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15th 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

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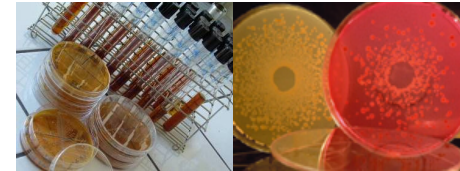


A multidisciplinary and multiscale approach, reinforced by two high-calibre facilities:

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

Consumer expectation

- Good organoleptic quality
- More natural and healthy products



2014-2019
Joelle LEONIL

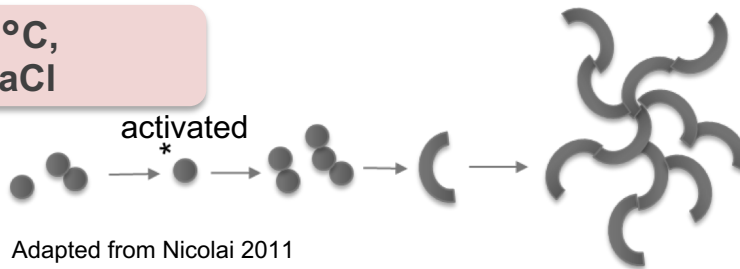
Industrial expectation

- 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

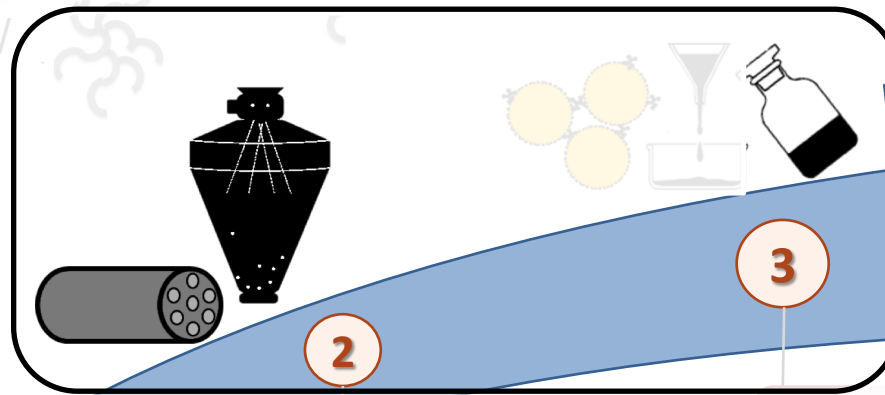
Increase
viscosity

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, Hennefier 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

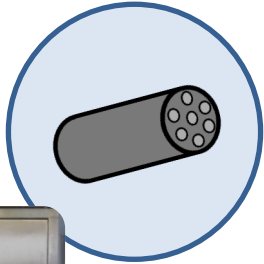
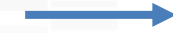
Conclusion

AGGREGATES PRODUCTION AND STABILIZATION

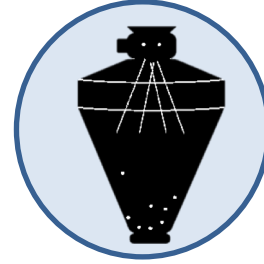
Pilot scale



100L



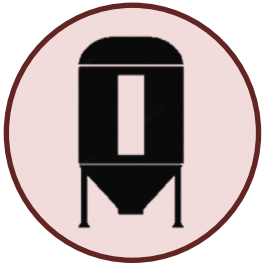
Vol : 40L



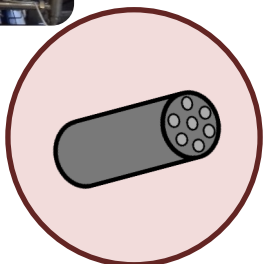
5 kg water.h⁻¹



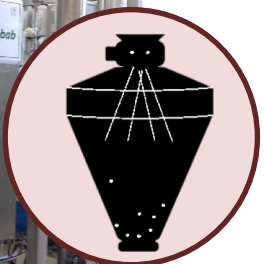
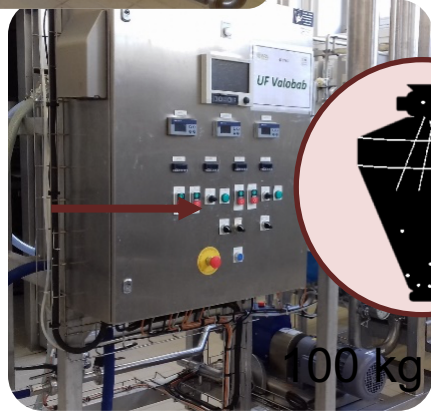
Industrial scale



400L



Vol : 400L



100 kg water.h⁻¹



Background & RQ

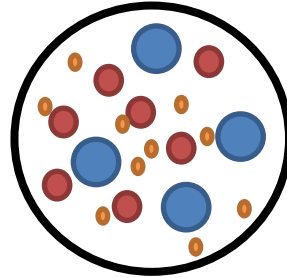
Strategy

Results / discussion

Conclusion

SIZE CHARACTERIZATION BY A4F

Asymmetrical Flow Field-Flow Fractionation (A4F)



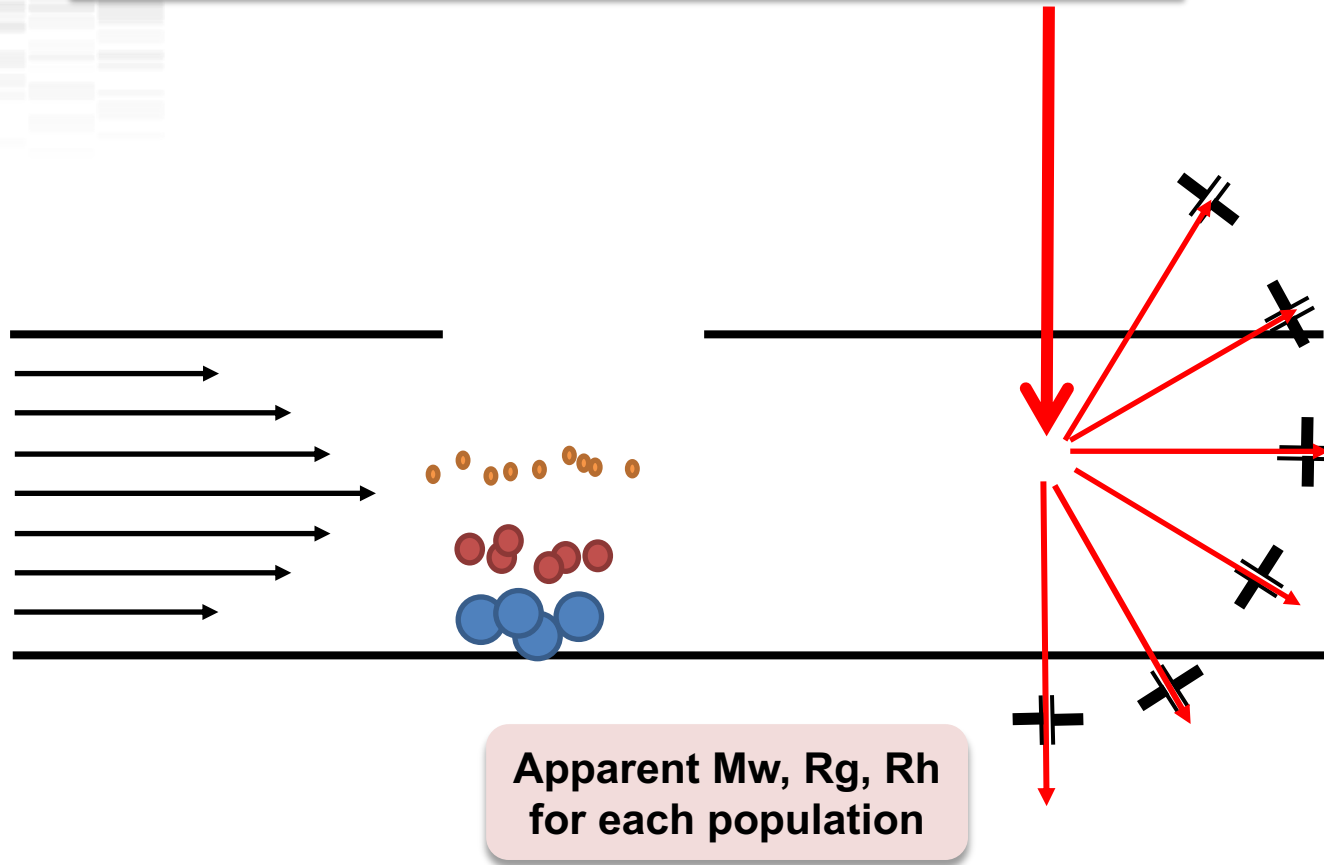
SIZE CHARACTERIZATION BY A4F

Asymmetrical Flow Field-Flow Fractionation (A4F)



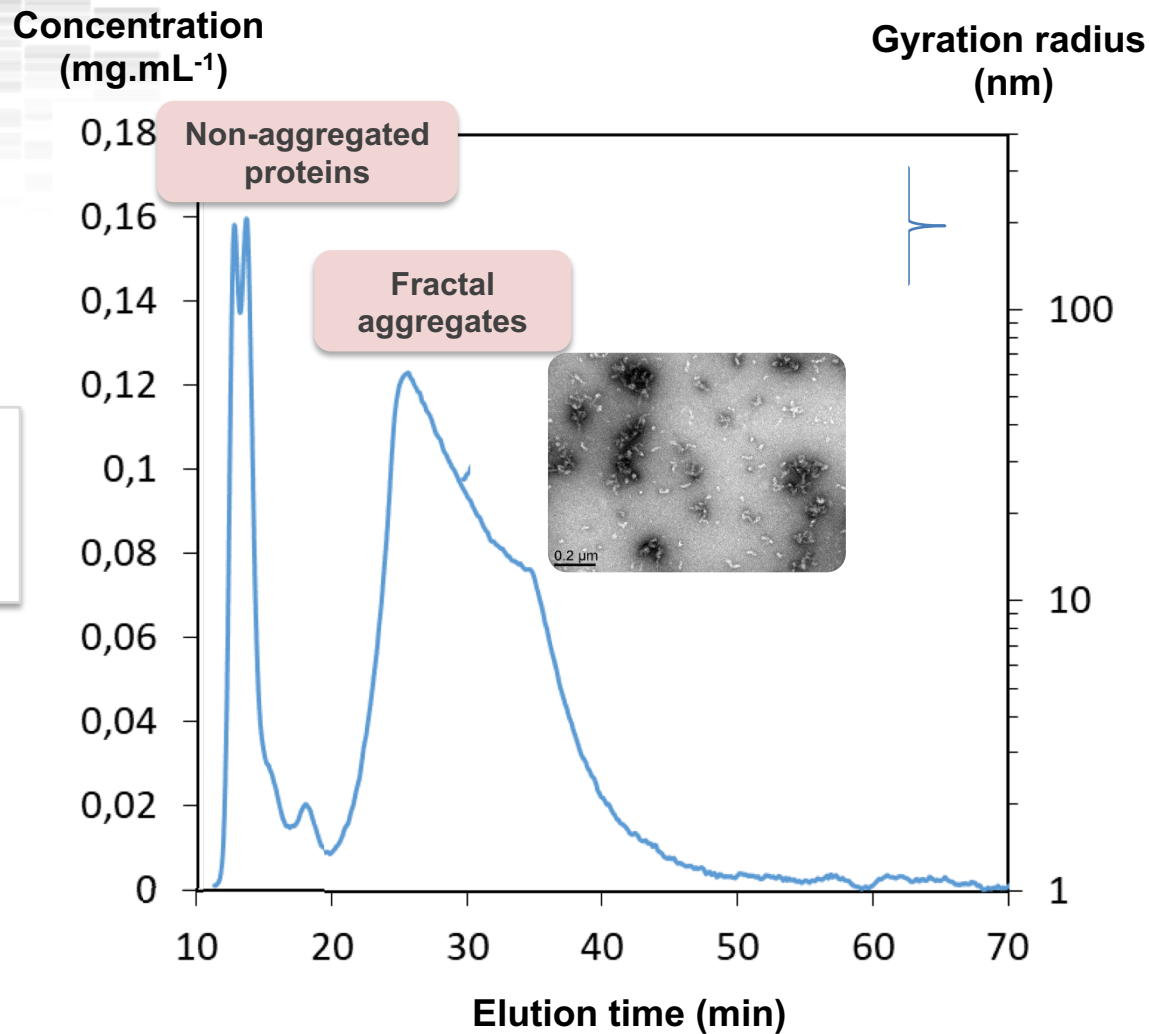
SIZE CHARACTERIZATION BY A4F

Asymmetrical Flow Field-Flow Fractionation (A4F)



SIZE CHARACTERIZATION BY A4F

Asymmetrical Flow
Field-Flow
Fractionation (A4F)



Background & RQ

Strategy

Results / discussion

Conclusion

COLD GELATION PROPERTIES OF FRACTAL AGGREGATES

Cold Gelation

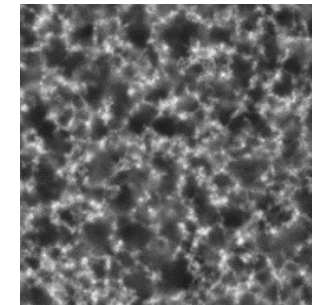
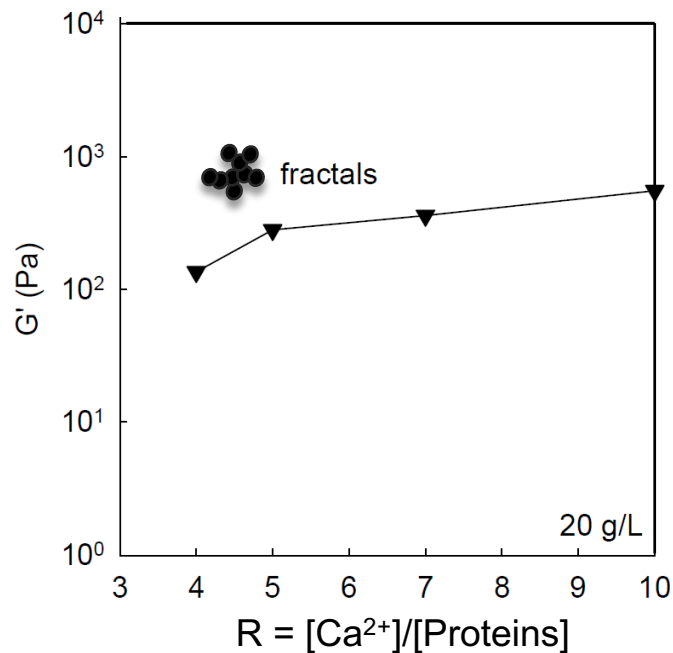
Principle

Reduce electrostatic repulsion to form gel without the use of heating



Interest

Specific food application
(fresh products ; preserve vitamins)



Kharlamova et al (2018)

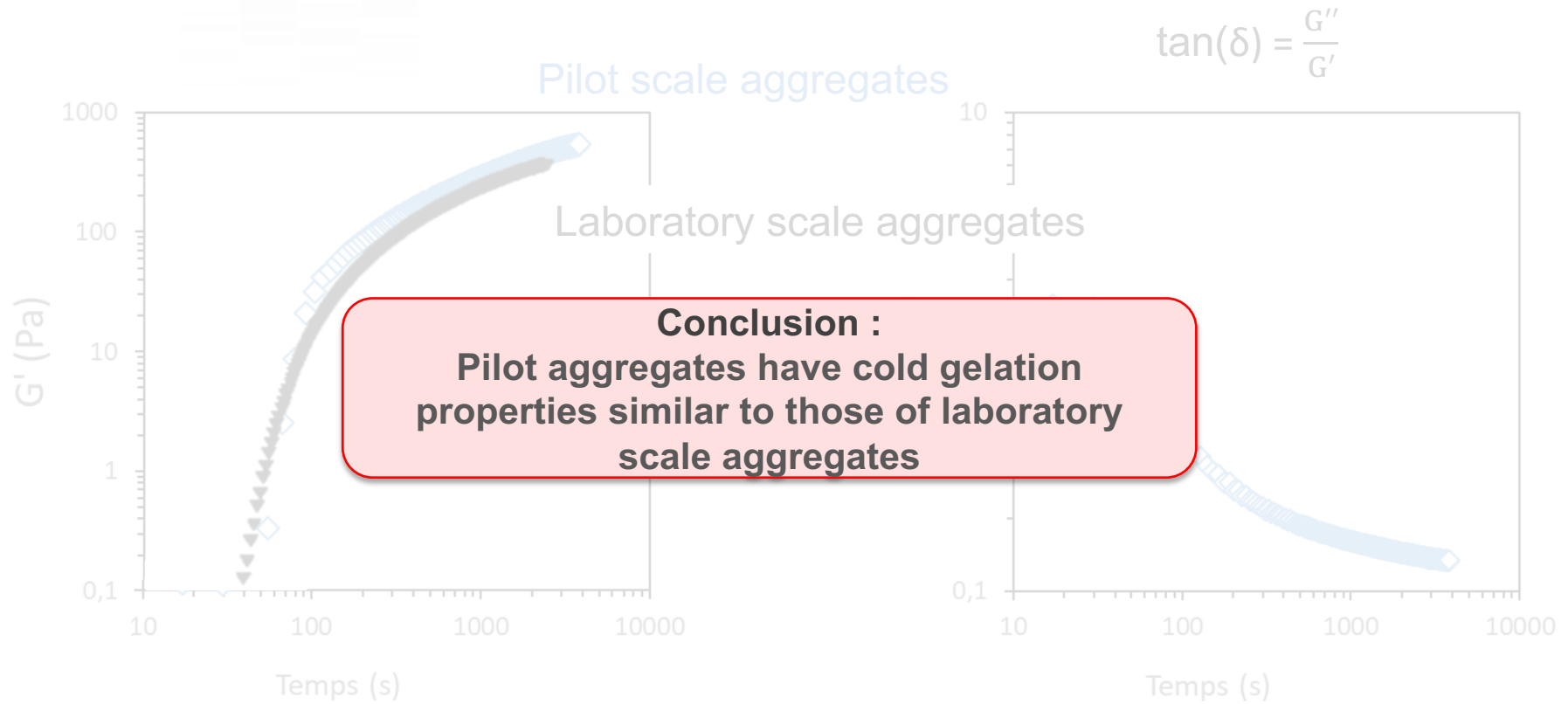
Background & RQ

Strategy

Results / discussion

Conclusion

COLD GELATION PROPERTIES OF PILOT & LABORATORY SCALE AGGREGATES



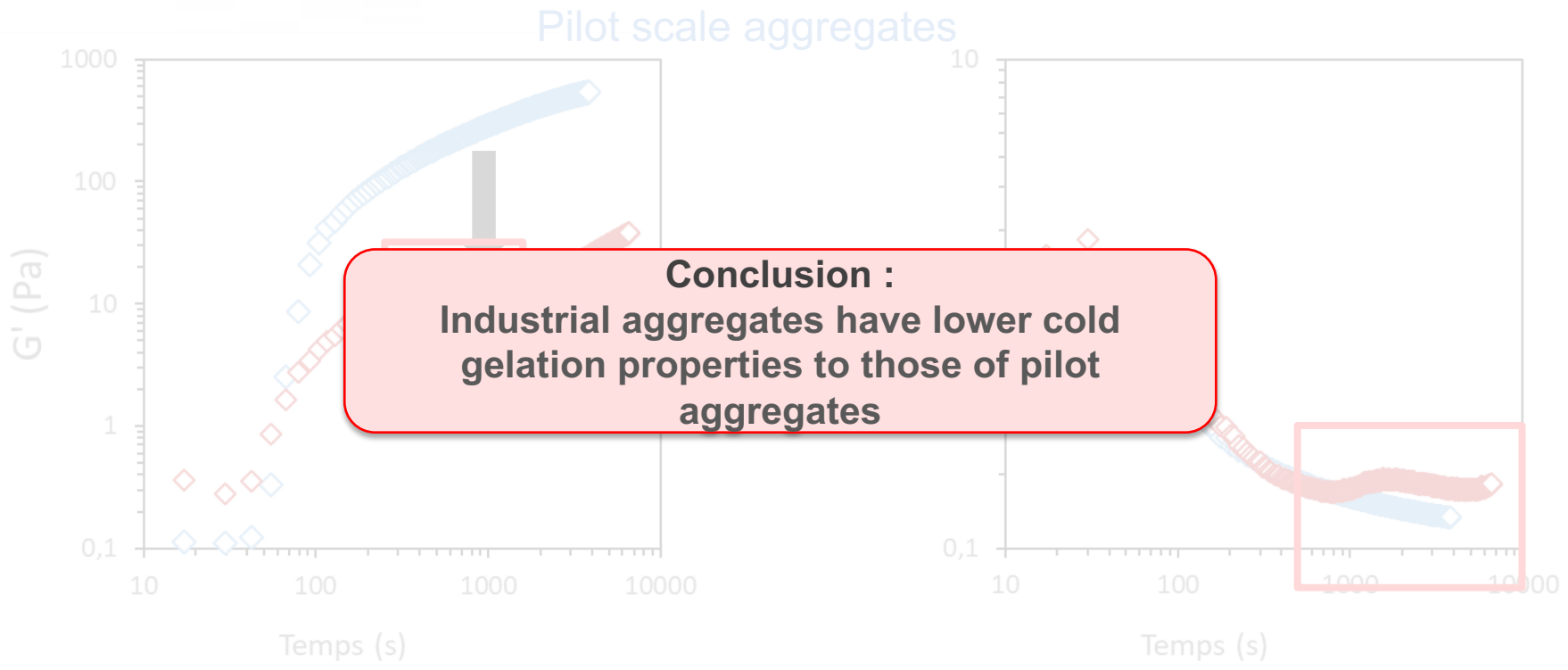
Background & RQ

Strategy

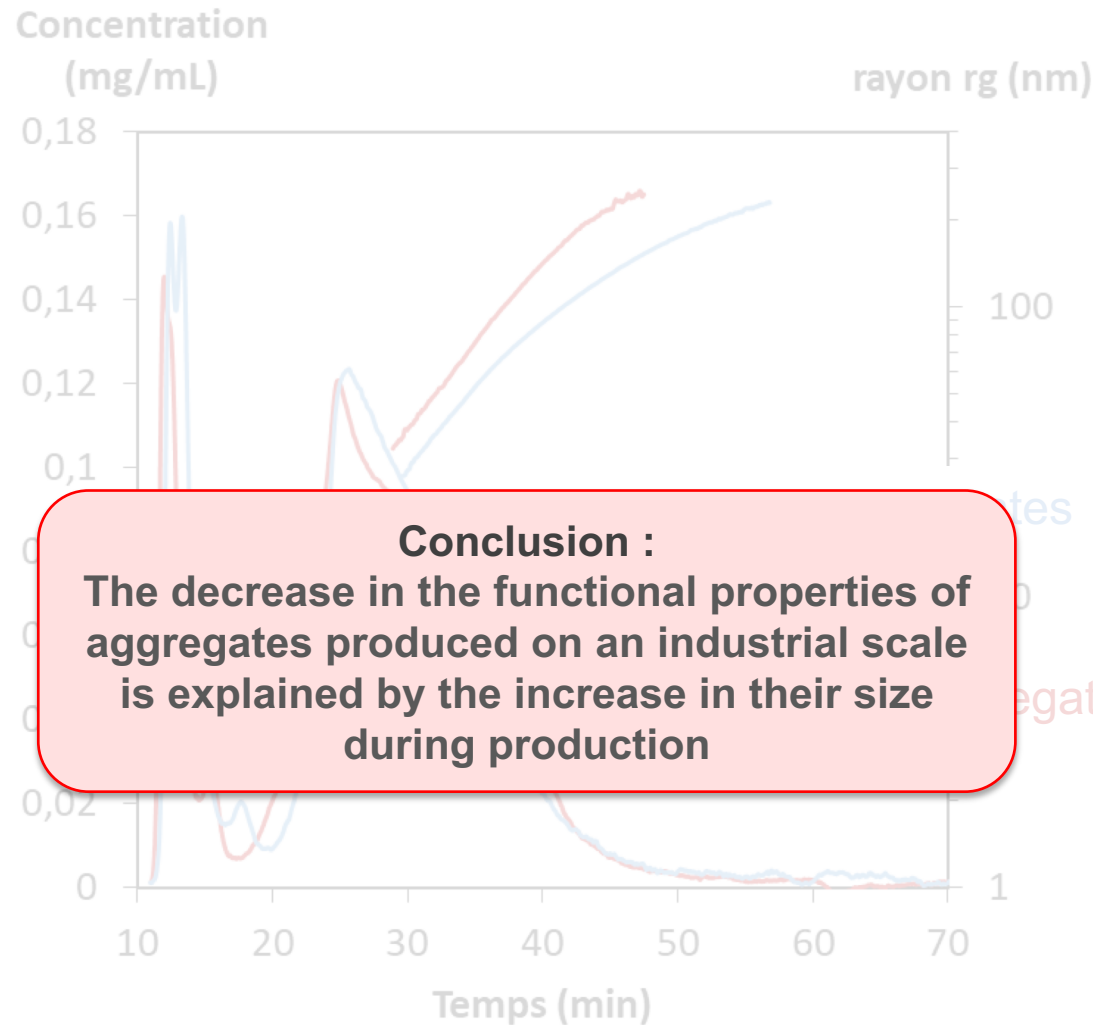
Results / discussion

Conclusion

COLD GELATION PROPERTIES OF PILOT & INDUSTRIAL SCALE AGGREGATES



SIZE INCREASE OF THE AGGREGATES AT INDUSTRIAL SCALE



Background & RQ

Strategy

Results / discussion

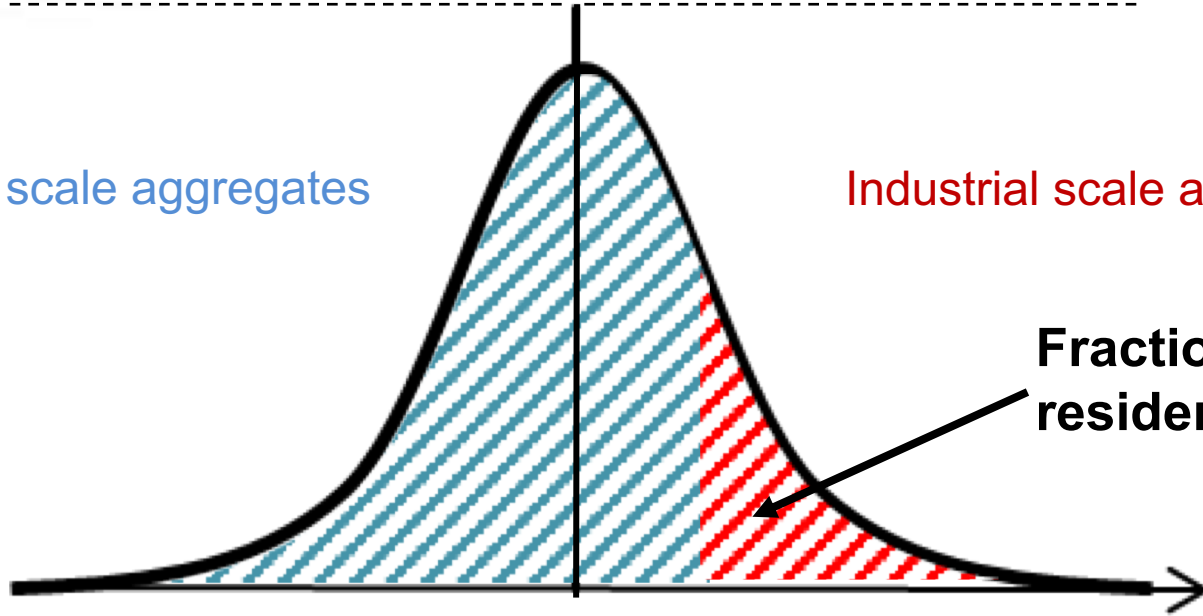
Conclusion



Pilot scale aggregates

Industrial scale aggregates

Fraction with high residence time

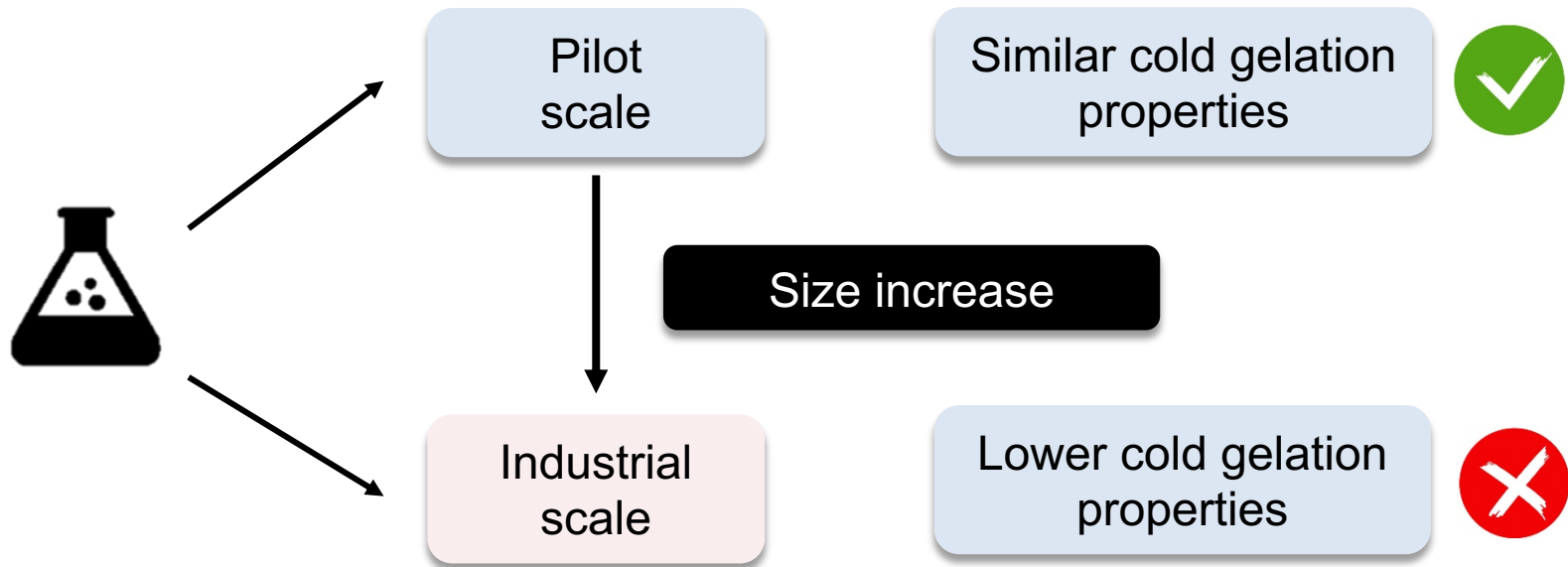


Mean residence time

CONCLUSION

Research question

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



Background & RQ

Strategy

Results / discussion

Conclusion



Thank you for your attention

