❑ Structuration / destructuration mechanisms  
of food matrix:**

*from structural characterisation to digestion*

**❑ Dairy processing and cheese making:**  
*toward sustainable dairy systems*

**❑ Microbial interaction:**  
*food matrix and host cell*



# CONTEXT



2014-2019  
Joelle LEONIL

## Consumer expectation

- Good organoleptic quality
- More natural and healthy products

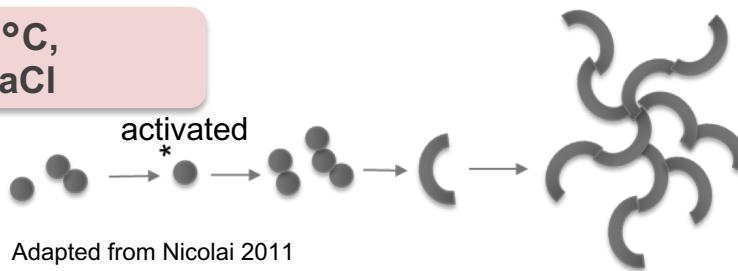
## Industrial expectation

- Target regular products properties by using additives
- Use less additives as possible (Clean label)
- **Add value to milk protein (technofunctional interest)**

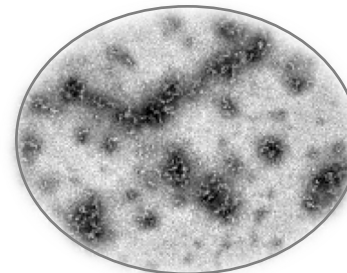


## Fractal aggregates : Whey protein aggregates

WPI, 80°C,  
pH 8, NaCl



Adapted from Nicolai 2011



- Repeated pattern
- Soluble
- Low density

Background & RQ

Strategy

Results / discussion

Conclusion



# PROPERTIES OF FRACTAL AGGREGATES AND RESEARCH QUESTION

## Properties of fractal aggregates

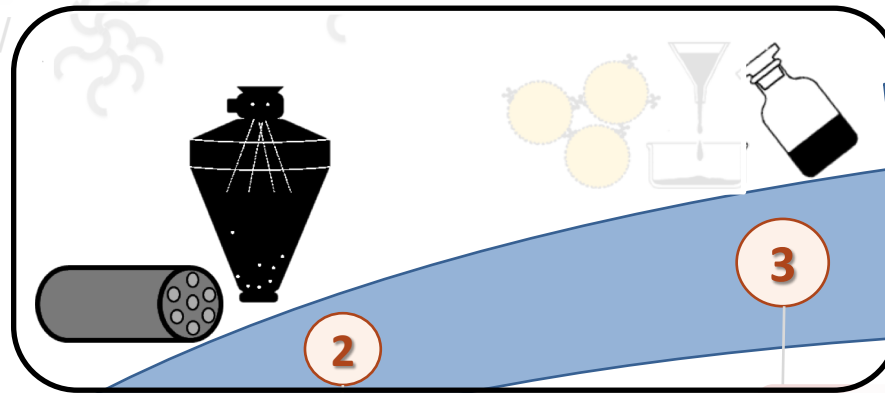
Increase  
viscosity

Gel

Limit  
syneresis

Bind fat droplet in  
emulsions

Resist to heating



Incorporation into  
dairy products

Check the

## Research question

What is the impact of the concentration and drying operations on the cold gelation functionality of fractal aggregates

Production at  
laboratory scale

De Guibert D, Martin F, Hennevier M, Gu YY, Le Floch Fouéré C, Delaplace G, Jeantet R. 2020. Flow process and heating conditions modulate the characteristics of whey protein aggregates. J Food Eng 264, article 109675, 1-10

Background & RQ

Strategy

Results / discussion

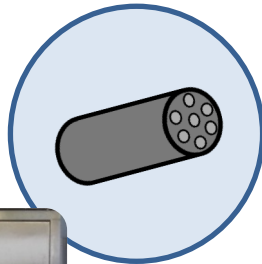
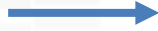
Conclusion

# AGGREGATES PRODUCTION AND STABILIZATION

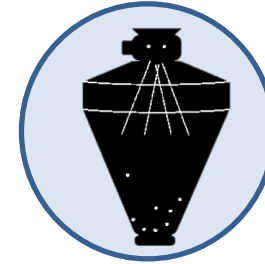
Pilot scale



100L



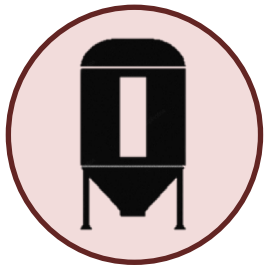
Vol : 40L



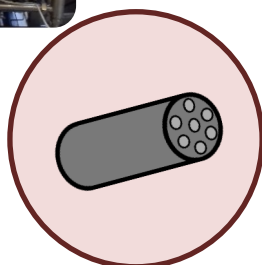
5 kg water.h<sup>-1</sup>



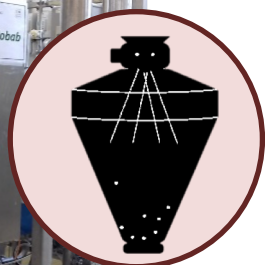
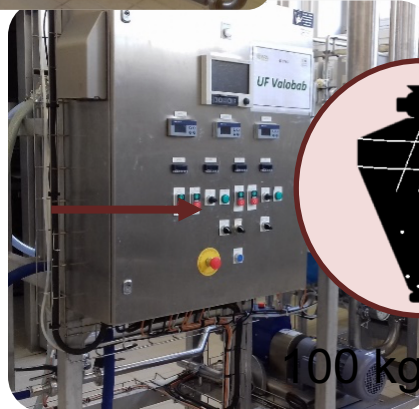
Industrial scale



400L



Vol : 400L

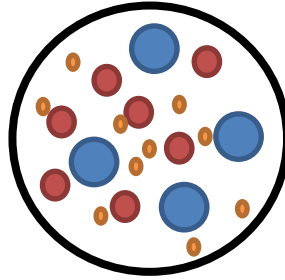


100 kg water.h<sup>-1</sup>



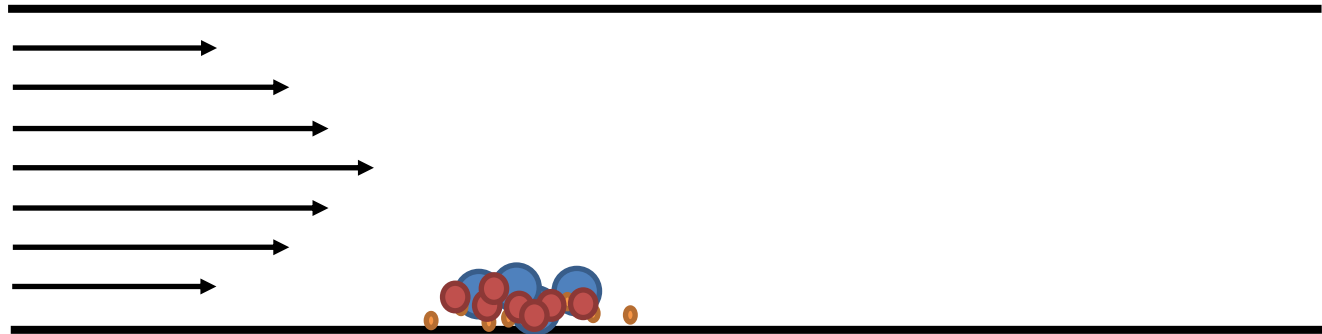
# SIZE CHARACTERIZATION BY A4F

Asymmetrical Flow Field-Flow Fractionation (A4F)



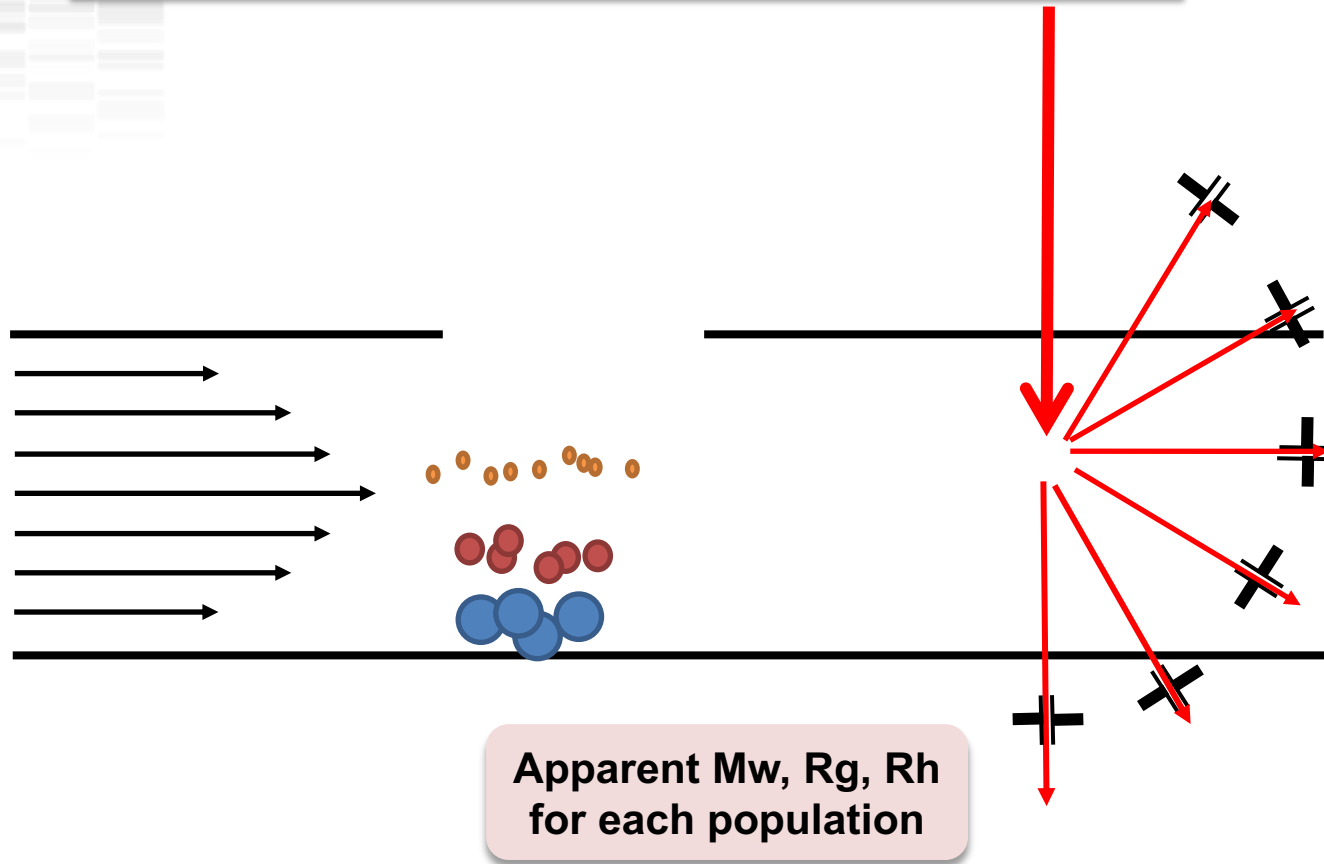
# SIZE CHARACTERIZATION BY A4F

Asymmetrical Flow Field-Flow Fractionation (A4F)



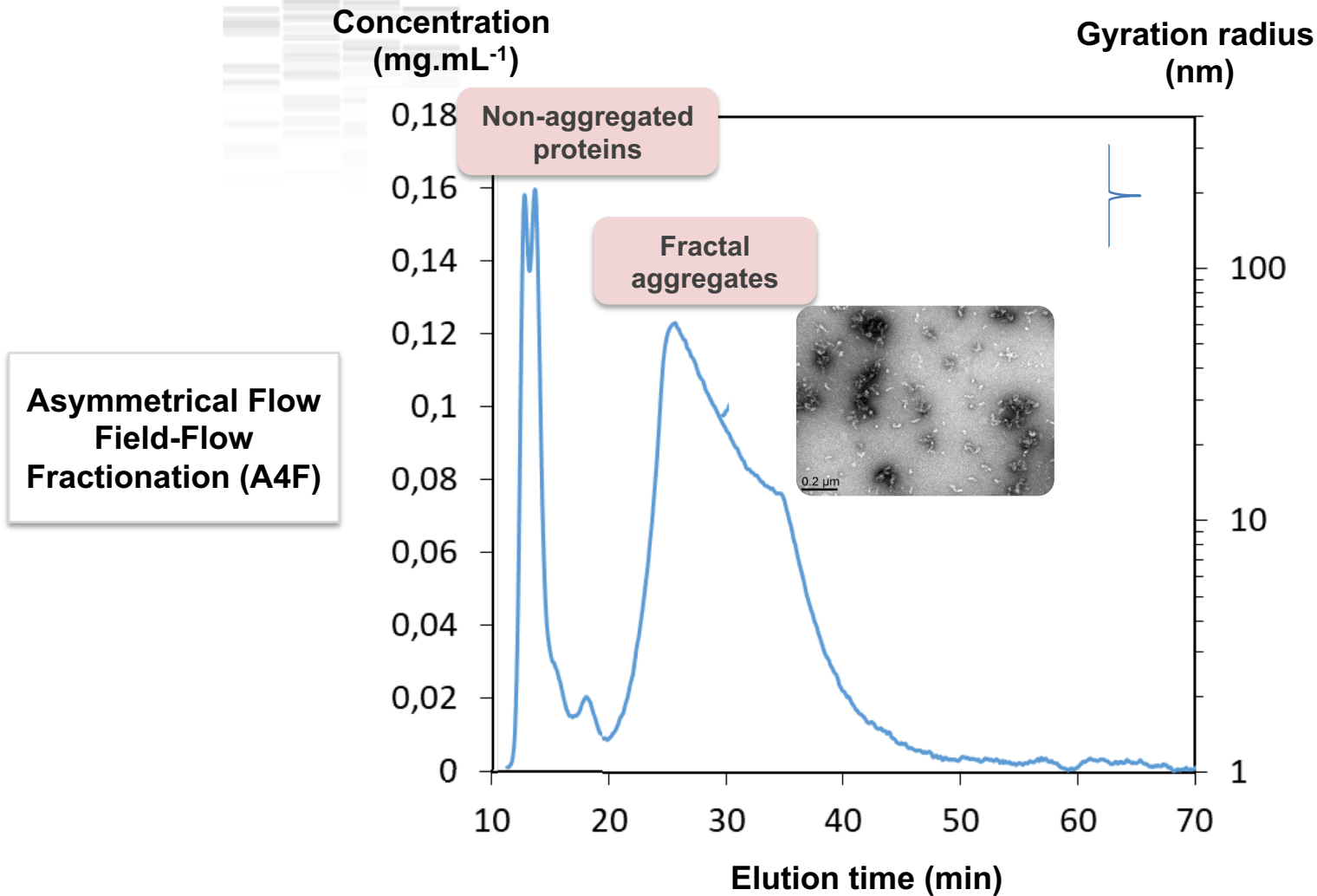
# SIZE CHARACTERIZATION BY A4F

Asymmetrical Flow Field-Flow Fractionation (A4F)





# SIZE CHARACTERIZATION BY A4F



# COLD GELATION PROPERTIES OF FRACTAL AGGREGATES

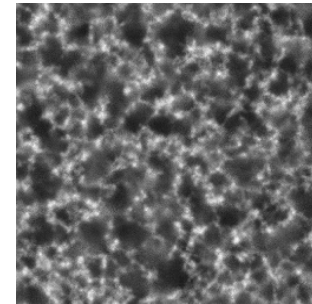
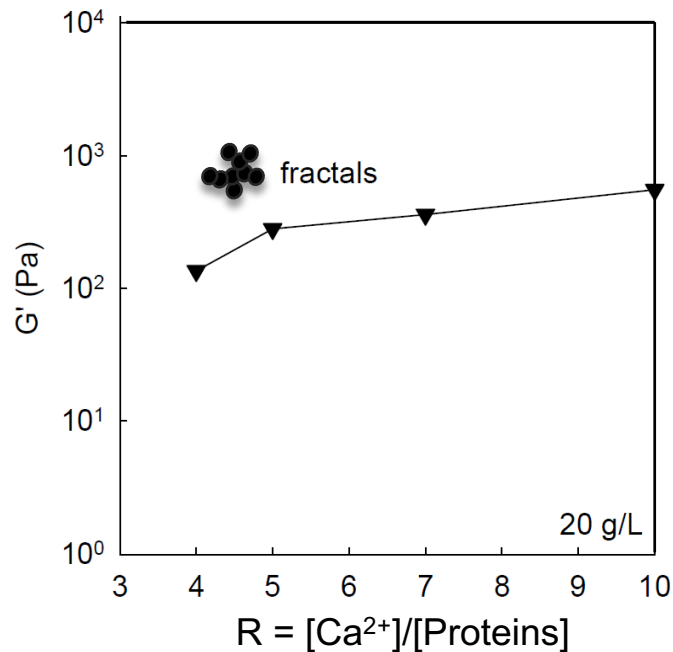
## Cold Gelation

### Principle

Reduce electrostatic repulsion to form gel without the use of heating

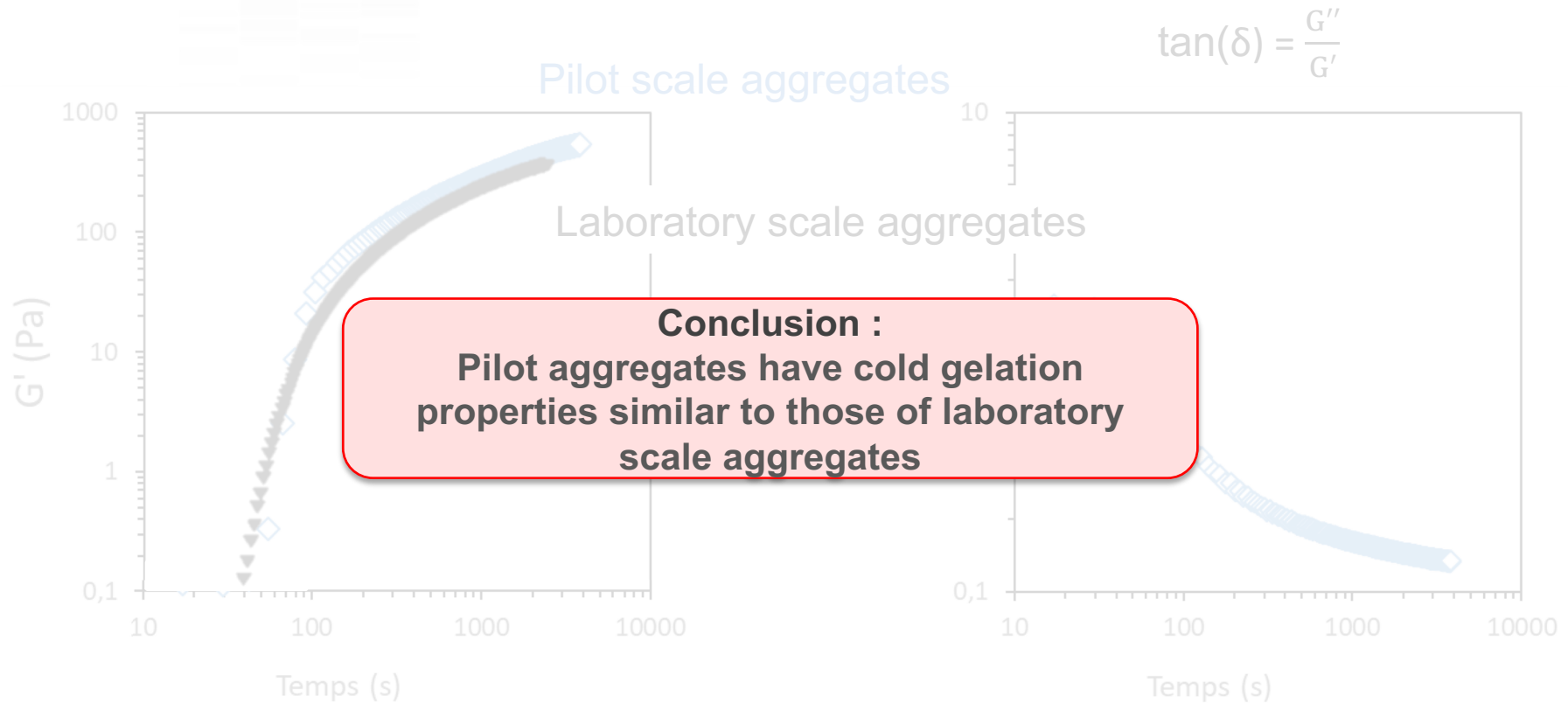
### Interest

Specific food application  
(fresh products ; preserve vitamins)

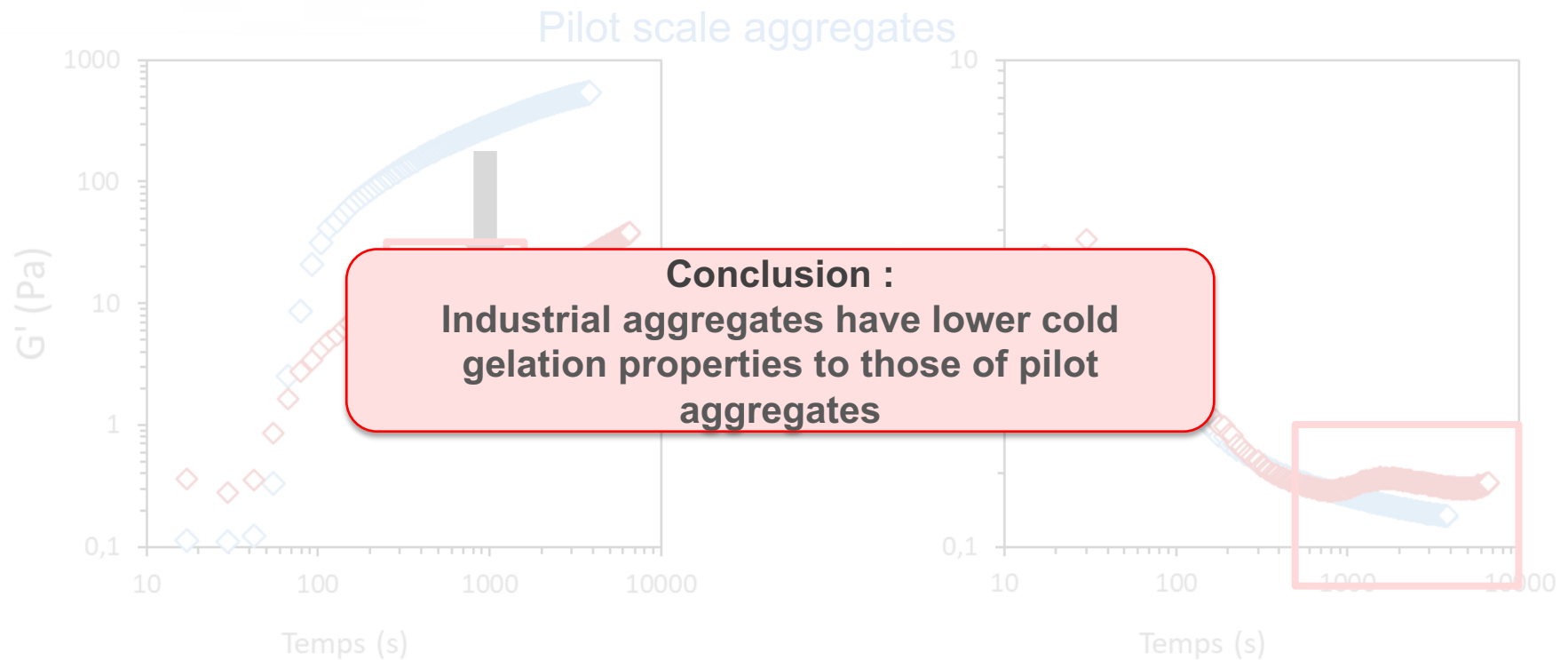


*Kharlamova et al (2018)*

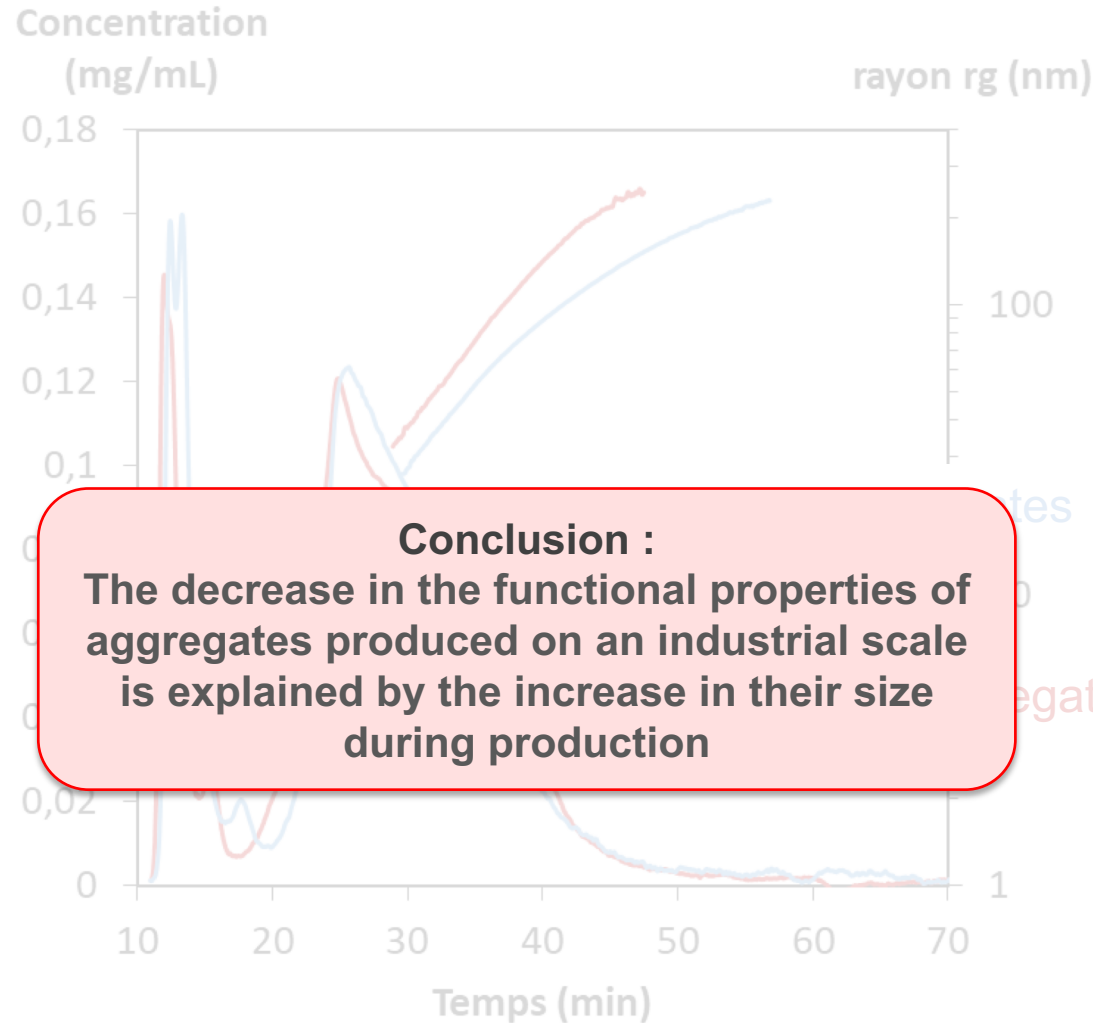
# COLD GELATION PROPERTIES OF PILOT & LABORATORY SCALE AGGREGATES



# COLD GELATION PROPERTIES OF PILOT & INDUSTRIAL SCALE AGGREGATES



# SIZE INCREASE OF THE AGGREGATES AT INDUSTRIAL SCALE



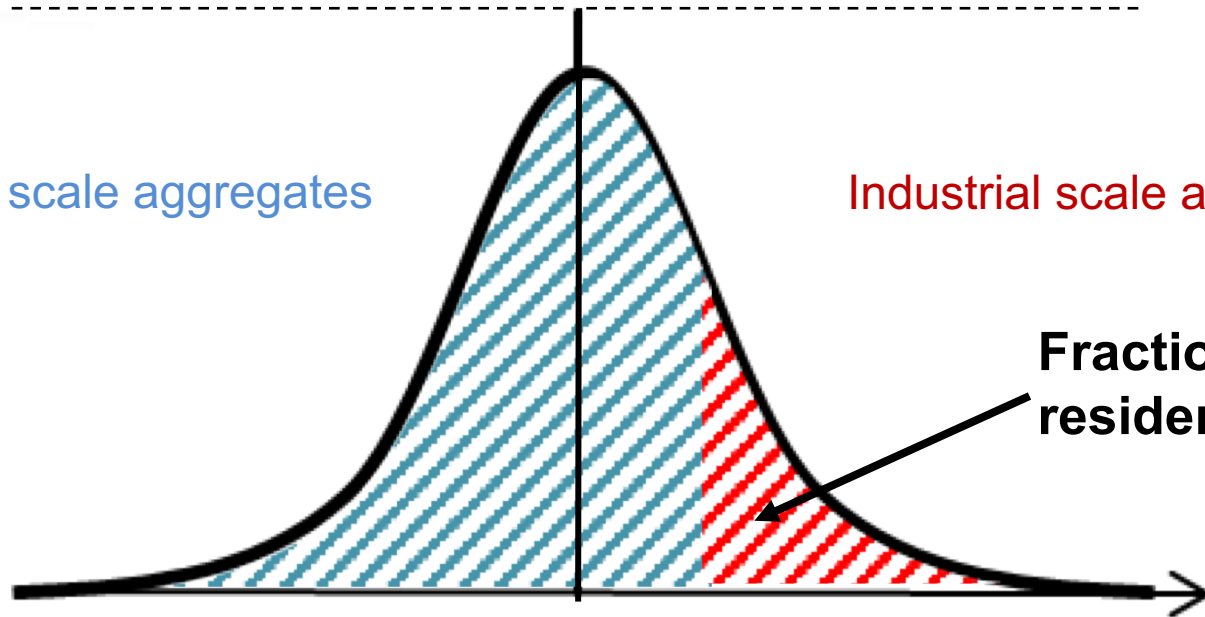




Pilot scale aggregates

Industrial scale aggregates

Fraction with high residence time

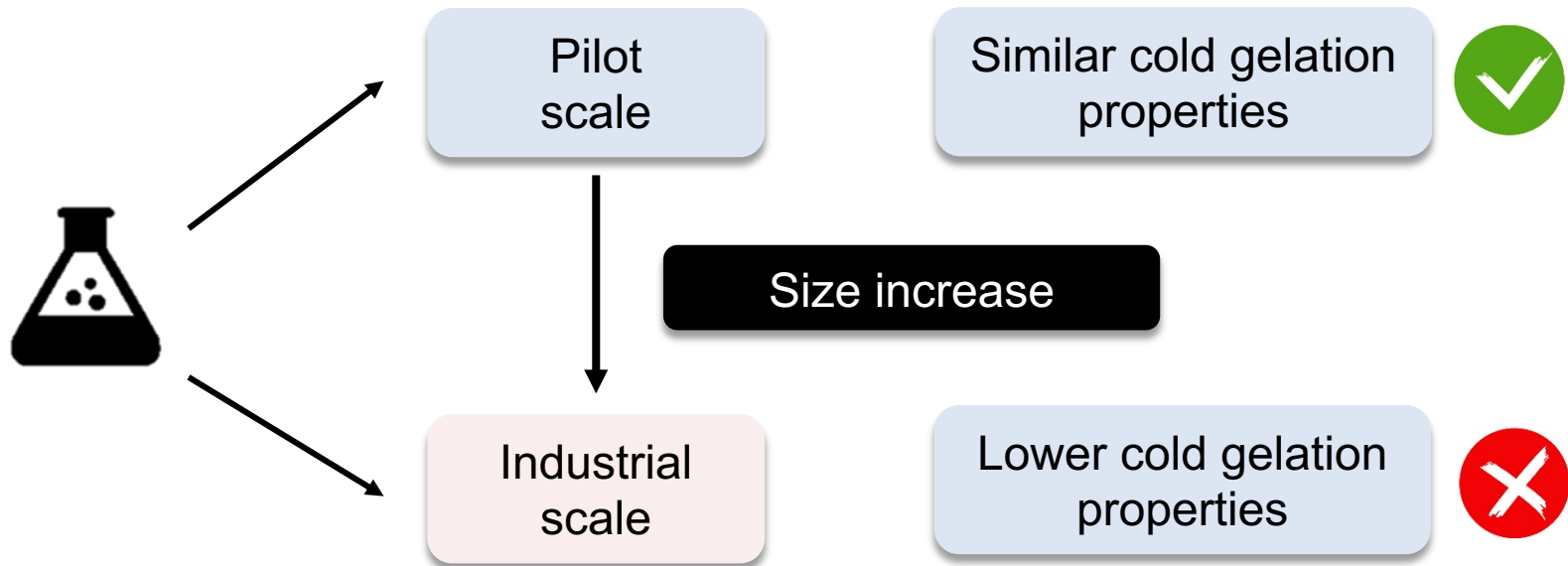


Mean residence time

# CONCLUSION

## Research question

What is the impact of the concentration and drying operations on the cold gelation functionality of fractal aggregates





***Thank you for your attention***

