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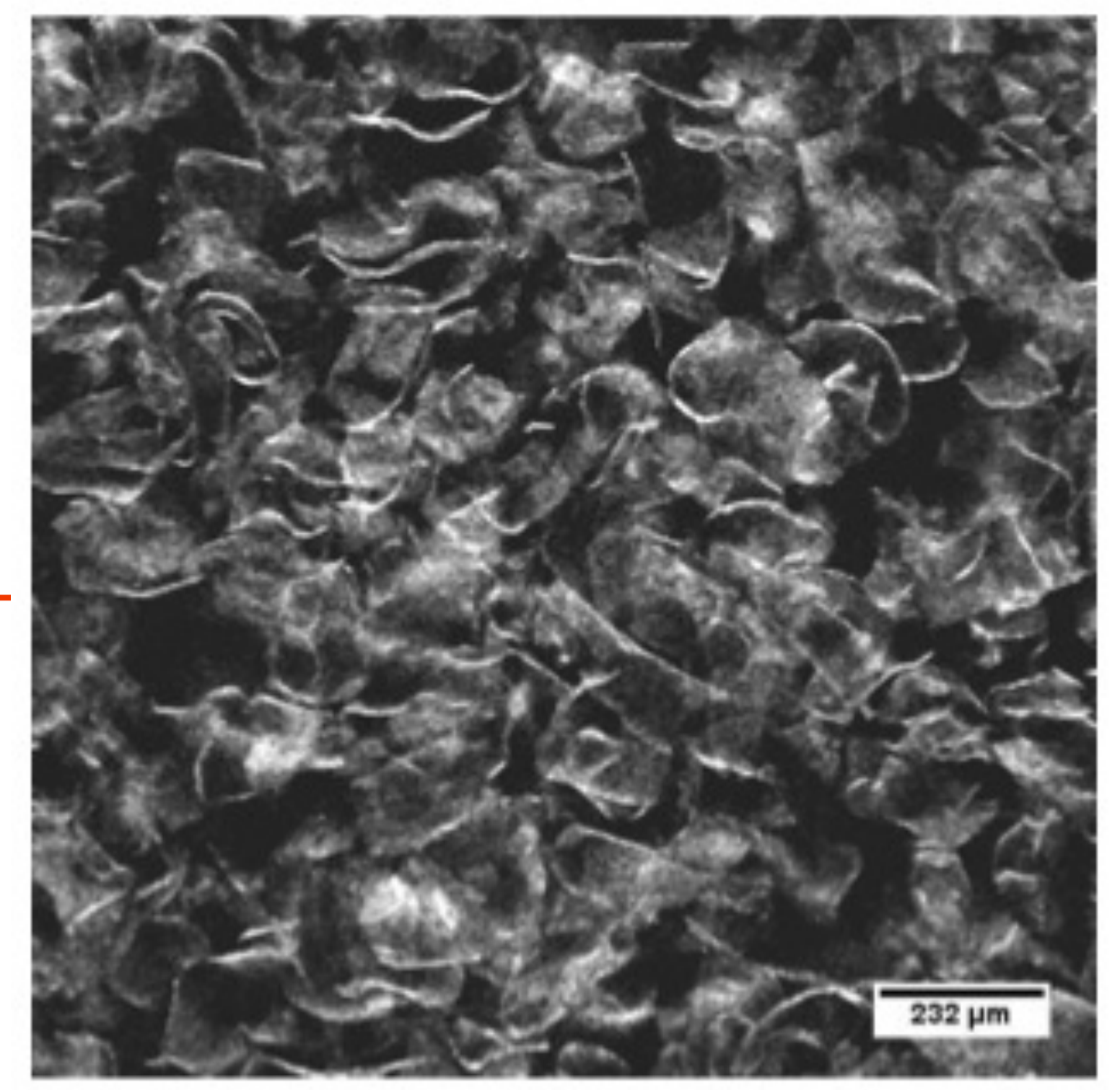
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Observation of soft apple cells in crowded environment

Cassandre Leverrier, Gabrielle Moulin, Giana Almeida, Gérard Cuvelier

UMR Ingénierie Procédés Aliments (JRU Food & Process Engineering)

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Research question:

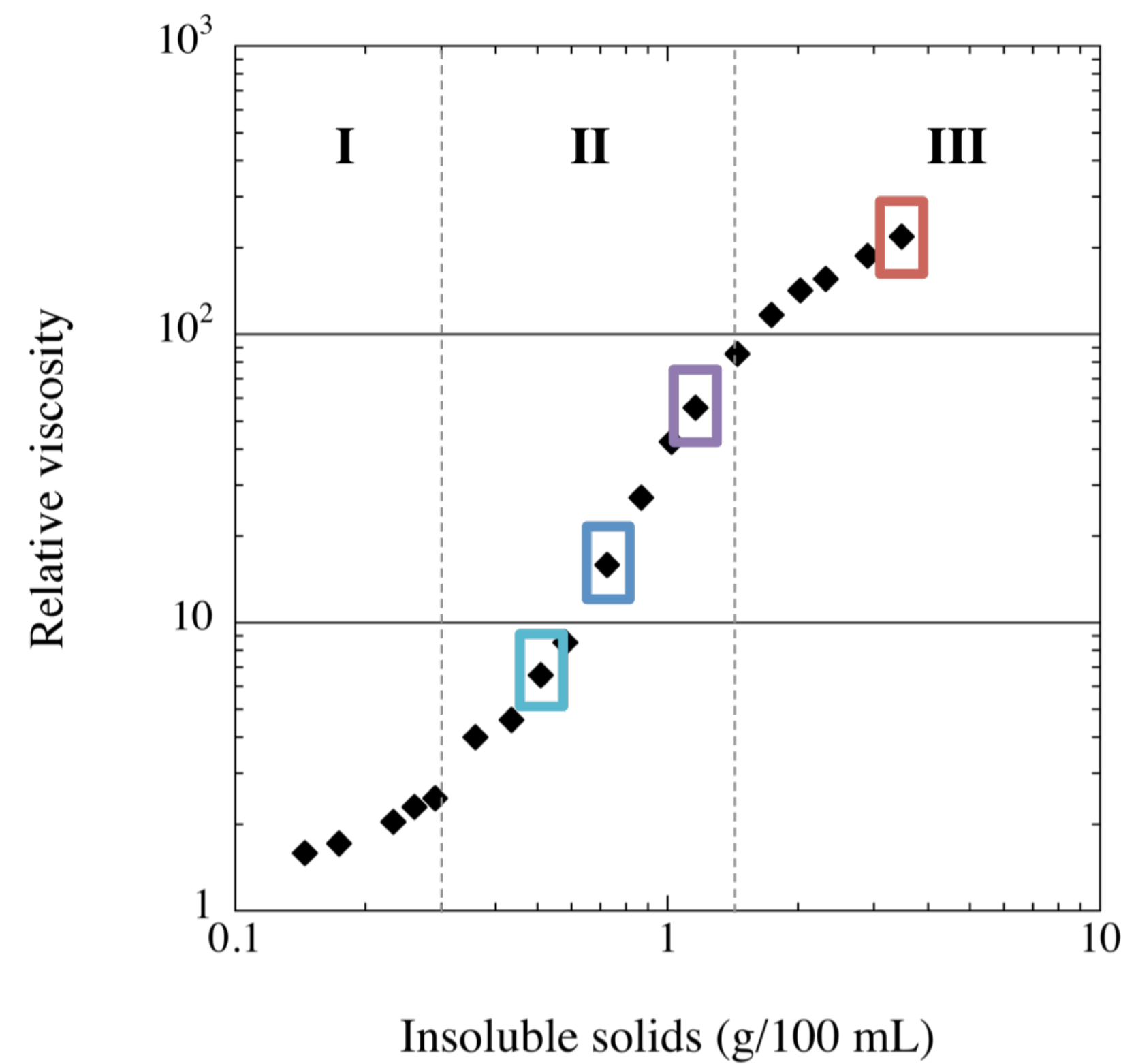
How to access to soft particle deformation and volume in crowded media ?

Background and Motivations

Fruit and vegetable cells are **soft particles whose size and volume can change** under stress [1].

Since they are delimited by a soft cell wall, they are able to highly deform and pack, and their **volume fraction in suspension is not well defined yet**. But rheological properties of plant cells suspensions will be driven by the cells volume fraction. In order to better understand the rheological behaviour of soft plant particles suspensions, it is thus necessary to estimate the volume fraction of the particles.

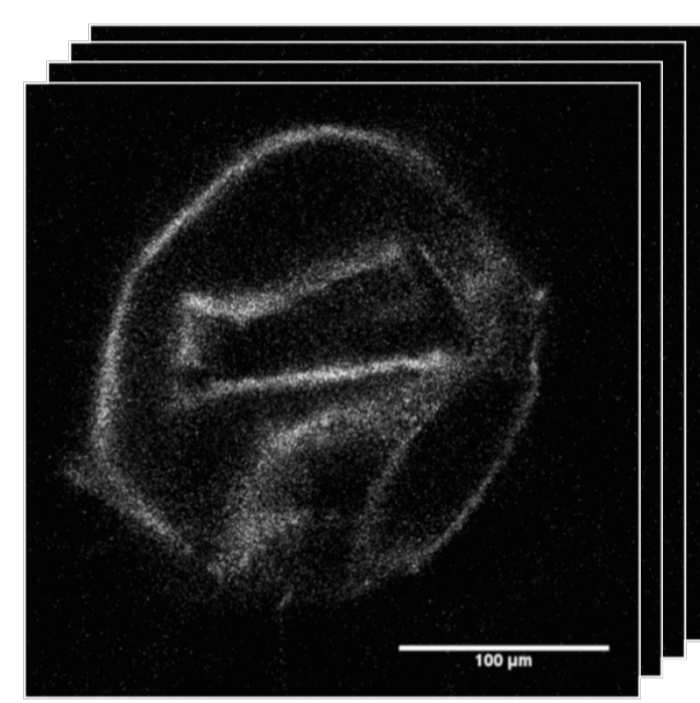
Three concentration domains have been highlighted in litterature, and particles are hypothesized to decrease their volume only in the concentrated domain.



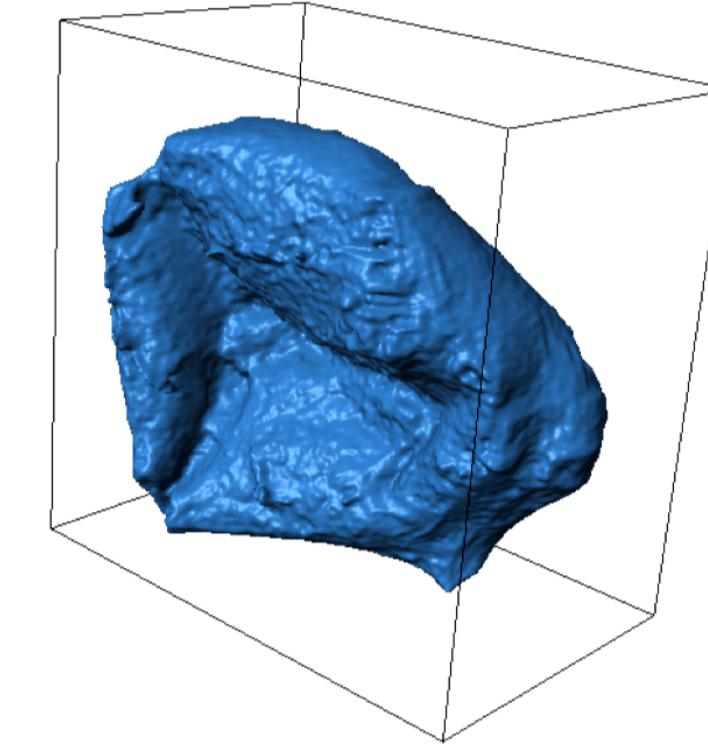
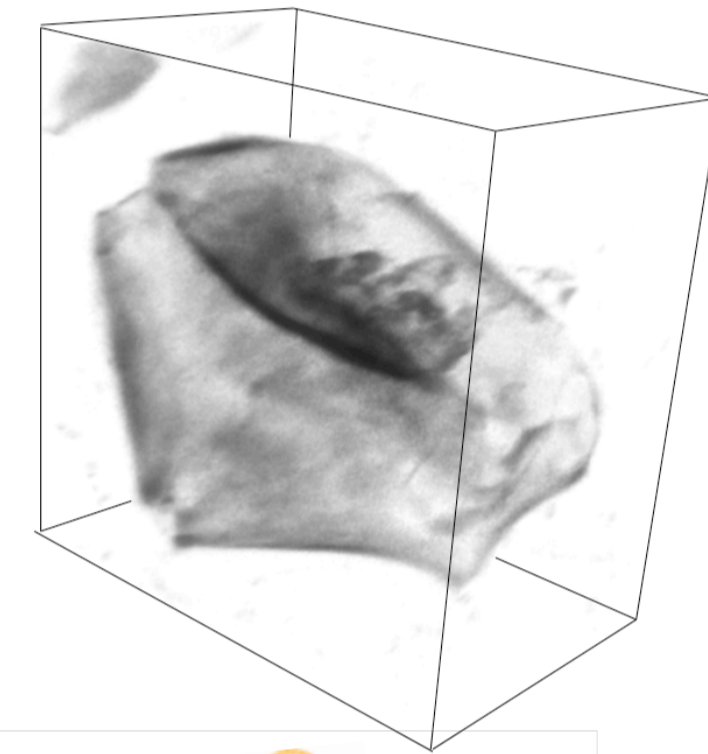
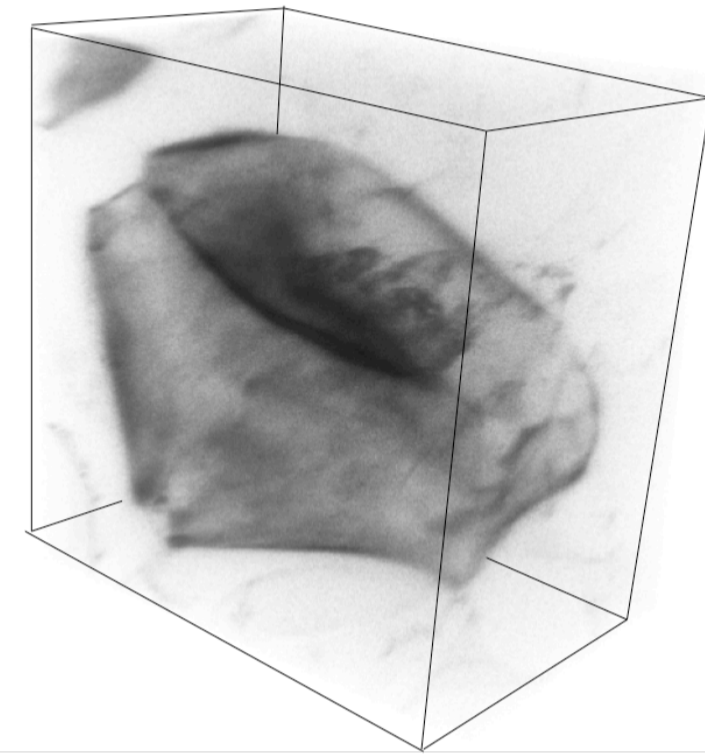
The aim of the present work is to approach the volume fraction occupied by apple cells in several concentration domains.

Material and Methods

Suspension hydration and staining



Confocal microscopy



3D reconstruction



Volume acquisition

4 concentrations chosen in the intermediate and the concentrated domains

simpleware

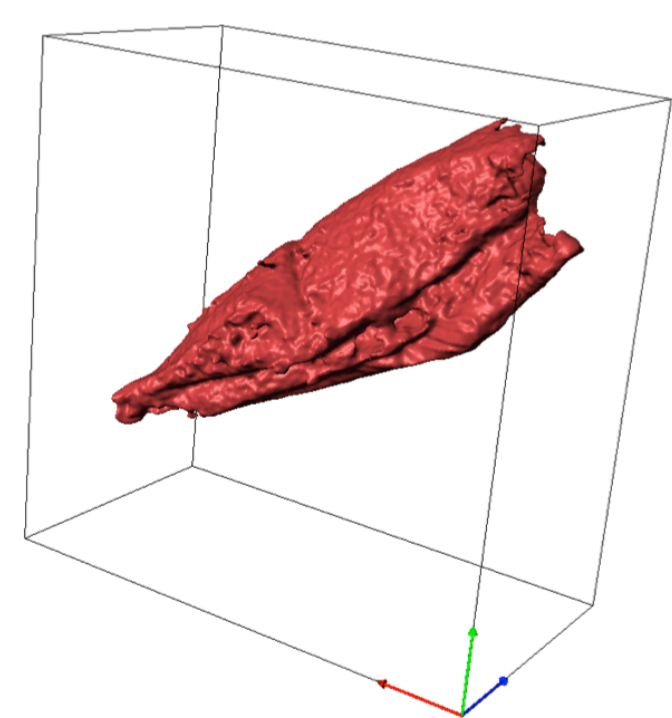
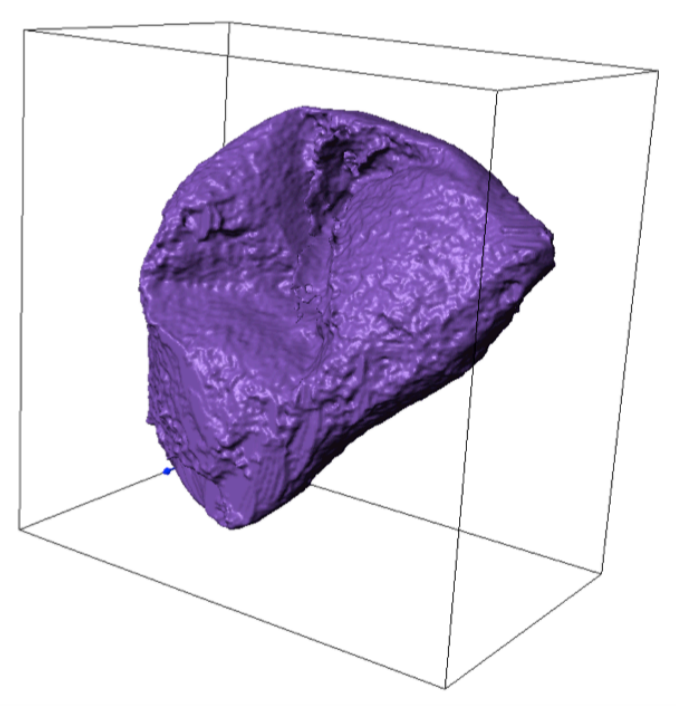
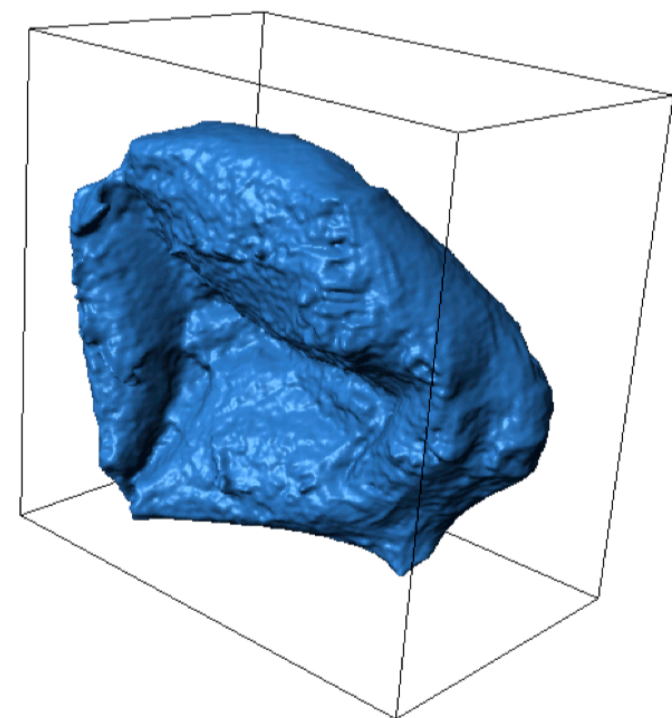
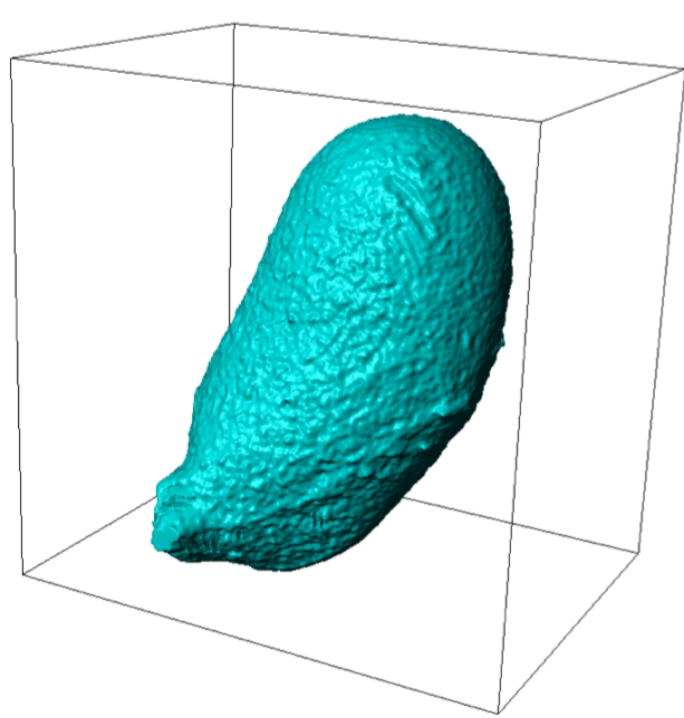
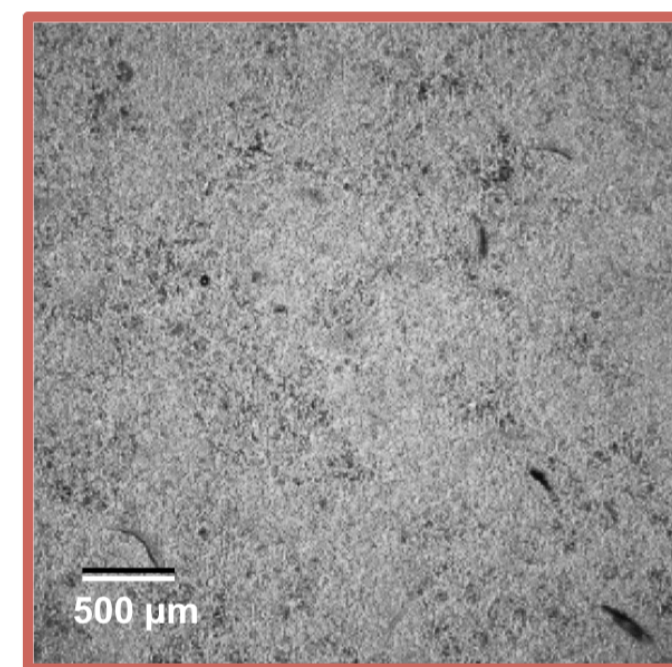
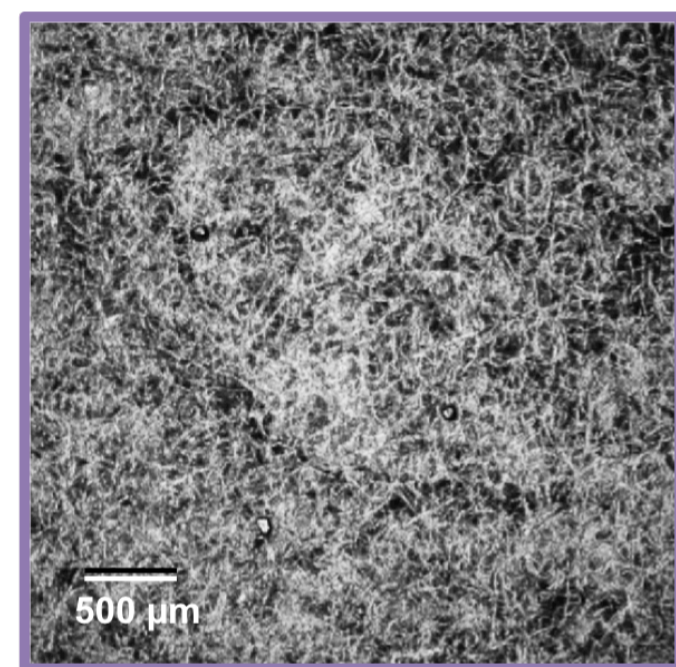
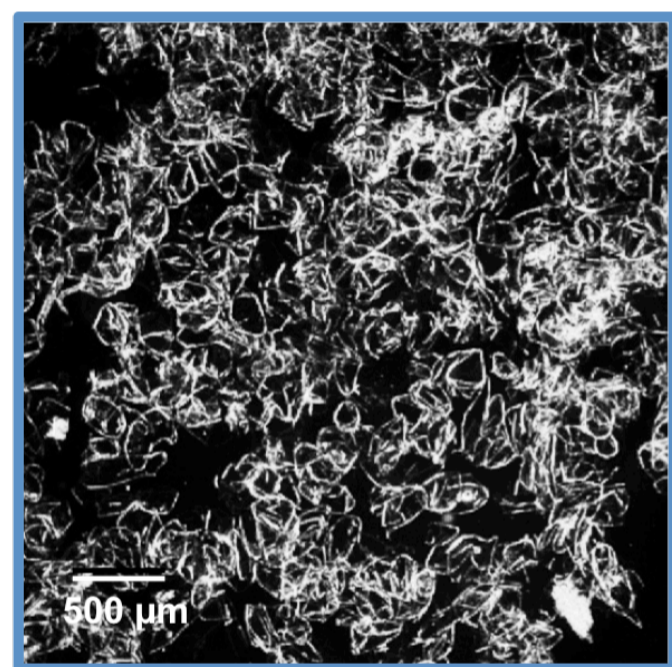
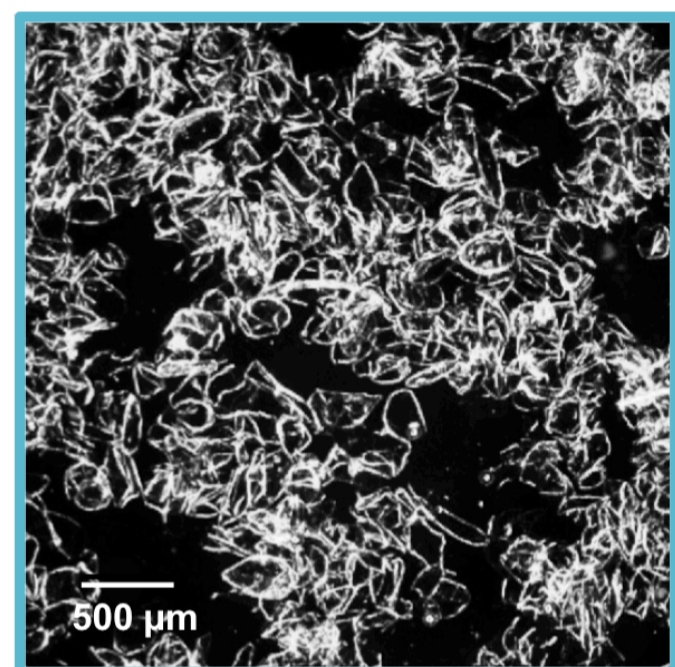
Results

0.47 g/100mL

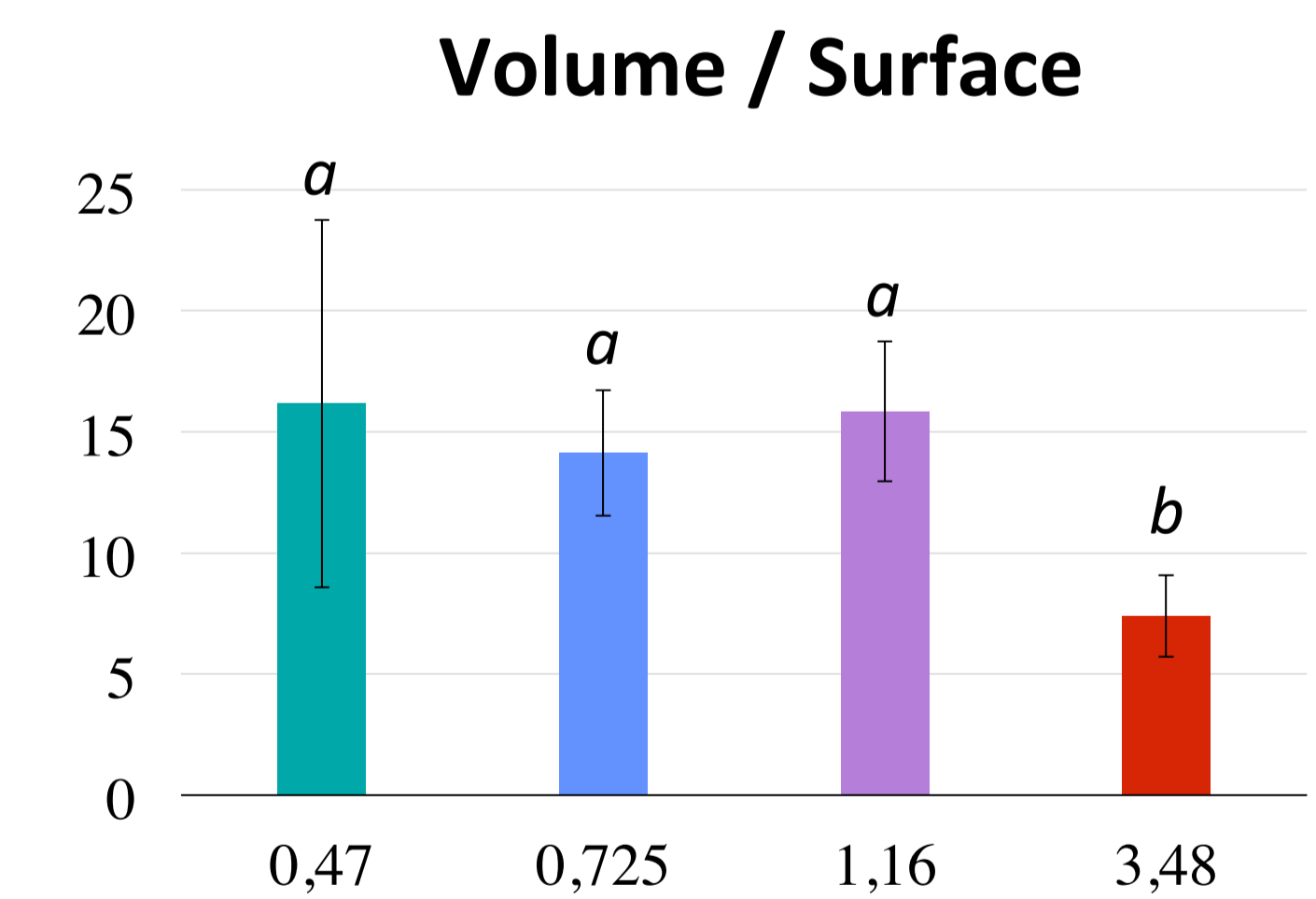
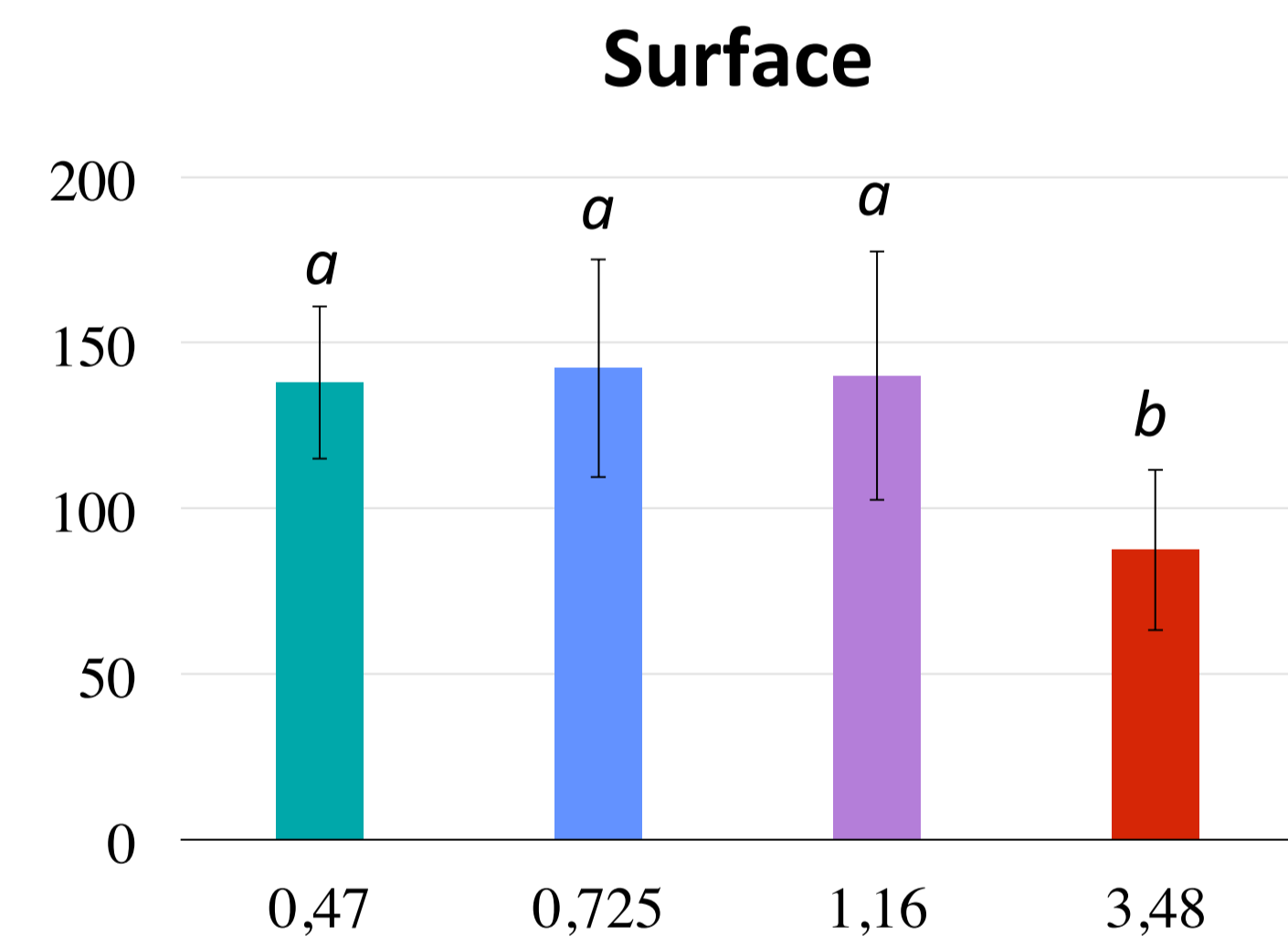
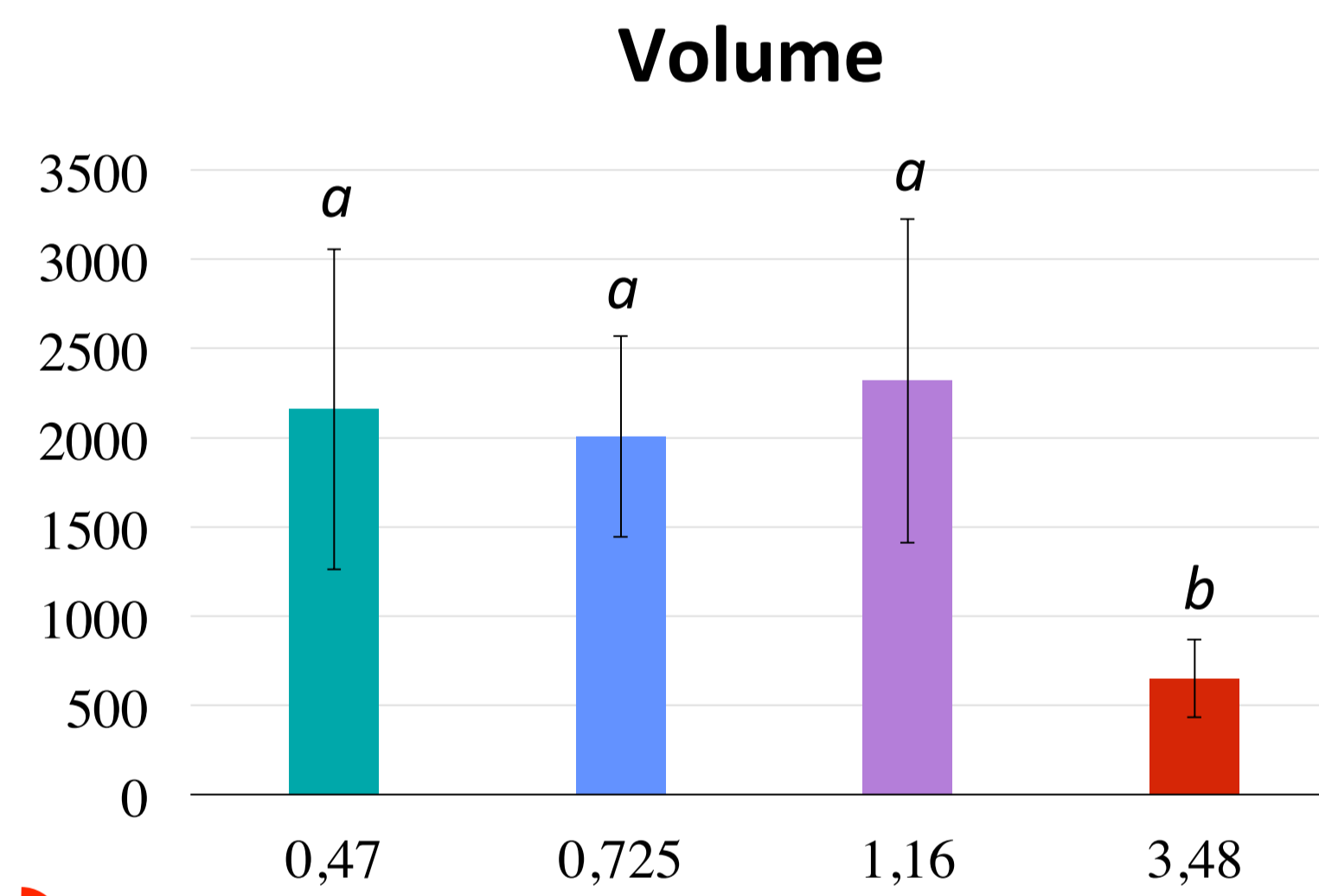
0.725 g/100mL

1.16 g/100mL

3.48 g/100mL



CONCENTRATION INCREASE



We were able to **observe each single particle** even in **highly concentrated suspensions** and to access to their volume and shape factor

Statistical analysis with Tukey, Fisher, Bonferroni & Newman Keuls

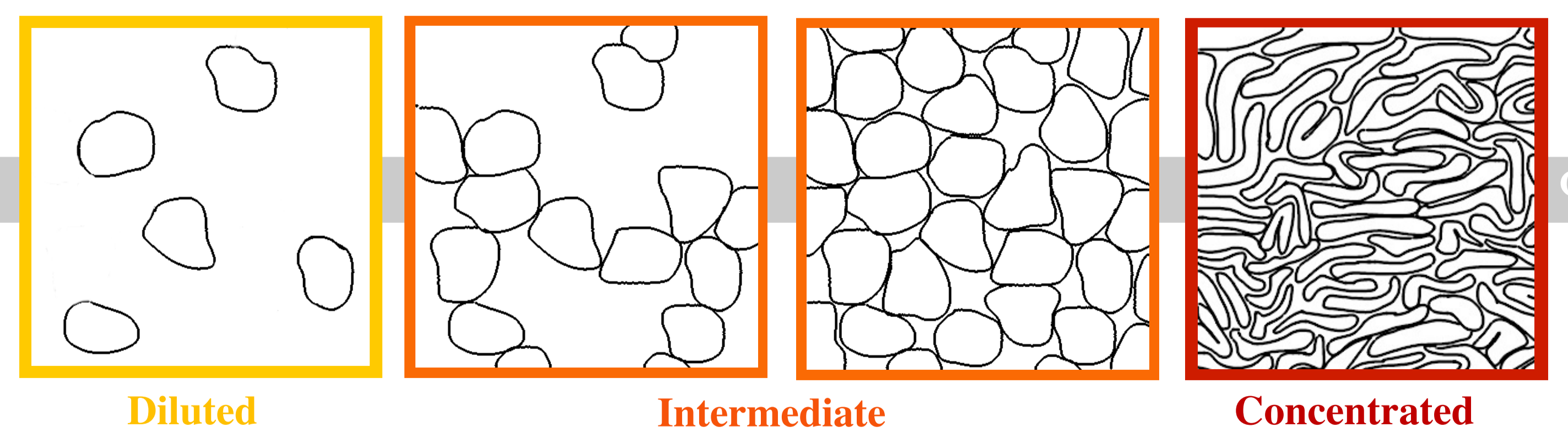
Table 1: Impact of insoluble solids content on the volume and the shape of the cells

Insoluble solids content g/100mL	Number of analysed cells	Volume 10 ³ μm ³	Surface 10 ³ μm ²	Ratio $\frac{V}{S}$ μm
0.47	3	2158 ± 897	138 ± 23	16 ± 6
0.725	7	2006 ± 562	142 ± 33	14 ± 3
1.16	5	2319 ± 907	140 ± 37	16 ± 3
3.48	5	650 ± 217	87 ± 24	7 ± 2

REFERENCES

[1] Day et al., Food and Bioprocess Technology, 3, 928–934, (2010).

Conclusions



- ✓ Acquisition of information about the packing of plant particles
- ✓ Particle volume starts to decrease only in the concentrated domain