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# **Effect of structural parameters on rheological** behaviour of reconstructed puree

## Cassandre Leverrier, Giana Almeida, Gérard Cuvelier

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## Context

In food industry, controlling texture allows to generate innovative products and to deal with consumer expectations or physical issues (ex. swallowing problems due to ageing).



Source: http://www.annabelkarmel.com/recipes/first-apple-pu

Source: care4brain.com/tag/intervention-for-demented-elde

**Research question:** How does fruit suspension structure impact its behaviour?

## Strategy

Fruit puree = vegetable deformable cells suspension

### Results

Impact of grinding process on cells structure and size



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С Z



 $V_{particle} < V_{equilibrium}$ 

**Settling stability** 

Turbiscan<sup>™</sup> LAB, Formulaction

Pectins

Sugar

Ions

■ pH

SERUM

**Construction of apple purees varying in :** ✓ particle size (  $\bigotimes_{n}$  ,  $\bigotimes_{n}^{n}$  and  $\circ_{n}^{n}$  )

 $\checkmark$  particle concentration (from 0 to 2.32g/100g)





Impact of cell structure and concentration on rheological behaviour : 3 concentration domains (I, II, III)



#### Apple puree Grinding Separation Reconstruction 5000g, 2H, 20°C Mixing from 0 to 2.32 g/100g 3 levels

Particle size distribution Mastersizer 2000, Malvern

## Light microscopy

Olympus BX51

TURE

STRUC<sup>T</sup>

UR

AVIO

EH

Μ

## Rheology

MCR 301, Anton Paar, using large gap coaxial cylinders (δr=5mm)

### Steady-state measurements\*

A round trip of shear rates distributed logarithmically was applied from 10s<sup>-1</sup> to 250s<sup>-1</sup>, each shear rate was applied for 1min. Apparent viscosity is taken as the viscosity obtained after 1min at 50s<sup>-1</sup>.

For highly diluted products, shear rate was increased from 0.1 to 100s<sup>-1</sup> (logarithmic ramp) for a total duration of 10min. Newtonian viscosity is taken as the mean viscosity between 10 and 50 s<sup>-1</sup>.

### Oscillatory measurements\*

A strain sweep from 0.015% to 150% was performed at constant pulse (10rad.s<sup>-1</sup>). Both **G**\* and **tanδ** are taken in the **linear viscoelastic domain**.

\*before the measurement, 2min preshear at 50s<sup>-1</sup> followed by 10min resting time were applied to steady over time products.

## **Conclusion & Perspectives**

- Rheological measurements have been performed on a wide range of concentrations with variable particles size distribution.
- Three concentration domains are visible, in both flow and dynamic measurements:
  - $\checkmark$  **Diluted regime**: Newtonian flow. Particles size and shape have little effect on rheology.
  - ✓ **Semi-diluted regime**: Existence of a weak network between particles.
  - $\checkmark$  **Concentrated regime**: The dependence between viscosity and concentration decreases. Particles begin to pack and their volume becomes lower than their equilibrium volume.
- **Next step**: determine the volume occupied by the particles in each domain, access to  $\Phi$ , determine the influence of the continuous phase and the influence of intrinsic properties of the particles.

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